

# TRAVEL AND TOURISM COMPETITIVENESS INDEX 2019 – QUANTILE REGRESSION APPROACH ON 2<sup>nd</sup> SUB-INDEX

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**ABSTRACT.** The aim of the paper is to examine how much four pillars of the Travel and Tourism Competitiveness Index (TTCI) sub-index “T&T Policy and Enabling Conditions” contribute to the overall TTCI and ranking among 140 countries. To meet the goal, quantile regression has been used. Several findings were obtained by analysis. The first result shows that pillar Price Competitiveness has almost no effect on the overall TTCI score or TTCI rank in the considered model. Second, the most important pillars are Prioritization of Travel and Tourism and International Openness. Third, a comparison of the results of the multiple quantile regression analysis with the ordinary least squares showed that the results of the above methods differ significantly for Pillar Environmental Sustainability. On the lower quantile levels, this pillar does not significantly affect the ranking while at higher quantile levels it does. On the contrary, it affects the overall TTCI score in the opposite way. Another reason for using quantile regression is justified by the restrictive assumptions of OLS that it does not require. This paper contributes to the existing literature connected with tourism competitiveness. It can help reveal hidden multidimensional relationships between variables considered at different quantile levels, and thus can be a motivation for further improving the methods used to create the index.

**Keywords:** The Travel and Tourism Competitiveness Index, Quantile regression, Tourism.

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## Introduction

Competitiveness is often a researched topic in many areas. The high competitiveness of the country in the field of tourism gives good preconditions for accelerating its performance. Porter's work is an initial work for the development of research focused on the competitiveness of tourism destinations (Porter, 1980; Porter, 1990). Tourism destination competitiveness is a multidimensional concept that is widely studied in the academic literature, but multiple factors make its measurement a difficult task (Salinas Fernández et al, 2020). Due to the reason that tourism is primarily a service-driven industry, tourism researchers had to adjust definitions, develop new models, and identify factors that would apply to the tourism industry (Cronjé & du Plessis, 2020). The Travel & Tourism Competitiveness Index (TTCI) is one of the most popular synthetic indicators worldwide developed by the WEF (2007). This index is published in odd-numbered years through WEF-TTC reports, since 2015 in a uniform methodology. According to the preface of Menon and Wolf of WEF-TTC report 2019 (Calderwood & Soshkin, 2019), the Travel & Tourism Competitiveness Report provides a valuable tool for policymakers, companies, and complementary sectors to understand and anticipate emerging trends and risks in global travel and tourism, adapt their policies and practices, and accelerate new models that ensure the longevity of this important sector. By allowing cross-country comparison and benchmarking countries' progress on the drivers of T&T competitiveness, it informs policies and investment decisions related to T&T business and industry development (Calderwood & Soshkin, 2019). For each country considered, the main travel and tourism competitiveness score is created using the four sub-indexes that make up their pillars. These pillars are made up of other sub-pillars. The score is ultimately the basis for determining the ranking of countries. According to the WEF-TTC report 2017 of Crotti and Misrahi (2017), the five pillars of the Enabling Environment sub-index capture the general settings needed to operate in the country; the T&T Policy and Enabling Conditions sub-index, which captures specific policies or strategic aspects that impact the T&T industry more directly, consists of four pillars; three pillars of sub-index Infrastructure captures the availability and quality of physical infrastructure in a country; two pillars of Natural and Cultural Resources captures the main reasons to travel (Crotti & Misrahi, 2017).

The aim of this paper is to solve a question, how the 2nd sub-index The T&T Policy and Enabling Conditions with its four pillars influence and relate to the overall score and overall ranking among investigated countries. The main aim is from a methodological point of view, to answer this question using quantile regression and finally compare this result with OLS.

This article is arranged as follows. The following section after brief Theoretical background presents the data and variables used in the empirical application and the quantile regression method used. The next section presents the results. In the last section, the article is concluded.

## Theoretical background

Current literature covers a wide range of research on competitiveness subject. Tourism destination competitiveness is a complex multidimensional concept, which was studied for example in Cucculelli and Goffi (2016), Andrades and Dimanche (2017), and Porto et al (2019). An impressive review of the literature on the competitiveness of destinations by Cronjé and du Plessis (2020) shows the widespread interest of researchers in the field of tourism research in recent decades. T&T Competitiveness Report has been published by WEF eight times up to the year 2020 but the composition of the index has been changed several times over the years. It is possible to find publications that are aimed at improving the methodology of tourism competitiveness indicators, for example, Croes and Kubickova (2013), Mihalic (2016), Evans (2016). Salinas Fernández et al (2020) used all of the simple variables included in the 2017 Travel & Tourism Competitiveness Index, proposing a new methodology for the construction of this synthetic index, which solves the problems of aggregation of variables expressed in different measures, arbitrary weighting and duplicity of information. Luštický and Štumpf (2021) focus on general models of destination competitiveness and, using the Analytic Hierarchy Process proposed model of system dynamics which allows depicting the complexity of relations among the factors of competitiveness in greater depth, to cover more relations and their causalities, and to reveal the leverage points indicating the most promising areas of cooperation. Some authors examine relationships between selected indicators of T&T Competitiveness Index, for example, Cirstea (2014), Litavcová et al (2019), and Litavcová and Vašničová (2019). Using quantile regression, Litavcová et al (2019) studied the relationship between 1<sup>st</sup> sub-index Enabling Environment and overall TTCI and ranking among 136 countries on previous data of TTCI from 2017. In Litavcová and Vašničová (2019),

the relationship of 13 other TTCI indices from 2017 to the Business Environment pillar, which is one of the five sub-pillars of the Enabling Environment pillar, was investigated using regression quantiles and lasso estimates for modeling. Nexus between TC and tourism performance can be found in Bazargani and Kilic (2021), Marti and Puertas (2017), Hanafiah and Zulkifly (2019). Bazargani and Kilic (2021) using three-step least-squares data estimation techniques have shown that tourism competitiveness is the main driver of the tourism flows and tourism contribution to GDP for all regions and income groups of countries across the world.

In some cases, data of the T&T Competitiveness Index was used for the other analysis (Zhang et al, 2011). Attention is currently being paid to studying the impact of the pandemic on various areas of the tourism sector, including competitiveness as can be seen for example in Santos, Oliveira, and Aldrighi (2021). Altinay and Kozak (2021) use chaos theory in order to evaluate the implications of the COVID-19 pandemic for destination competitiveness.

## Data and methodology

### Data

The Travel and Tourism (T&T) Competitiveness Index can be considered a quality and strategic means of assessing a country's position. According to the methodology of its creation valid for 2019, the main index was divided into 4 sub-indexes, which together consisted of 14 pillars. The pillars are created on the basis of 90 individual indicators. Composition of the T&T Competitiveness Index in 2019 presents Table 1.

Table 1: Composition of T&T Competitiveness Index in 2019

| Sub-index                                           | Pillars                                          |
|-----------------------------------------------------|--------------------------------------------------|
| Sub-index I.<br>Enabling Environment                | 1. Business Environment (BE)                     |
|                                                     | 2. Safety and Security (SS)                      |
|                                                     | 3. Health and Hygiene (HH)                       |
|                                                     | 4. Human Resources and Labour Market (HRL)       |
|                                                     | 5. ICT Readiness (ICT)                           |
| Sub-index II.<br>T&T Policy and Enabling Conditions | 6. Prioritization of Travel and Tourism (TT)     |
|                                                     | 7. International Openness (IO)                   |
|                                                     | 8. Price Competitiveness (PC)                    |
|                                                     | 9. Environmental Sustainability (ES)             |
| Sub-index III.<br>Infrastructure                    | 10. Air Transport Infrastructure (ATI)           |
|                                                     | 11. Ground and Port Infrastructure (GPI)         |
|                                                     | 12. Tourist Service Infrastructure (TSI)         |
| Sub-index IV.<br>Natural and Cultural Resources     | 13. Natural Resources (NR)                       |
|                                                     | 14. Cultural Resources and Business Travel (CRB) |

Source: own processing according to Calderwood and Soshkin, 2019.

Pillars 1<sup>st</sup> to 5<sup>th</sup> of the Enabling Environment sub-index in Table 1 are closely linked to economic growth. The next four pillars 6<sup>th</sup>-9<sup>th</sup> of the T&T Policy and Enabling Conditions sub-index can direct measure of observable T&T policies (pillar *Prioritization of Travel and Tourism*), which can directly impact tourists' decision to select a destination (pillars *International Openness*, *Price Competitiveness*) and which indicates to what extent natural capital is being conserved (Environmental Sustainability). The following three pillars 10<sup>th</sup>-12<sup>th</sup> assess the connectivity and hospitality infrastructure and enable policy makers to provide accurate information. The last two pillars 13<sup>th</sup>-14<sup>th</sup> represent natural and cultural resources and can be the main reason for visiting the country. The methodology of index creation in 2019 was the same as in 2017. The pillars in Table 1 were similarly described in our previous works Litavcová et al (2019), and Litavcová and Vašaničová (2019), citing Crotti and Misrahi (2017).

Our dataset consists of values of the Travel and Tourism Competitiveness Index (TTCI) and its pillars among 140 economies from the year 2019. The question is, how much each pillar of the second

sub-index contributes to the overall index, and to the ranking in 140 countries. This article aims to answer that question by using quantile regression.

In this work, we focus on the second sub-index, which is described here according to Calderwood and Soshkin (2019). Sub-index T&T Policy and Enabling Conditions are composed of four pillars. The pillar *Prioritization of Travel and Tourism* consists of 6 indicators that cover the extent to which the government favors the T&T sector. The stability of government policy can affect the sector's ability to attract further private investment. This pillar also includes measures of government spending, the effectiveness of marketing campaigns and country branding, and the completeness and timeliness of providing T&T data to international organizations, as this indicates the importance that a country assigns to its T&T sector. The pillar *International Openness* consists of 3 indicators and describes the degree of openness and travel facilitation. Components measured in this pillar include the openness of the bilateral air service agreements which the government has entered, which impacts the availability of air connections to the country, and the number of regional trade agreements in force, which proxies the extent to which it is possible to provide world-class tourism services. The pillar *Price Competitiveness* consists of 4 indicators such as airfare ticket taxes and airport charges, which can make flight tickets much more expensive; the relative cost of hotel accommodation; the cost of living, proxied by purchasing power parity; and fuel price costs, which directly influence the cost of travel. The pillar *Environmental Sustainability* consists of 10 indicators that cover policies and factors enhancing environmental sustainability. These include policy indicators such as the rigor and enforcement of government environmental regulations and variables assessing the state of water, forest resources, and marine life, and the extent to which the T&T industry is developed in a sustainable manner (more in Calderwood and Soshkin (2019)).

## Methodology

The effect of a change in the TTCI score and the TTCI rank of the country among 140 countries depending on the four pillars of T&T Policy and Enabling Conditions would be tested by using the ordinary least squares method, or by using a more complex generalized linear model. Our good experience with quantile regression so far (in the context of TTCI 2017 in Litavcová et al (2019), for example) is the impetus for the decision to use it again. We used quantile regression also in other contexts, for example in the context of M&A with interesting results in Litavcová, Hečková, and Chapčáková (2016) and in Litavcová, Hečková, and Chapčáková (2017).

The response and all the regressors are continuous variables without missing values, in our data of TTCI 2019. However, outliers occur in 4 variables. When using OLS, the collinearity diagnostics confirm that there are serious problems with multicollinearity. Several eigenvalues are close to zero, indicating that the predictors are highly intercorrelated and that small changes in the data values may lead to large changes in the estimates of the coefficients. The condition indices are computed as the square roots of the ratios of the largest eigenvalue of  $X^T X$  to each successive eigenvalue. One of these indices is larger than 30, suggesting a serious problem with collinearity (Rawlings, Pantula, and Dickey, 1998). Thus, other methods should be used (see Jurczyk (2012), Kalina and Peřtová (2017)).

As Agresti (2015) explains, the simple ordinary least squares method describes the conditional mean of the response variable as a linear function of the explanatory variable. Quantile regression models quantiles of a response variable as a function of explanatory variables. This method can be less severely affected by outliers than is ordinary least squares. When the response conditional distributions are highly skewed with possibly highly non-constant variance, the method can describe the relationship better than a simple normal model with constant variance. Quantile regression model fitting minimizes of a weighted sum of absolute residuals, formulated as a linear programming problem. However, when the normal linear model truly holds, the least-squares estimators are much more efficient (Agresti 2015, in Litavcová, Hečková, and Chapčáková, 2016).

The OLS model estimates the constant effects of the independent variables on the conditional mean of the dependent variable and assumes a normal distribution of errors with constant variance. As stated in Koenker (2005), quantile regression is a statistical technique intended to estimate, and conduct inference about, conditional quantile functions. Just as classical linear regression methods based on minimizing sums of squared residuals enable one to estimate models for conditional mean functions, quantile regression methods offer a mechanism for estimating models for the conditional median function, and the full range of other conditional quantile functions (Koenker, 2005).

Quantile regression models were initially proposed by Koenker and Bassett (1978) as a method of robust regression that would account for the non-normal distribution of error terms and as a test for heteroskedastic error terms (Koenker, 2005). At the heart of the optimization problem is the minimization of asymmetrically weighted absolute residuals. By asymmetrically weighted residuals,

they mean assigning different weights to positive and negative residuals (Britt, 2009), (Fenske, 2012). This results in the minimization equation for conditional quantiles

$$\min_{\xi \in R} \sum_{i=1}^n \rho_{\tau}(y_i - \xi(x, \beta)), \quad (1)$$

where  $\rho(\cdot)$  is the absolute value function that gives the  $\tau$ -th sample quantile,  $y_i$  is the observed value of the dependent variable, and  $\xi(x, \beta)$  is the predicted value in the form of parametric function.

## Results

Table 2 shows the coefficients of the *TTC score* and the *TTCI rank* among 140 countries as a dependent variable, which were estimated at the 15<sup>th</sup>, 20<sup>th</sup>, 25<sup>th</sup>, 30<sup>th</sup>, 40<sup>th</sup>, 50<sup>th</sup>, 60<sup>th</sup>, 70<sup>th</sup>, 75<sup>th</sup>, 80<sup>th</sup>, and 85<sup>th</sup> quantile levels (taus) using multiple quantile regression on four pillars of the second sub-index. Robust bootstrap estimates of standard errors according to Koenker and Hallock (2001) were made and significance tests were based on them. As can be seen from Table 2, the quantile regression provided us with a more complete and detailed statistical analysis of the stochastic relationships between the random variables examined. For comparison, the coefficients of the OLS model are in the last line.

It is clear from Table 2 that the first two pillars *Prioritization of Travel and Tourism* and *International Openness* in this presented multiple quantile regression model influence significantly all the investigated quantile levels of both examined dependent variables - overall *TTC score* and *TTCI rank*. On the contrary, the third pillar *Price Competitiveness* has no effect on any of the quantile levels of both dependent variables. This unexpected result is because not all 14 pillars were included in the considered model as a set of independent variables. The *Environmental Sustainability* variable affects the different quantile levels of the *TTC score* variable differently. As quantile levels of *TTC score* increase, the effect of *Environmental Sustainability* decrease and cease to be significant at the 60th percentile. However, a similar effect in the opposite direction is achieved with the variable *TTCI rank*. The higher its quantile level, the more it is affected by the *Environmental Sustainability* variable. Significance begins with the median of the dependent variable *TTCI rank*.

Table 2 Estimated coefficients of Business Environment as a dependent variable - results of multiple quantile regression

|      | 1 <sup>st</sup> model - dependent: TTCI Rank |                      |                    |                      | 2 <sup>nd</sup> model - dependent: TTC Score |                    |        |                    |
|------|----------------------------------------------|----------------------|--------------------|----------------------|----------------------------------------------|--------------------|--------|--------------------|
| tau  | TT                                           | IO                   | PC                 | ES                   | TT                                           | IO                 | PC     | ES                 |
| 0,15 | -18.539 <sup>d</sup>                         | -19.373 <sup>d</sup> | 7.998              | -3.148               | 0.292 <sup>d</sup>                           | 0.262 <sup>c</sup> | 0.015  | 0.473 <sup>d</sup> |
| 0,20 | -18.416 <sup>d</sup>                         | -19.759 <sup>d</sup> | 6.963 <sup>a</sup> | -4.059               | 0.281 <sup>d</sup>                           | 0.319 <sup>d</sup> | 0.067  | 0.475 <sup>d</sup> |
| 0,25 | -17.914 <sup>d</sup>                         | -20.466 <sup>d</sup> | 4.694              | -6.921               | 0.295 <sup>d</sup>                           | 0.301 <sup>d</sup> | 0.108  | 0.478 <sup>d</sup> |
| 0,30 | -20.984 <sup>d</sup>                         | -21.013 <sup>d</sup> | 1.590              | -7.035               | 0.276 <sup>d</sup>                           | 0.319 <sup>d</sup> | 0.093  | 0.436 <sup>d</sup> |
| 0,40 | -13.569 <sup>d</sup>                         | -25.860 <sup>d</sup> | 2.252              | -13.134 <sup>a</sup> | 0.260 <sup>d</sup>                           | 0.324 <sup>d</sup> | 0.072  | 0.352 <sup>d</sup> |
| 0,50 | -15.826 <sup>d</sup>                         | -20.836 <sup>d</sup> | 1.194              | -17.110 <sup>c</sup> | 0.257 <sup>d</sup>                           | 0.321 <sup>d</sup> | 0.004  | 0.297 <sup>c</sup> |
| 0,60 | -13.921 <sup>d</sup>                         | -19.581 <sup>d</sup> | -3.952             | -24.982 <sup>d</sup> | 0.232 <sup>d</sup>                           | 0.378 <sup>d</sup> | -0.059 | 0.241 <sup>a</sup> |
| 0,70 | -15.353 <sup>d</sup>                         | -19.264 <sup>d</sup> | -2.953             | -26.681 <sup>d</sup> | 0.345 <sup>d</sup>                           | 0.358 <sup>d</sup> | -0.040 | 0.132              |
| 0,75 | -17.398 <sup>d</sup>                         | -17.312 <sup>d</sup> | -2.802             | -28.516 <sup>d</sup> | 0.368 <sup>d</sup>                           | 0.336 <sup>d</sup> | -0.129 | 0.073              |
| 0,80 | -15.215 <sup>d</sup>                         | -20.068 <sup>d</sup> | -0.666             | -28.278 <sup>d</sup> | 0.377 <sup>c</sup>                           | 0.334 <sup>c</sup> | -0.153 | 0.068              |
| 0,85 | -17.777 <sup>d</sup>                         | -14.016 <sup>c</sup> | 1.769              | -29.789 <sup>d</sup> | 0.414 <sup>c</sup>                           | 0.297 <sup>c</sup> | -0.162 | 0.075              |
| OLS  | -16.999 <sup>d</sup>                         | -19.207 <sup>d</sup> | 1.754              | -16.291 <sup>d</sup> | 0.299 <sup>d</sup>                           | 0.329 <sup>d</sup> | 0.057  | 0.271 <sup>c</sup> |

Note: "a", "b", "c", "d" denotes 10%, 5%, 1%, and 0.1% significance level; the abbreviations at the top of the table are explained on page 2.

The following figures (Figure 1, Figure 2) provide a more detailed and moderate overview of the examined dependencies. The images allow a fine view of the studied dependencies and allow a comparison with OLS.

The OLS estimate of the average value of the dependent variable is shown by a red line, with his 95% confidence interval, respectively.



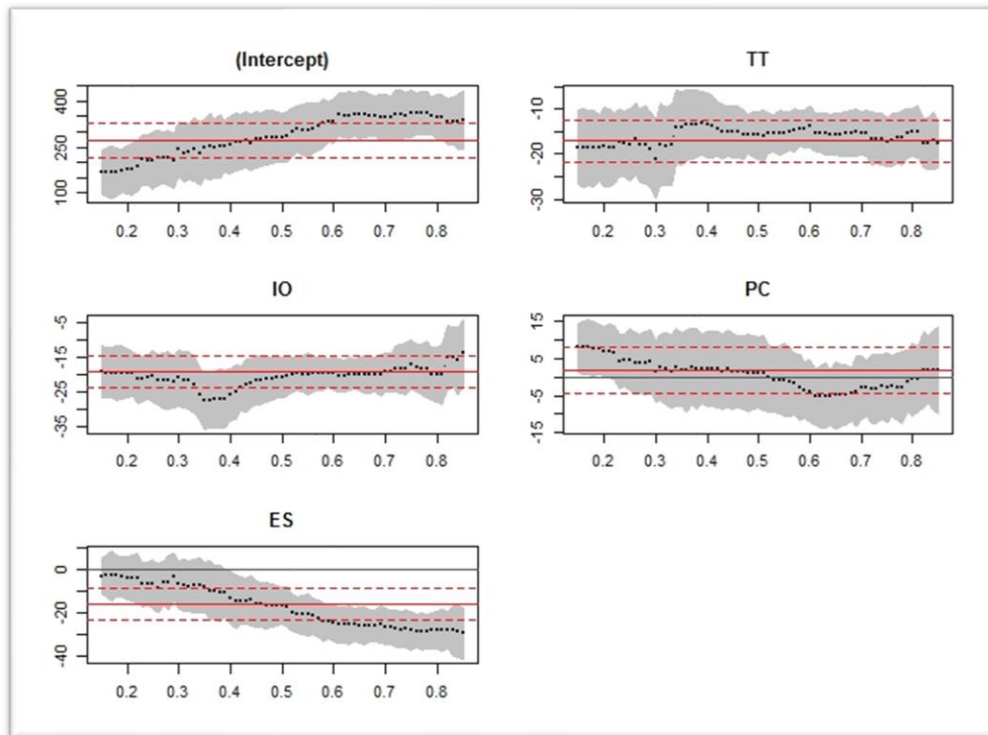


Figure 1 Comparison of estimated parameters at various quantile levels as a result of quantile regression with dependent variable TTC Rank.

Note: CIs are based on bootstrap estimates of standard errors.

Source: own calculation in R.

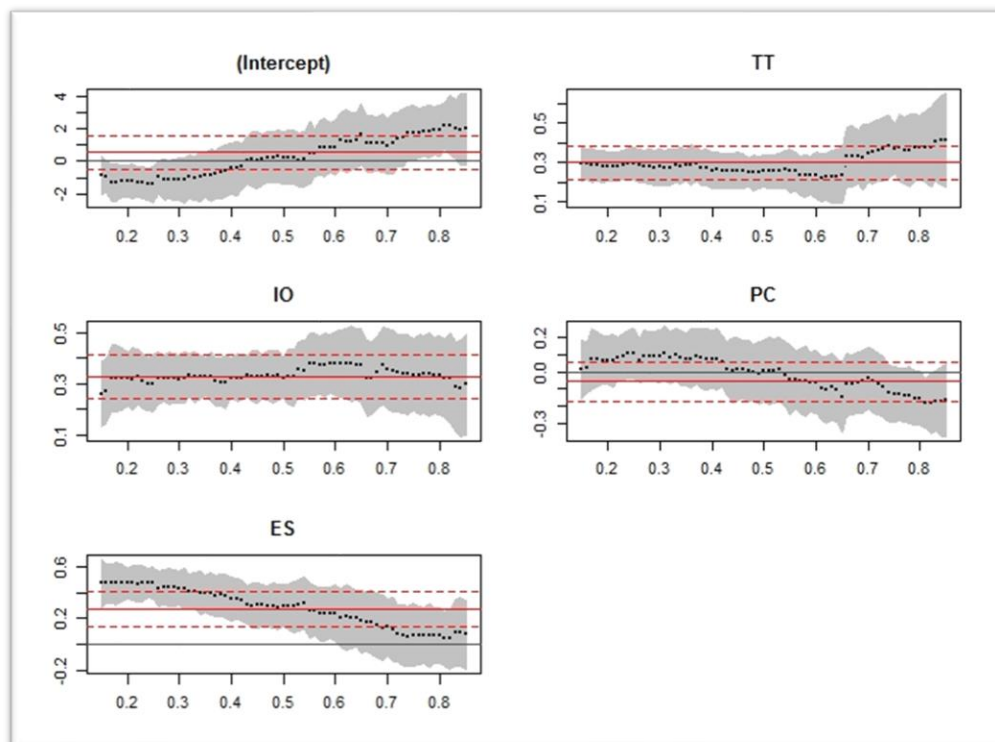


Figure 2 Comparison of estimated parameters at various quantile levels as a result of quantile regression with dependent variable TTC Score.

Note: CIs are based on bootstrap estimates of standard errors.

Source: own calculation in R.

It is clear from Figure 1 that the very low quantile levels of the dependent variable *TTC rank* are significantly affected by the variable *Price Competitiveness*, but the OLS model does not say so. The choice of the quantile regression model over the OLS model is fully justified in the case of the considered multidimensional model in terms of the *Environmental Sustainability* variable - Figures 1 and 2 show that the estimate of the mean value differs from the estimate of the quantile level of both dependent variables *TTC score* and *TTCI rank* at most their quantile levels. The OLS model considers the influence of the *Environmental Sustainability* variable to be significant, the quantile regression model only at certain quantile levels.

## Discussion

To reveal the relationship between the TTC index and ranking among 140 countries on four pillars of the 2<sup>nd</sup> sub-index of TTCI the multiple quantile regression analysis was used. The expected significant impact of the *Price Competitiveness* pillar has not been confirmed in this model. Therefore, we also checked the overall model not listed here, where we took all 14 pillars. There, the importance of the *Price Competitiveness* pillar has already been proven. Significance of pillars *Prioritization of Travel and Tourism* and *International Openness* was revealed in all considered quantile levels. This makes the result no different from OLS and there is reason to accept the result of OLS taking into account that according to Agresti (2015) the normal linear model truly holds. On the contrary, a result that speaks of the significance of the *Environmental Sustainability* pillar only at certain quantile levels gives a good reason to derive managerial implications based on quantile regression results. These results do not differ from our results in previous work (Litavcová et al, 2019) that emerged from the analysis of data TTCI from previous 2017 report.

## Conclusion

In this paper, the relationship between selected four pillars of the Travel and Tourism Competitiveness Index (TTCI) in its second sub-index and the overall variable *TTC score* (and *TTCI rank* too) among 140 countries was studied. The data of TTCI 2019 was studied. Quantile regression allowed us to examine this relationship in a broader context. The aim of this contribution was to examine the multivariate relationship between response variable, which is the overall *TTC score* (and *TTCI rank*) among 140 countries and selected four of all 14 continuous predictors, e. g. pillars of second sub-index "T&T Policy and Enabling Conditions". We recorded several findings from the results of the analyses. First, the most important pillars in the investigated model are *Prioritization of Travel and Tourism*, and *International Openness*. Second, on the contrary, the pillar *Price Competitiveness* has almost no effect on the overall TTCI score or TTCI rank in the considered model. Third, a comparison of the results of the multiple quantile regression analysis with the ordinary least squares showed that the results of the above methods differ significantly for pillar *Environmental Sustainability*. The estimate of the mean value differs from the estimate of the quantile level of both dependent variables *TTC score* and *TTCI rank* at most their quantile levels. The OLS model considers the influence of the *Environmental Sustainability* pillar to be significant, the quantile regression model only at certain quantile levels. On the lower quantile levels, this pillar does not significantly affect the ranking while at higher quantile levels it does. On the contrary, it affects the overall TTCI score in the opposite way. Another reason for using quantile regression is justified by the restrictive assumptions of OLS that it does not require. To conclude, these results may be helpful for a deeper understanding of the relationship between the overall *TTC score* (and *TTCI rank*) among 140 countries and its continuous predictors from the second sub-index of TTCI. This paper contributes to the existing literature connected with tourism competitiveness. It can be useful in revealing hidden multidimensional relationships between variables considered at different quantile levels. The obtained results can be a motivation for further in-depth analysis and ultimately for further improvement of the methods used in compiling the index.

Tourism destination comprises a highly competitive and complex market (Luštický and Štumpf, 2021). TTCI is a multidimensional concept that is complex and makes sense to study it in more depth. It has been improved several times since its first release in 2007. In 2015, it underwent the last significant methodological change. In this article, the latest pre-pandemic version from 2019 is studied. The tourism-related sectors have been among the most affected by the pandemic, notably air travel, due to the perception that they could be a conduit to the virus's spread (Santos, Oliveira, and Aldrighi, 2021). It is possible to assume that other variables can therefore be added to the TT concept, the issue of health safety of travel, for example. Altinay and Kozak (2021) proposed in this context the butterfly

competitiveness model which suggests that as destinations transform themselves to adapt to the unpredictable consequences of COVID-19 and strive to remain competitive in the tourism market, they need to demonstrate health leadership. It will therefore be interesting to study data from 2021 on how the models tested so far will behave. According to WTTC news (15 October 2021) „In a slower than expected recovery GDP contribution will only increase by less than one third. Nearly 19 million Travel & Tourism jobs are in the balance in 2021“. In-depth statistical analysis of variables for each area, also for destination competitiveness in tourism, the results can help policy makers set parameters to address the consequences of the pandemic and to achieve increased competitiveness.

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# DIGITAL PERFORMANCE IN V4 COUNTRIES

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**ABSTRACT.** Digital technologies affect our daily lives, whether private or professional. The Covid-19 pandemic highlighted the importance and necessity of digital technologies and the transfer of some activities to the online space. The Digital Economy and Society Index (DESI) monitors Europe's overall digital performance. It is an essential indicator for comparing levels in digital skills and opportunities between EU countries. The aim of the article is to analyze the 3rd part of this index, namely Use of Internet. On the sample of V4 countries, we analyze the performance of individuals in this area. We analyze the overall DESI in the year 2020. The partial analysis of selected segments of DESI was in the period 2015 - 2020, to show not only the results from the last year, because they may be influenced by the Covid-19 situation, but the countries' progress made by last years. We identify 2 interesting situations. One was in the case of Hungary and the second in Poland. The paradoxes in these countries are fascinating and suitable for further in-depth investigation.

**Keywords:** DESI, use of Internet, digital transformation, V4 countries.

**JEL Classification:** O33, A13

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## Introduction

By joining the European Union, Slovakia has committed itself to the development of the ICT sector, which has been an integral part of the European Union (EU) agenda for more than two decades. Following the eEurope 2002 and eEurope 2005 action plans, the i2010 program was launched as part of the Lisbon Strategy, which focused on the convergence of ICT environments in national countries and creating a unified information environment across the EU. (Ondrejková, 2016)

The progress in the digital economy development is crucial for improving the competitiveness of the EU economy (Kljucnikov, Mura, Sklenár, 2019). To meet all requirements posed by the progress of civilization and increased competition in the economic, social and cultural spheres, calls for selecting appropriate territorial policy also aimed at attaining the objectives of the Europe 2020 strategy (Chapčáková et al., 2019). The need for development policy territorialization was indicated in the Territorial Agenda adopted in 2011, where it was pointed out that the successful implementation of the Europe 2020 strategy depended on taking into account its territorial dimension. The territorialization in such terms can be understood in two ways: the first is the coordination of policies (Suhányi & Džupka, 2012) and differentiation in space; the second is the use of specific, territory-relevant capital, should be stimulated by local authorities. (Kwasny, 2018)

In February 2020, the Commission set out its vision for the digital transformation in the communication “Shaping Europe’s digital future” to deliver an inclusive use of technology that works for people and respects EU fundamental values (DESI, 2020).

The Digital Agenda for Europe is part of the Europa 2020 strategy. The overall goal of the Digital Agenda is to deliver sustainable economic and societal benefits from the Digital Single Market based on fast and ultra-fast Internet and interoperable applications. (Ondrejková 2016) The Commission responded swiftly to the new challenge by launching several measures in the area of digital. (DESI, 2020)

The current topics of digitalization, informatization, and electronization of public administration are interconnected to such extent that it is difficult to clearly identify the boundaries between eGovernment, the digitalization of society, and smart cities. (Ručinská & Fecko, 2021)

The transformation of the technological structure of the modern economy has led to the emergence of a digital economy. This fact opens up opportunities and creates some threats. The consequence of this process is the qualitative transformation of economic relations. Attention is increasingly paid to the development of the digital economy and its conceptualization. (Stavytskyy, Kharlamova, & Stoica, 2019)

In general, the digital economy is not only the relationships mediated by the Internet, cellular communication, and ICT. Among the significant benefits of the digital economy for business, we can include that it affects business interaction and accelerates the course of both the business itself and the various transactions associated with it. It also helps to overcome barriers to entry and provides competitive advantages to companies and ultimately reduces costs. (Stavytskyy, Kharlamova, & Stoica, 2019)

## Theoretical background

Several indices, scores, indicators, and measurement units describe the status of the digital economy, society, public administration, and they are used as descriptors of digital transformation. The DESI report tracks the progress made by EU member countries concerning their digitalization. It is a widely used and quoted measurement system by experts and policymakers. (Bánhidi, Dobos, Nemeslaki, 2020)

The Digital Economy and Society Index (DESI) monitors Europe’s overall digital performance and tracks the progress of EU countries in digital competitiveness. Providing data on the state of digitalization of each Member State helps them identify areas requiring priority investment and action. (DESI, 2020)

The European Commission monitors Member States’ digital progress using the Digital Economy and Society Index (DESI) in reports published since 2014. These reports include country profiles as well as thematic chapters. The DESI country reports combine quantitative data obtained from DESI indicators in five areas within the index and an overview of policies and best practices in each country.

The current COVID-19 pandemic has shown how important digital assets have become for our economies and how networks and Connectivity, data, artificial intelligence, as well as basic and advanced digital skills, support the economy and society by enabling us to continue working and lead the day life even with appropriate restrictions. (DESI Slovensko, 2020)

Table 1. The structure of DESI

|                                     |                                                                                          |
|-------------------------------------|------------------------------------------------------------------------------------------|
| 1 Connectivity                      | Fixed broadband take-up, fixed broadband coverage, mobile broadband and broadband prices |
| 2 Human capital                     | Internet user skills and advanced skills                                                 |
| 3 Use of Internet                   | Citizens' use of internet services and online transactions                               |
| 4 Integration of digital technology | Business digitalization and e-commerce                                                   |
| 5 Digital public services           | e-Government                                                                             |

Source: (DESI 2020)

### Broadband connectivity

Access to a fast and reliable broadband connection is crucial in the current context, in which key societal and economic services are delivered online. Everybody needs to have an internet connection in everyday life. Internet is essential in the area of education, in professional work-life, in the case of shopping options, etc. Today, it is a necessity for life for most people in Europe.

### Human capital – digital skills

Digital skills are the backbone of the digital society. They enable people to use digital services and engage in basic activities online, especially when mobility is restricted. The pandemic Covid-19 situation has shown that adequate digital skills empowering citizens to access information and services are crucial for the whole population.

### Use of Internet

During the Covid-19 pandemic, the need to access the Internet proved to people. Whether for work duties or shopping, educating children, and spending free time on entertainment platforms.

### Integration of digital technology by businesses

At present, especially in the context of the ongoing Covid-19 pandemic, companies have had to adapt to the new, resp. changed situation by introducing alternative working conditions. It is difficult for SMEs (including micro-enterprises) with a low level of digital intensity to provide their employees with the opportunity to work from home. One of the main obstacles to the digitalization of SMEs is the digital knowledge gap, which is caused by the low level of digital literacy between owners, managers and employees. Addressing these shortcomings will be necessary to ensure a comprehensive recovery.

### Digital public services

The crisis caused by COVID-19 shows how important it is to ensure the continuation of government activities when social distance measures are in place. A successful strategy to overcome the current pandemic will require large-scale digital public services or improving the functionality of these systems, including eHealth. (DESI, 2020)

## Methodology

We analyzed the whole DESI index divided into 5 primary groups (Connectivity, Human capital, Use of Internet, Integration of digital technology and Digital public services). The DESI contains all 5 areas but in different percentages. DESI overall index is calculated as the weighted average of the five main DESI dimensions: 1 Connectivity (25%), 2 Human capital (25%), 3 Use of Internet (15%), 4 Integration of digital technology (20%) and 5 Digital public services (15%).

Because this index contains 5 primary areas, which are very specific, we decided to describe one area more closely. We have chosen the 3rd area named Use of Internet.

This area, of course, is divided into the following 3 levels, where are analyzed these fields:

- a) Internet use,
- b) Activities online,
- c) Transactions.

The article aims to analyze the performance in the 3rd part of the DESI index, namely Use of Internet. Therefore, we selected the V4 countries for comparison. The analyzed period was from 2015 to 2020.

The data for analysis were obtained from the official DESI website. For the research, we used the methods of descriptive statistics, such as time analysis, country segmentation, overall DESI analysis, DESI segment analysis, detailed 3rd segment of DESI analysis.

## Results

The performance of the countries during the time is non-uniform. Some countries are advancing more, others less and slower. A comparison of DESI growth and the last score in EU countries is shown in Figure 1. The countries' progress is shown in one of the 4 quadrants, which were created on the basis of the average values of all EU countries. All V4 countries gained the score under the EU average. The most progressive country among the ones we analyzed was Hungary (HU), then Poland (PL). The Czech Republic (CZ) gained the highest score. And Slovakia (SK) gained the lower progress and score.



Figure 1. Digital Economy and Society Index – Member States' progress, 2015-2020

Source: DESI (2020)

The performance of overall DESI in the last year 2020 is shown in Figure 2. We see how the individual segments affect the general index. According to the composition of DESI, we can identify where the country has its weaknesses. Hungary, Poland and Slovakia gained the lowest values in the Integration of digital technology. Human capital and Connectivity are the most represented segments of the DESI. Unfortunately, we must state that none of the V4 countries reached a value higher than the EU average. In all 4 countries, values below the EU average were reached in 2020.



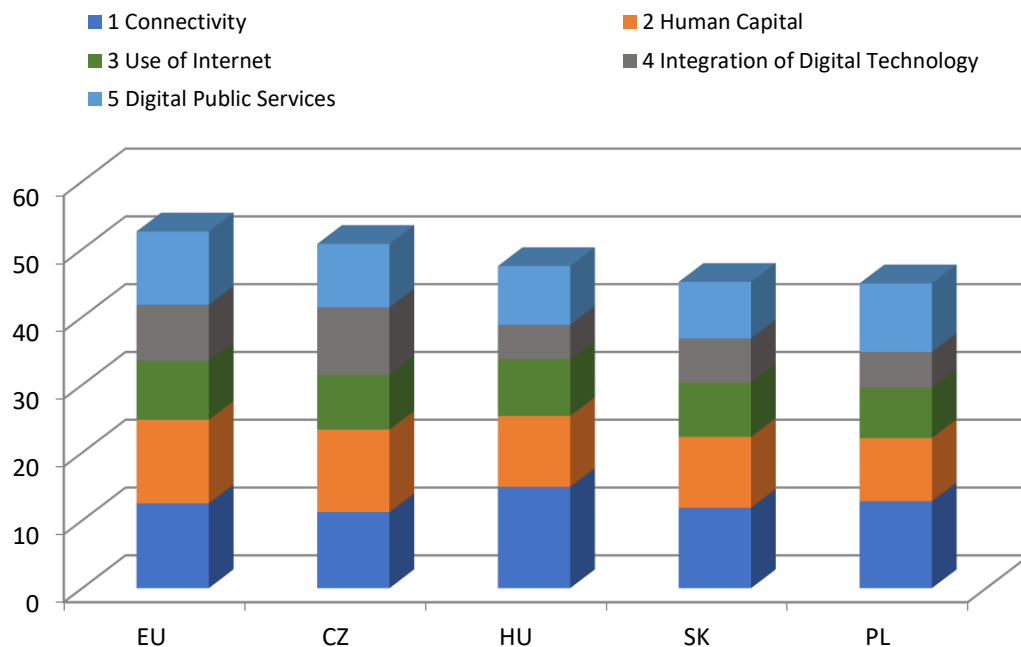


Figure 2. DESI 2020 in V4 countries

Source: DESI (2020)

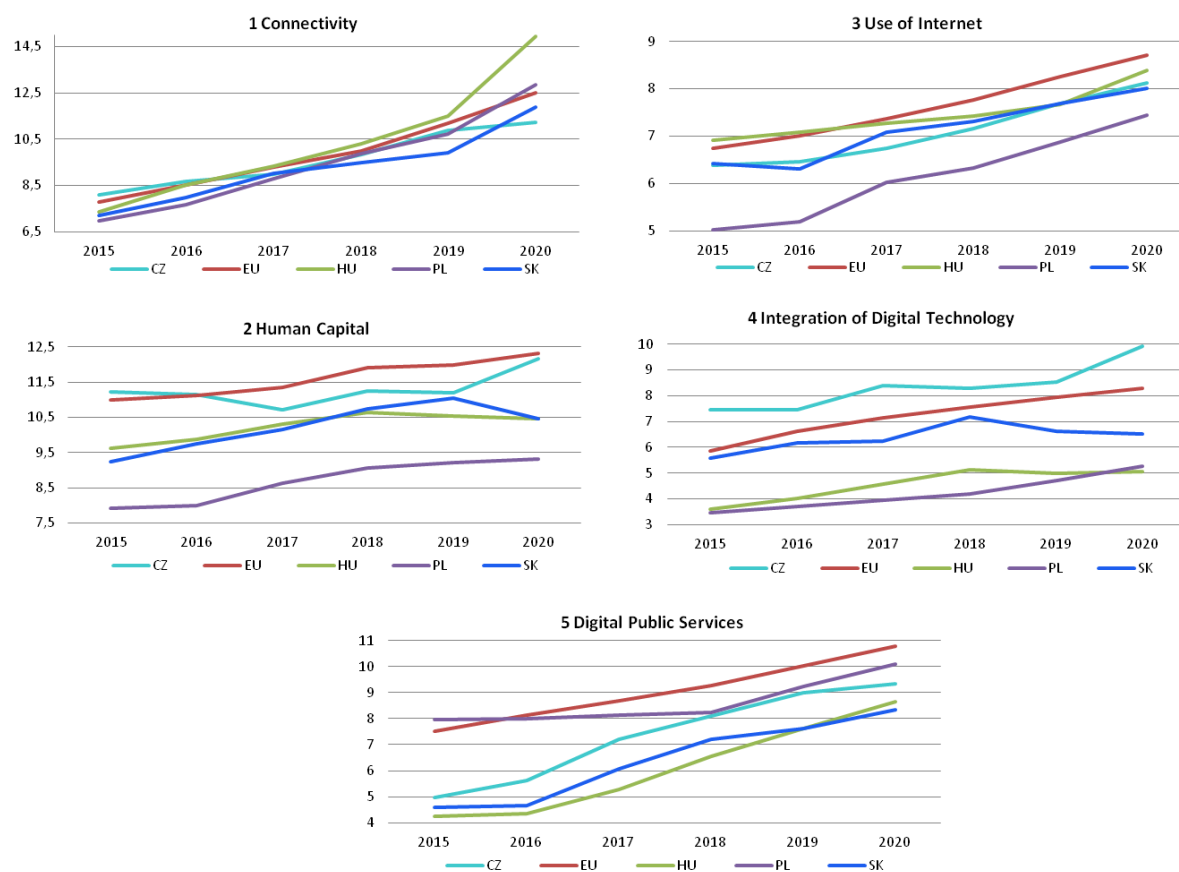


Figure 3. Performance of 5 basic groups of DESI in V4 countries

Source: own processing

However, when we compare the development over time and in the individual segments that make up DESI (Figure 3), we see that the values have an increasing trend. Thus, the situation in the V4 countries is improving from year to year. However, progress in individual DESI segments is not uniform. This also has an overall effect on the lower overall DESI performance.

The most significant increase was in the 1st area of DESI, in Connectivity. It is logical because the other areas cannot increase without the internet connection, e.g., Digital public services. The connectivity segment is also attractive because the differences between the V4 countries and the EU average are the smallest. Hungary has just significantly improved in the last year. In segments 2, 3, and 5, the values for the V4 countries are lower than the EU average. In segment 1, only Hungary is over the EU average. In segment 4, only the Czech Republic is over the EU average.

For a more detailed analysis, we chose 3rd part of DESI, namely Use of Internet. Overall, 3 Use of Internet within DESI in the V4 countries is lower than the EU average. In this respect, Hungary is the leader among the analyzed countries and the weakest is Poland. We are interested in how individuals use the Internet, its availability, and the most common reason for using it. In this respect, we have selected only the individuals. We did not consider the pattern of behavior of enterprises and companies on the Internet.

The 3rd part of DESI is divided into the following 3 levels, namely 3a) Internet use, 3b) Activities online and 3c) Transactions. Interestingly, there are significant differences in Internet access between the V4 countries (Table 2). Countries with the most households connected to the Internet have, paradoxically, the most individuals who have never used the Internet. In this area, the Czech Republic gained the most points in the DESI index from V4 countries (Figure 4), not only in the last analyzed year but in the entire period under review.

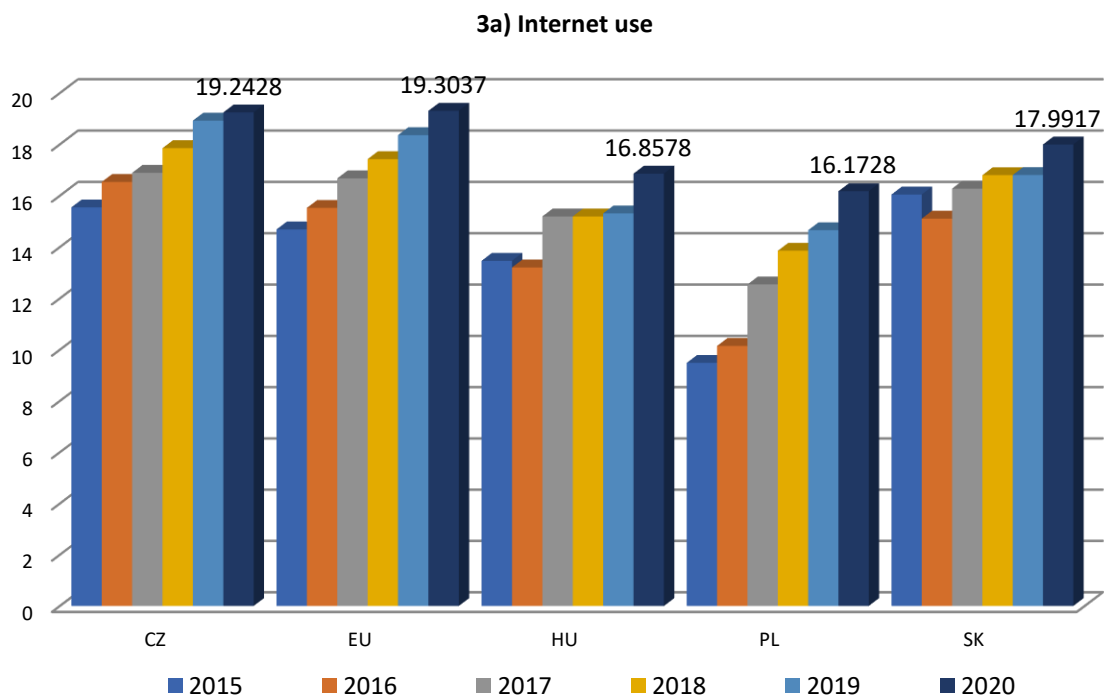


Figure 4. Performance of V4 countries in 3a) Internet use

Source: DESI (2020)

Hungary leads again in the 3b) Activities online section (Figure 5). This country is ranked the highest in this respect. Compared to other countries, it also has significantly higher DESI values. But in the 3c) Transactions, Hungary has the lowest values during the whole period. The values of the EU average are very important for comparison. We see that in 3b) Online activities, other V4 countries except for Hungary have lower values. However, the fact that an apparent growing trend of values for all analyzed countries can be seen in the given area remains positive.

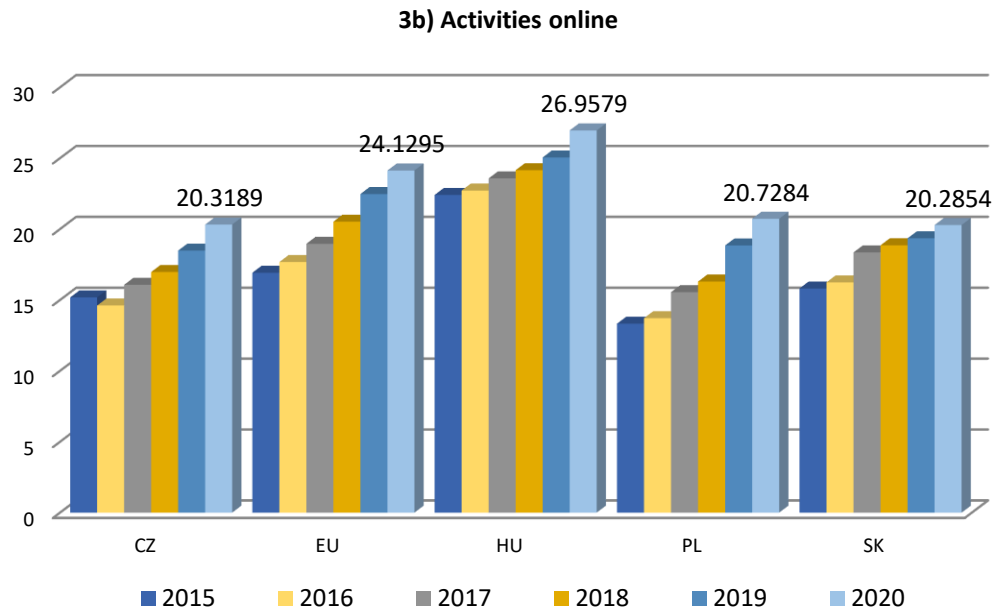


Figure 5. Performance of V4 countries in 3b) Activities online  
Source: DESI (2020)

In area 3c) Transactions (Figure 6), the highest values during the whole analyzed period, are in the EU average. The positive note is that in the last 2 years, the values in the case of Slovakia have increased significantly and are even higher than the EU average. Also, in the case of the Czech Republic, we can talk about comparable results in the last 2 years.

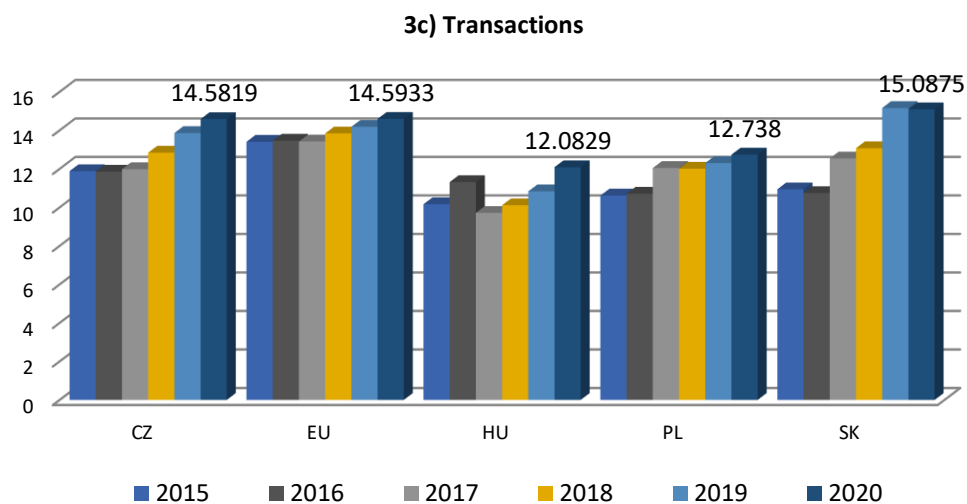


Figure 6. Performance of V4 countries in 3c) Transactions  
Source: DESI (2020)

## Discussion

In recent years, we can see that there has been an increase in the monitored indicators in all V4 countries and an increase in EU average values. This is also a consequence of the intensive support in this area in recent years.

On 19 February 2020, the European Commission approved the “digital package” document. It contains documents setting out the digital policy of the new European Commission. The most important message was the idea that digital technologies would serve everyone. The digital package contains three important documents determining the digital policy of the new European Commission:

- Communication Shaping Europe’s digital future.
- Communication on a European Data Strategy.
- White Paper Excellence and Confidence in Artificial Intelligence.

And two accompanying documents:

- Commission report on the safety and accountability implications of artificial intelligence, the Internet of Things and robotics.
- B2G Data Sharing Expert Group Report (Digital agenda, 2021).

The main strategic document is the “Chapeau” Communication Shaping Europe’s Digital Future. Based on the priorities and initiatives set out in the document, it can be stated that the new EU digital agenda contains fewer legislative acts. It will focus more on making the digital transformation in the EU a process that Europe will actively shape following its democratic values and on ensuring synergies between the digital transformation and other priority EU policy areas.

The European Data Strategy focuses on the issue of data sharing within the private sector and also the sharing of private sector data with the public sector with a vision to make Europe a leader in the data economy given a large amount of industrial and public sector data at its disposal.

The White Paper on Excellence and Confidence in Artificial Intelligence summarizes this issue in terms of the current EU regulatory environment, as well as in terms of existing EU policy activities and outlines, what issues and to what extent need to be addressed in relation to the future regulatory framework for Artificial Intelligence (Digital agenda, 2021).

In addition to this strategic document, operational actions were taken in various countries in the period 2020-2021, reflecting the requirements that arose from the Covid-19. Due to various restrictions, several institutions have switched to electronic communication. In Slovakia, many municipalities quickly adapted to the changed conditions and began to communicate electronically. Also, in education, online communication has adapted rapidly to common practice through the transition to distance learning. In Poland, also due to the global COVID-19 situation, many companies, not only institutions, are delivering their work remotely (Pilipczuk, 2021).

In addition to the overall EU assistance in the field of computerization and implementation of digital policy, it is crucial to evaluate the specific use of the Internet within the examined sample of countries in our article. It is important to evaluate the reasons for using the Internet because many psychosocial disorders are thought to be related to excessive Internet use. The presence of specific comorbid diagnoses, including mood disorders, bipolar disorders, and social anxiety disorder, are highly represented among groups of excessive Internet users (Yellowlees, Marks, 2007).

In the results and based on the data from Figures 4-6, we can see that the use of the Internet is different. Finally, the question is, what activities are done on the Internet by individuals? Because we see significantly different values in the example of Hungary. Table 2 contains selected indicators that can help us better justify the data obtained above. There are only selected indicators, which we found necessary for our research area.

In areas 3b) and 3c), we see the most significant differences in Hungary. 87 % of all internet users spend their time on social networks and communicating with friends in this country. We can conclude from this that in 2020, perhaps also due to the impact of the Covid-19 pandemic, time spent on the Internet was mainly creating social bonds and contacts. Shopping and online banking were used in this country, at least in comparison with other countries. On the contrary, online banking was the most successful in the Czech Republic. In this country, up to 80% of all internet users used online banking services in 2020.

Another area that became more important, especially during the Covid-19, is the Use of Internet for education. In this respect, we were surprised by the results. Only 15% of all internet users in Hungary are doing online courses. It was also the highest percentage among the V4 countries. The lowest % of all internet users doing online courses was in Poland.

Poland is a specific country which, on the one hand, has the highest coverage and use of the Internet by households, but also the highest number of people who do not use the Internet. These data must also consider that Polish inhabitants spend the least time on activities on the Internet compared to other V4 countries, whether on online banking, education and online courses, or even contacting on social networks.

Table 2. Selected indicators in V4 countries in 2020

|                                        |                                                |                      | CZ | HU | PL | SK |
|----------------------------------------|------------------------------------------------|----------------------|----|----|----|----|
| 3a)<br>Intern<br>et use                | Households with access to internet at home     | % of all households  | 88 | 88 | 90 | 86 |
|                                        | Individuals who have never used the Internet   | % of all individuals | 8  | 12 | 13 | 7  |
| 3b)<br>Activities<br>online and<br>3c) | on-line banking - individuals                  | % of internet users  | 80 | 61 | 59 | 65 |
|                                        | Doing an on-line course - individuals          | % of internet users  | 11 | 15 | 8  | 10 |
|                                        | Participating in social networks - individuals | % of internet users  | 67 | 87 | 66 | 72 |

Source: own processing according to Digital agenda data (2020)

## Conclusion

The Digital Economy and Society Index monitors Europe's overall digital performance. Its values reflect the country's overall state in the Use of Internet and technology, not only by the population but also by corporations and government at the same time. DESI contains a summary of several areas and aspects. It is good that we can value the current situation in a given country with one DESI value. But, on the other hand, it is not good to rely only on the overall value of DESI but also to examine its components. Because if a country shows problems in any of the areas surveyed, it will affect the overall assessment.

DESI consists of 5 basic areas, each of which again consists of several parts and a large number of indicators and variables enter into the calculation. However, we decided to analyze only one in more detail for the above reasons, namely the 3rd area from DESI.

In analyzing this section, we have identified in more detail the differences between countries as well as within a country. Surprising findings were made in Hungary, where most internet users were concentrated on social networks. Here we have the opportunity for further research into this phenomenon in a broader context. It would be interesting to examine in more detail the behavior of Internet users in this country, perhaps also with regard to the age and educational structure of the population.

In contrast, the country with the best internet coverage of households, Poland, had the fewest users in the area of Online activities and transactions among the analyzed countries. In this country, a deeper analysis would be needed to understand this current situation, as well as other activities of interest to consumers on the Internet.

To better understand and evaluate the obtained results, it is necessary to subject the remaining 4 areas forming the DESI to a deeper analysis. This could be a suggestion for further research on this issue.

The possible extension of the research sample to other countries or the whole EU could be a topic for further research. The field of the digital economy and the use of information technology, whether for everyday life or business, is very extensive. As can be seen in the summary, there are other possibilities where research can be directed in this area.

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# ASSESSMENT OF THE RELATIONSHIP BETWEEN ECONOMIC GROWTH, ENERGY CONSUMPTION, CARBON EMISSIONS AND RENEWABLE ENERGY SOURCES IN THE V4 COUNTRIES

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**ABSTRACT.** The aim of this paper is to assess the long-term and short-term relationships between economic growth, energy consumption, CO<sub>2</sub> emissions and the share of energy produced from renewable energy sources in the V4 countries in the period 1992-2019. The autoregressive distributed lag (ARDL) bounds testing methodology was applied for each of the examined variables as a dependent variable. The ARDL bounds reliably confirmed long-run cointegration between carbon emissions, energy consumption, economic growth, and renewables in Czechia, Slovakia, and Poland. Economic growth has a significant impact on carbon emissions in the long run in all of these three countries. Energy consumption has a significant impact on carbon emissions in the long-run in Poland; however, renewables significantly impact carbon emissions in Czechia and Slovakia. Understanding the interrelationships between the variables examined is essential for making informed and responsible decisions on climate and energy policies, strategies and actions in individual countries.

**Keywords:** energy consumption, economic growth, CO<sub>2</sub> emissions, renewable energy sources, decarbonisation, carbon-neutral economy, V4 countries

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## Introduction

Energy has been inextricably linked to human development since its beginning. It fueled and accelerated the industrial revolution more than two hundred years ago, and up to this day, it supports a highly complex interplay of human needs, desires, activities, and technologies. Although energy is fundamental for economic growth, its production and consumption are responsible for a number of negative environmental impacts. One of the most challenging global issues is anthropogenic greenhouse gas emissions, coming mainly from fossil fuel combustion for energy production. Rising concentrations of greenhouse gas emissions (especially CO<sub>2</sub>) in the atmosphere are causing air temperature increases, resulting in climate change. According to the IPCC report, human-induced global warming reached approximately 1°C above pre-industrial levels and in the absence of efficient mitigation policies aimed at a sharp decline in greenhouse gas emission, global warming is likely to surpass 1,5°C sometime between 2030 and 2045 (IPCC, 2021). These unprecedented changes pose a threat to humanity and ecosystems in the form of various natural disasters, rapid weather changes, health problems, threats to biodiversity, etc.

Although EU greenhouse gas emissions are gradually being reduced, the energy sector is still the largest producer of these emissions. Until 2009, the second-largest share of greenhouse gas (GHG) emissions was accounted for by the industrial sector, whose emissions fell after that year and were replaced by those of the transport sector. As CO<sub>2</sub> accounts for up to 80% of total greenhouse gas emissions, it is considered the primary driver of climate change (EEA, 2021; Tiseo, 2021). An overview of GHG emissions by sector, accounting for the largest share of EU GHG emissions, is shown in Figure 1.

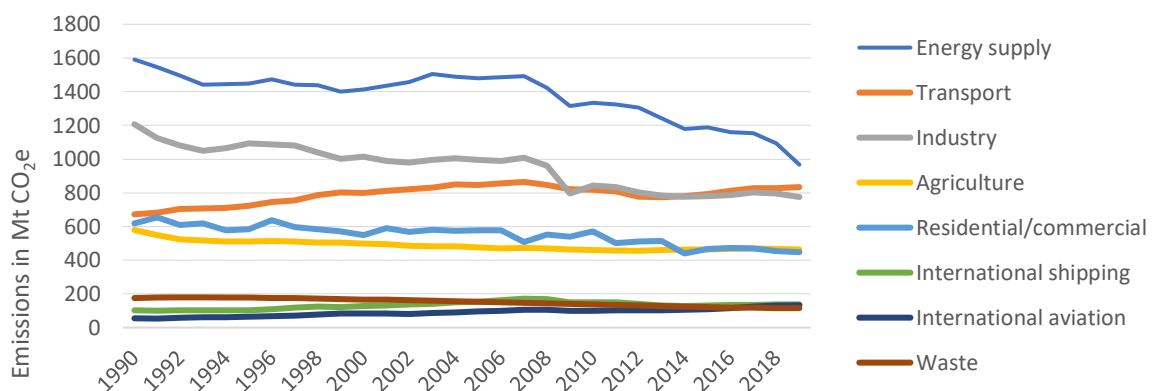


Figure 1. Annual greenhouse gas emissions in the European Union from 1990 to 2019, by sector (in million metric tons of CO<sub>2</sub>-equivalent)

Source: own processing, based on Eurostat

The adverse effects of rising carbon dioxide levels in the atmosphere have become a central topic in global discussion on transition to a carbon-neutral, green economy (EC, 2020; OECD, 2014; United Nations, 2015). The importance of these issues is also reflected in the European Union's political and strategic decisions. In December 2019, the EU introduced an ambitious proposal to make the bloc climate-neutral by 2050 (EC, 2019). This objective is at the heart of the European Green Deal and is in line with the EU's commitment to global climate action under the Paris Agreement. However, not all countries are proponents of green growth visions. Especially in V4 countries, Poland and the Czech Republic are reluctant to reduce greenhouse gases at the expense of economic development. The aim of the paper is to discuss the link between economic growth, energy consumption, CO<sub>2</sub> emissions and the share of renewable energy sources in energy production in the V4 countries. Assessing the relationship between the four variables will shed light on the driving forces of CO<sub>2</sub> emission production and the potential mitigation effect of renewables.

The paper is structured as follows. First, the theoretical background and overview of the previous empirical research carried out in this area are presented. Section 2 outlines the research methodology and data used. In the third section, the results of analysis are presented, followed by the fourth section discussing the results and limitations of the research. The last section concludes the paper.

## Theoretical background

Numerous studies focus on investigating the relationship between economic growth, energy use and GHG emissions, testing the validity of the Environmental Kuznets Curve (EKC) hypothesis that postulates an inverted U-shaped relationship between environmental degradation and per capita income in different countries/regions.

The use of EKC can be observed on two levels: theoretical and empirical. Theoretical studies devoted to the EKC can be traced to the early 1990s. One of the seminal works in this field was a study on measures to improve air quality (Grossman & Krueger, 1991). Other theoretical works from this period include (Panayotou, 1994) and (Shafik, 1994), in which the authors provide the earliest and most detailed explanation of the possible relationship between the degree of environmental degradation and the level of economic development expressed by the EKC (Yandle et al., 2004).

The empirical research on EKC focused mainly on two areas. The first group consists of studies examining the validity of the EKC for various indicators of environmental pollution (e.g., Diao et al., 2009; Hilton & Levinson, 1998; Kaika & Zervas, 2013; Sapkota & Bastola, 2017; Sarkodie, 2018; Selden & Song, 1994). These studies confirm the EKC's hypothesis that although economic growth leads to an increase in emissions at the beginning of economic development, over time these emissions may decrease due to various technological and structural changes in the economy. The second group of studies focuses on turning points for specific pollutants and countries (e.g. Apergis & Ozturk (2015); Gawande et al. (2000); Özokcu & Özdemir (2017); Park & Lee (2011); Patel et al. (1995); Zaim & Taskin (2000). Numerous studies on extensive material empirically demonstrate the validity of the EKC for various pollutants and processes in the environmental sphere (air, water, deforestation), as well as for economic sectors and countries. The validity of the EKC hypothesis, confirmed by many empirical studies, has led to its application in complex international research (e.g. Bölük & Mert (2014); Chovancová & Vavrek (2019); Cole et al. (1997); Miglietta et al. (2017); Sarkodie & Strezov (2018); Shafiei & Salim (2014); Waqih et al. (2019)).

However, the relationship between economic growth and environmental impacts is not straightforward, and other variables enter into this relationship. The United Nations report (UN, 2021), which assesses the achievement of sustainable development goals, emphasizes that energy consumption is responsible for 60% of total global greenhouse gas emissions. In light of this, the interaction between environmental degradation, energy consumption, and economic growth has been a frequently discussed issue in the energy economics literature in the last few decades. Ang (2007) first examined the dynamic relationship between pollutant emissions, energy consumption and economic development in France between 1960 and 2000. Ang points out that if these three variables are intensely interconnected, omitting one of them can cause serious problems in empirical analysis. Tiba & Omri (2017) conducted a comprehensive literature review on the relationship between energy, the environment, and economic growth at the level of individual countries and regions. After Ang, different authors explore the interrelationships of the three variables for different countries: e.g. Soytaş et al. (2007) focused on the USA, Zhang & Cheng (2009) analyzed the situation in China, Halicioglu (2009) in Turkey, Acaravci & Ozturk (2010) analyzed nineteen EU Member States, Vavrek & Chovancová (2020) examined energy performance of EU28, Baloch et al. (2019) performed the analysis of BRICS countries, Ozcan & Tzeremes (2020) surveyed 27 OECD countries and Litavcová & Chovancová (2021) performed the analysis of Danube region countries.

Researchers and practitioners point to renewable energy sources as a possible avenue for rebalancing economic growth, and environmental quality. Hence, the development of renewable energy has attracted the attention of many countries, including the EU member states. Therefore, this study examines the interrelationship between economic growth, energy consumption, greenhouse gas emissions, and the share of energy from renewable sources as a possible tool for mitigating negative environmental impacts.

## Data and methodology

### Data

The paper examines the relationship between economic growth (GDP per capita), energy consumption per capita, CO<sub>2</sub> emissions per capita, and the share of renewable energy sources in the Visegrad Group (V4) countries (Czech Republic, Hungary, Poland, and Slovakia) in the period 1992-2019. The data were retrieved from the World Bank's databases (GDP per capita in constant 2010 US \$)

and Eurostat (energy consumption per capita in kWh, CO<sub>2</sub> per capita in tons, renewable energy sources in % of gross final energy consumption).

The descriptive statistics are presented in Table 1, where the mean, minimum and maximum values, and standard deviation are calculated for each of the V4 countries. Stata 15.1 was used as the software tool for data processing and statistical analysis.

Table 1. Descriptive Statistics, n=28

|                                      |          | Czechia  | Slovakia | Hungary  | Poland   |
|--------------------------------------|----------|----------|----------|----------|----------|
|                                      |          | CZ       | SK       | HU       | PL       |
| GDP per capita                       | Mean     | 29978,67 | 21194,98 | 20461,56 | 22901,04 |
|                                      | Min      | 20760,05 | 11690,94 | 10714,66 | 15854,16 |
|                                      | Max      | 40696,31 | 31871,33 | 33120,52 | 32553,52 |
|                                      | Std.Dev. | 6156,32  | 6523,68  | 6604,11  | 4807,33  |
| Per capita CO <sub>2</sub> emissions | Mean     | 11,590   | 7,508    | 8,639    | 5,428    |
|                                      | Min      | 9,430    | 6,020    | 7,090    | 4,350    |
|                                      | Max      | 13,969   | 9,040    | 9,940    | 6,143    |
|                                      | Std.Dev. | 1,292    | 0,897    | 0,602    | 0,521    |
| Energy consumption per capita        | Mean     | 46878,68 | 37557,10 | 29018,28 | 27758,85 |
|                                      | Min      | 43317,38 | 32904,99 | 25954,79 | 24560,78 |
|                                      | Max      | 51297,28 | 41549,63 | 32106,32 | 30463,14 |
|                                      | Std.Dev. | 2284,56  | 2684,21  | 1582,11  | 1373,81  |
| Renewables (% sub energy)            | Mean     | 2,569    | 6,515    | 2,342    | 1,593    |
|                                      | Min      | 0,808    | 2,529    | 0,380    | 0,198    |
|                                      | Max      | 5,183    | 9,700    | 6,182    | 4,017    |
|                                      | Std.Dev. | 1,645    | 1,583    | 2,133    | 1,360    |

Source: own processing, based on Eurostat and World Bank

The Czech Republic leads the table in GDP per capita, per capita CO<sub>2</sub> emissions, and energy consumption per capita. The share of renewables in this country is the second-lowest, with a maximum of 5,183%.

Energy consumption per capita reaches the highest number in Slovakia, but renewables are also in the highest place among the surveyed countries. However, all of these countries lag far behind the EU average of 19.7% in 2019 in renewable energy production.

Significant heterogeneity of individual variables can be observed in some countries, which is reflected in the high value of standard deviation. Hungary and Slovakia are examples of countries where the significant growth of GDP can be observed. However, despite significant GDP growth, except for the Czech Republic, all countries in the survey group are below the EU average GDP per capita, which was 35,070.328 USD in December 2019.

## Methodology

The theoretical and empirical literature indicates that economic growth, CO<sub>2</sub> emissions, and energy consumption are bound together, as well as that employing renewable energy sources has a mitigating effect on the production of greenhouse gas emissions. We work with such data from four countries, collectively known as the Visegrad Group. All variables related to economic growth, energy consumption, CO<sub>2</sub> emissions, and renewables are utilized in natural logarithmic form. We use the abbreviations logGDp<sub>t</sub>, logCO<sub>2t</sub>, logEC<sub>t</sub>, and logRESt to denote their values at time *t*.

This research utilizes the unit root test of Dickey & Fuller (Dickey & Fuller, 1979), and bound test for cointegration of Pesaran et al. (Pesaran et al., 2001) which is extended by critical values and approximate p-values of Kripfganz and Schneider (Kripfganz & Schneider, 2020).

Some time series are bound together due to equilibrium forces even though the individual time series might move considerably. We focus on four of such series, logGDp<sub>t</sub>, logCO<sub>2t</sub>, logEC<sub>t</sub>, and logRESt. The methodology to determine this long-term impact and significance of considered variables uses an



autoregressive distributed lag (ARDL) modelling approach, widely developed by Pesaran and Shin (Pesaran & Shin, 1999) and Pesaran, Shin and Smith (Pesaran et al., 2001), which allows establishing whether there is cointegration between the variables, even if they are of a different order. For the purpose of efficient estimation of the model coefficients, an optimal lag order is obtained with model selection criteria such as the Akaike or Schwarz information criterion. However, for testing purposes, it is of primary concern that the error term is free of serial correlation. Once a conclusion from the test is drawn, a more parsimonious model can be estimated (Kripfganz & Schneider, 2020).

An additional advantage of its estimation is that it allows obtaining unbiased and efficient parameters when the presence of endogeneity and serial correlation problems is suspected. In addition, it is more appropriate for estimating short and long term on small samples, which is also our case.

For the first, the stationarity test was done using the Augmented Dickey–Fuller (ADF) test to ensure that none of the series employed in this study is I(2) (Litavcová & Chovancová, 2021).

To find a cointegration relationship between economic growth, CO<sub>2</sub> emissions, energy consumption, and renewables employed ARDL( $p, q_1, q_2, q_3$ ) model can be expressed as follows:

$$y_t = c_0 + \sum_{i=1}^p \phi_i y_{t-i} + \sum_{i=0}^{q_1} \beta_{1,i} x_{1,t-i} + \sum_{i=0}^{q_2} \beta_{2,i} x_{2,t-i} + \sum_{i=0}^{q_3} \beta_{3,i} x_{3,t-i} + u_t \quad (1)$$

where  $p \geq 1, q_1 \geq 0, q_2 \geq 0, q_3 \geq 0$  are optimal lag orders for dependent variable  $y$  and three independent variables  $x_1, x_2$  and  $x_3$ ;  $\phi$ -s and  $\beta$ -s are coefficients;  $c_0$  is a constant;  $u_t$  is the error term. Independent variables allowed to be I(0) or I(1) or cointegrated. For each of the considered countries, we estimate four ARDL models, for each of the four variables logGDPt, logCO2t, logECt, and logRES in the position of the explained variable.

The existence of a long-run cointegrating relationship can be tested based on the error correction representation. A bounds testing procedure allows to find out this relationship regardless the variables are integrated of order zero or one, I(0) or I(1), respectively. In this way, if the value calculated for the F-statistic is above the critical value of the upper limit, the null hypothesis of no cointegration is rejected and the existence of a long-term relationship is concluded. On the contrary, if the F-statistic is below the critical value of the lower limit, it implies the absence of cointegration (Pesaran et al., 2001).

However, where there is cointegration according to Pesaran et al. (2001), the model can be represented by an error correction form. The error-correction form of the ARDL model separates the adjustment coefficient to deviations from long-run equilibrium, long-run coefficients, and short-run coefficients. The model can be written as follows:

$$\Delta y_t = c_0 - \alpha(y_{t-1} - \theta_1 x_{1,t} - \theta_2 x_{2,t} - \theta_3 x_{3,t}) + \sum_{i=1}^{p-1} \psi_i \Delta y_{t-i} + \sum_{i=0}^{q_1-1} \gamma_{1,i} \Delta x_{1,t-i} + \sum_{i=0}^{q_2-1} \gamma_{2,i} \Delta x_{2,t-i} + \sum_{i=0}^{q_3-1} \gamma_{3,i} \Delta x_{3,t-i} + u_t \quad (2)$$

where  $\alpha$  is the speed adjustment coefficient;  $\theta$ -s are long-run,  $\psi$ -s and  $\gamma$ -s are short-run coefficients. To confirm the long-term relationship, the coefficient  $\alpha$  is expected to be negative and statistically significant. Likewise, to ensure the validity of the results of the cointegration test, the tests of heteroscedasticity, autocorrelation and normality of the residuals are applied. In line with Odugbesan and Rjoub (Odugbesan & Rjoub, 2020), we also employed Breusch–Godfrey Serial Correlation LM (Lagrange multiplier) test to investigate a serial correlation in each equation, and Breusch–Pagan–Godfrey heteroskedasticity test was also used to determine that the model is free from the heteroskedasticity problem. To test the normality of residuals, the SW test was used. Finally, as (Pesaran et al., 2001) recommend, the cumulative sum of recursive residuals (CUSUM) should be applied in determining the stability of the ARDL model.

## Results

### Unit Root Test

The unit root test was applied to determine the stationarity of our data set. This is necessary to avoid an unpredictable outcome in our time series analysis (Odugbesan & Rjoub, 2020). There exist several tests of stationarity. In this analysis, one of them, particularly the augmented Dickey–Fuller unit-root test (ADF) on the level and on the first difference was employed. The three-time series are stationary already at level, i.e. logRES in Slovakia, and logCO2 in Poland and in Hungary. In the case of logGDP and logEC, the time series of all countries have unit root at a level and are stationary after the first differences. Also variables logCO2 and logRES meet the requirements for further analysis because they



are stationary at the first difference. None of the variables employed in the analysis is integrated at I(2) so as not to violate the assumptions of ARDL (Pesaran et al., 2001).

Table 2 Augmented Dickey-Fuller unit-root test

| Country  | logGDP |                  | logCO <sub>2</sub> |                  | logEC  |                  | logRES    |                  |
|----------|--------|------------------|--------------------|------------------|--------|------------------|-----------|------------------|
|          | Level  | First difference | Level              | First difference | Level  | First difference | Level     | First difference |
| Czechia  | -0.567 | -3.449**         | -1.541             | -7.003***        | -1.465 | -4.689***        | -0.784    | -5.978***        |
| Slovakia | -1.216 | -3.919**         | -1.679             | -8.092***        | -1.091 | -7.407***        | -4.175*** | -6.119***        |
| Poland   | -1.517 | -3.154*          | -3.238*            | -9.731***        | -1.230 | -4.408***        | -0.050    | -4.421***        |
| Hungary  | 0.121  | -3.374*          | -3.119*            | -8.756***        | -1.710 | -4.441***        | -0.505    | -3.447**         |

Note: The significance of the ADF test is indicated by an asterisks in the table where “\*”, “\*\*\*”, “\*\*\*\*” denotes 5%, 1%, and 0.1% significance level.

### ARDL bound testing for cointegration

The results of the bound test show F-values and the lower and upper critical F-values of Kripfganz & Schneider (Kripfganz & Schneider, 2020) at 5% are captured in table 3.

Table 3. The ARDL Bound Testing for cointegration with Kripfganz and Schneider (Kripfganz & Schneider, 2020) critical values and approximate p-values

| Country   | Variable           | F-statistic | I(0) bound (5%) | I(1) bound (5%) | Co-integration | Decision                           |
|-----------|--------------------|-------------|-----------------|-----------------|----------------|------------------------------------|
| <b>CZ</b> | logCO <sub>2</sub> | 12.355      | 3.979           | 5.729           | Yes            | error correction model             |
|           | logLEC             | 4.953       | 3.967           | 5.660           | Yes            | error correction model (in 10% cv) |
|           | logGDP             | 1.744       | 3.929           | 5.454           | No             | short-run model                    |
|           | logRES             | 5.718       | 3.992           | 5.798           | Yes            | error correction model             |
| <b>SK</b> | logCO <sub>2</sub> | crashed     |                 |                 | Yes            | error correction model             |
|           | logLEC             | 2.652       | 3.941           | 5.523           | No             | short-run model                    |
|           | logGDP             | crashed     |                 |                 | Yes            | error correction model             |
|           | logRES             | 5.737       | 3.916           | 5.385           | Yes            | error correction model             |
| <b>PL</b> | logCO <sub>2</sub> | 21.169      | 3.904           | 5.317           | Yes            | error correction model             |
|           | logLEC             | 11.189      | 3.979           | 5.729           | Yes            | error correction model             |
|           | logGDP             | 4.830       | 3.904           | 5.317           | No             | short-run model                    |
|           | logRES             | 3.350       | 3.941           | 5.523           | No             | short-run model                    |
| <b>HU</b> | logCO <sub>2</sub> | crashed     |                 |                 | No             | short-run model                    |
|           | logLEC             | crashed     |                 |                 | No             | short-run model                    |
|           | logGDP             | 5.630       | 3.916           | 5.385           | No             | short-run model (due to test)      |
|           | logRES             | 6.121       | 3.954           | 5.591           | Yes            | error correction model             |

In the case of Czechia, if CO<sub>2</sub> is the dependent variable, then the cointegration among CO<sub>2</sub>, GDP, energy consumption and renewables was detected. This indicates that there are possibilities of a long-run relationship among the variables. So there will be necessary to estimate the error correction model to determine the speed of adjustment in case there is a shock. The same applies for the energy consumption and renewables as dependent variables. Based on the result of the ARDL bounds test for cointegration, for GDP as a dependent variable, it is necessary to apply only the ARDL short-run model. Here, the cointegration was not confirmed.

In the case of Poland, when CO<sub>2</sub> and energy consumption are considered dependent variables, the cointegration with the other three variables was revealed and the error correction model was performed to determine the significance of the long-run relationship and the speed of adjustment. For GDP and renewables in the position of dependent variable, there is no cointegration, i.e. only a short-run model was applied.

As for Slovakia, the result from the bounds test shows a cointegration when renewables is the dependent variable, while in the case of logCO<sub>2</sub> and logGDP bound test failed due to the small number of data. When examining both models, i.e. long-run and short-run, based on the results we decided for the error correction model.

Considering Hungary, the same situation occurred. Similarly, as in Slovakia, we decided for the ARDL (short-run) models for variables CO<sub>2</sub> and energy consumption because the time series were too short. In this country, the selection of the error correction model was verified by a bound test only for renewables as the dependent variable. The bound test showed the suitability of the short-run model for variable logGDP.

### Estimates for causal relationship

For Czechia, Slovakia and Poland, the error correction model was estimated to determine the long-run relationship and the speed of adjustment due to the long-run relationship among CO<sub>2</sub> emissions, economic growth, energy consumption, and renewables. As can be seen in Table 4, the economic growth and CO<sub>2</sub> emissions have a stable long-run causal relationship in all of these three countries. The Error Correction Term (ECT) coefficients for these countries are -2.41, -1.04, and -1.47; all of them are negative and statistically significant. The first of them is too low - this implies that it will take a long period for the system to adjust back to equilibrium in the presence of shock and equilibrium will be adjusted in a dampening manner (Odugbesan & Rjoub, 2020). Diagnostic tests reveal that models for Czechia and Slovakia have a serious problem with serial correlation and the model for Poland has a problem with the normality of residuals. As the time series were too short, a better model could not be found. If there is no validity problem, the result implies that in the presence of shock, it will take a long time to return back to equilibrium as a result of the high speed of adjustment in these countries (Odugbesan & Rjoub, 2020).

The results in Table 5 reveal statistically significant short-run causality running from economic growth to CO<sub>2</sub> emissions in Slovakia and Hungary. The short-run causality running from energy consumption to CO<sub>2</sub> emissions has been demonstrated in the same countries, i.e. Slovakia and Hungary, and the short-run causality running from renewables to CO<sub>2</sub> emissions has been demonstrated in Czechia, Slovakia and Hungary. The results for Hungary are the product of a valid short-run model.

The variables that contribute to the economic growth in the V4 countries are depicted in Table 4. The results reveal that only in one country, i.e. Slovakia, the CO<sub>2</sub> emissions, and renewables have a long-run relationship with economic growth. But, as diagnostic tests reveal, there is a problem with serial correlation in this model.

The results shown in Table 5 indicate that there is a short-run causality running from CO<sub>2</sub> emissions to economic growth in three countries: Czechia, Slovakia and Poland, whereas the other two variables, energy consumption and renewables, have short-run causality to economic growth in Slovakia, Poland and Hungary.

The existence of cointegration, i.e. long-run relationship among energy consumption, economic growth, CO<sub>2</sub> emissions and renewables was present in Czechia and Poland, as it follows from Table 4. The ECT coefficient for Czechia is -0.47 and the long-run relationship is stable and valid. This implies that the energy consumption converges to the long-run equilibrium by 47% in one period with the speed adjustment via the channel of economic growth, CO<sub>2</sub> emissions, and renewables (Türsoy, 2017). As in the model for Poland, random errors are not normally distributed; the model is not valid. However, a better model could not be found. Statistically significant short-run causality running from economic growth to energy consumption was present only in Czechia, as it follows from Table 5. The short-run causality running from CO<sub>2</sub> emissions to energy consumption has been proved in Poland and Hungary, and the short-run causality running from renewables to energy consumption has been demonstrated in Slovakia, Poland, and Hungary.

On the variables that contribute to the increase of renewables use for energy production in the V4 countries, the results depicted in Table 4 reveal that in Czechia, Slovakia, and Hungary economic growth, CO<sub>2</sub> emissions, and energy consumption a long-run relationship with renewables is present, with good validity of all three long-run models. Table 4 shows that economic growth and CO<sub>2</sub> emissions have a stable long-run causal relationship with renewables in Czechia and Hungary. However, energy consumption has a stable long-run causal relationship with renewables only in Slovakia. The ECT coefficient of a stable long-run relationship for Slovakia is -0.84. Therefore, this implies that the renewables converge to the long-run equilibrium by 84% in one period with the speed adjustment via the channel of economic growth, CO<sub>2</sub> emissions, and energy consumption (Hobijn et al., 1998).

Moreover, the results shown in Table 5 reveal that there is also a short-run causality running from economic growth to renewables in Hungary, running from CO<sub>2</sub> emissions to renewables in Czechia and Hungary. The significant short-run relationship running from energy consumption to renewables has not been demonstrated in any of the V4 countries. This implies that energy consumption in the V4 countries does not cause renewable energy consumption.

The diagnostic tests mentioned in the previous chapter was used for verification of the validity of each model. It was found that 9 of all 16 models are valid and relevant and can support responsible

and evidence-based decisions and policy making. Also, the testing of the stability of the models revealed that they all fall within the 5% significance level boundary.

Table 4 Long-run statistic and Diagnostic test

| <b>Part A: Long run statistics</b> |                           |                           |          |                                  |                                             |           |
|------------------------------------|---------------------------|---------------------------|----------|----------------------------------|---------------------------------------------|-----------|
|                                    | Dependent variable        | logGDPt                   | logCO2t  | logLEct                          | logLRESt                                    | ECT       |
| <b>CZ</b>                          | $\Delta \log \text{CO2t}$ | 0.14*                     |          | -0.15                            | -0.22***                                    | -2.41***  |
|                                    | $\Delta \log \text{LEct}$ | 0.56**                    | 0.37     |                                  | -0.16*                                      | -0.47**   |
|                                    | $\Delta \log \text{GDPt}$ |                           |          |                                  |                                             |           |
|                                    | $\Delta \log \text{RESt}$ | 0.74**                    | -4.36*** | -0.71                            |                                             | -1.99**   |
| <b>SK</b>                          | $\Delta \log \text{CO2t}$ | -0.51***                  |          | 0.04                             | 0.33*                                       | -1.04***  |
|                                    | $\Delta \log \text{LEct}$ |                           |          |                                  |                                             |           |
|                                    | $\Delta \log \text{GDPt}$ |                           | -1.90*** | 0.11                             | 0.69**                                      | 0.32**    |
|                                    | $\Delta \log \text{RESt}$ | -0.01                     | -0.50    | -1.98**                          |                                             | -0.84***  |
| <b>PL</b>                          | $\Delta \log \text{CO2t}$ | -0.16*                    |          | 0.78***                          | 0.02                                        | -1.47***  |
|                                    | $\Delta \log \text{LEct}$ | 0.15**                    | 0.89***  |                                  | -0.001                                      | -1.61***  |
|                                    | $\Delta \log \text{GDPt}$ |                           |          |                                  |                                             |           |
|                                    | $\Delta \log \text{RESt}$ |                           |          |                                  |                                             |           |
| <b>HU</b>                          | $\Delta \log \text{CO2t}$ |                           |          |                                  |                                             |           |
|                                    | $\Delta \log \text{LEct}$ |                           |          |                                  |                                             |           |
|                                    | $\Delta \log \text{GDPt}$ |                           |          |                                  |                                             |           |
|                                    | $\Delta \log \text{RESt}$ | 4.68***                   | -5.44**  | 3.64                             |                                             | -0.67***  |
| <b>Part B: Diagnostic tests</b>    |                           |                           |          |                                  |                                             |           |
|                                    | Dependent variable        | Normality<br>Wilk p-value | Shapiro  | Ser. Corr<br>bgodfrey<br>p-value | Homoskedasticity<br>imtest white<br>p-value | Stability |
| <b>CZ</b>                          | $\Delta \log \text{CO2t}$ |                           | 0.20     | 0.01**                           | 0.40                                        | stable    |
|                                    | $\Delta \log \text{LEct}$ |                           | 0.81     | 0.14                             | 0.40                                        | stable    |
|                                    | $\Delta \log \text{GDPt}$ |                           | 0.31     | 0.68                             | 0.76                                        | stable    |
|                                    | $\Delta \log \text{RESt}$ |                           | 0.29     | 0.09                             | 0.40                                        | stable    |
| <b>SK</b>                          | $\Delta \log \text{CO2t}$ |                           | 0.72     | 0.02*                            | 0.40                                        | stable    |
|                                    | $\Delta \log \text{LEct}$ |                           | 0.96     | 0.93                             | 0.40                                        | stable    |
|                                    | $\Delta \log \text{GDPt}$ |                           | 0.34     | 0.02*                            | 0.40                                        | stable    |
|                                    | $\Delta \log \text{RESt}$ |                           | 0.07     | 0.32                             | 0.26                                        | stable    |
| <b>PL</b>                          | $\Delta \log \text{CO2t}$ |                           | 0.02*    | 0.34                             | 0.52                                        | stable    |
|                                    | $\Delta \log \text{LEct}$ |                           | 0.01*    | 0.58                             | 0.40                                        | stable    |
|                                    | $\Delta \log \text{GDPt}$ |                           | 0.85     | 0.04*                            | 0.40                                        | stable    |
|                                    | $\Delta \log \text{RESt}$ |                           | 0.04*    | 0.58                             | 0.40                                        | stable    |
| <b>HU</b>                          | $\Delta \log \text{CO2t}$ |                           | 0.98     | 0.47                             | 0.40                                        | stable    |
|                                    | $\Delta \log \text{LEct}$ |                           | 0.86     | 0.20                             | 0.40                                        | stable    |
|                                    | $\Delta \log \text{GDPt}$ |                           | 0.13     | 0.01*                            | 0.40                                        | stable    |
|                                    | $\Delta \log \text{RESt}$ |                           | 0.15     | 0.64                             | 0.40                                        | stable    |

Note: The significance of the coefficients is indicated by an asterisks in the tables where “\*”, “\*\*”, “\*\*\*” denotes 5%, 1%, and 0.1% significance level.

Table 5. Short-run statistic

| Part A             |                     | $\Delta \log GDP$ |         |        |        |        | $\Delta \log CO_2$ |          |          |          |         |
|--------------------|---------------------|-------------------|---------|--------|--------|--------|--------------------|----------|----------|----------|---------|
| Dependent variable |                     | t                 | t-1     | t-2    | t-3    | t-4    | t                  | t-1      | t-2      | t-3      | t-4     |
| CZ                 | $\Delta \log CO_2t$ |                   |         |        |        |        |                    | 0.89**   | 0.58**   |          |         |
|                    | $\Delta \log LECt$  | 0.25              | -0.79** | 0.12   | -0.53* |        |                    |          |          |          |         |
|                    | $\Delta \log GDPt$  |                   | 0.39*   |        |        |        | 0.21*              |          |          |          |         |
|                    | $\Delta \log REST$  |                   |         |        |        |        | 6.03**             | 3.25*    | 2.12*    |          |         |
| SK                 | $\Delta \log CO_2t$ | 2.08***           | 1.86**  |        |        |        |                    | -0.72*** | -0.66*** | -0.38*** |         |
|                    | $\Delta \log LECt$  | -0.17             |         |        |        |        | 0.18               |          |          |          |         |
|                    | $\Delta \log GDPt$  |                   | -1.09** |        |        |        | 0.01               | 0.46***  | 0.41***  | 0.23**   |         |
|                    | $\Delta \log REST$  |                   |         |        |        |        |                    |          |          |          |         |
| PL                 | $\Delta \log CO_2t$ |                   |         |        |        |        | -1.07***           | -0.57**  | -0.18    |          |         |
|                    | $\Delta \log LECt$  |                   | 0.76**  | -0.49* | -0.19  |        | -0.14*             | -0.02    | -0.17    | -0.20*   | -0.20** |
|                    | $\Delta \log GDPt$  | -16.1             | 13.3    | -6.39  | -5.83  |        | -2.01              | 0.84     | -1.63    | -3.09    | -3.46   |
|                    | $\Delta \log REST$  |                   |         |        |        |        |                    |          |          |          |         |
| HU                 | $\Delta \log CO_2t$ | 1.89              | -2.28*  | 2.77** | -1.25* | -1.56* |                    | -0.53*   |          |          |         |
|                    | $\Delta \log LECt$  | 0.46              |         |        |        |        | 0.26**             | 0.29**   | 0.41***  | 0.19**   |         |
|                    | $\Delta \log GDPt$  |                   | 0.62*   | -0.64* | 0.52*  |        | 0.07               | -0.04    | -0.18    |          |         |
|                    | $\Delta \log REST$  | -9.21**           | -3.41   |        |        |        | 1.49*              |          |          |          |         |

| Part B             |                     | $\Delta \log EC$ |        |         |         |        | $\Delta \log RES$ |          |         |          |         |
|--------------------|---------------------|------------------|--------|---------|---------|--------|-------------------|----------|---------|----------|---------|
| Dependent variable |                     | t                | t-1    | t-2     | t-3     | t-4    | t                 | t-1      | t-2     | t-3      | t-4     |
| CZ                 | $\Delta \log CO_2t$ |                  |        |         |         |        | 0.36**            | 0.34***  | 0.29**  | 0.12*    |         |
|                    | $\Delta \log LECt$  |                  | 0.38*  |         |         |        |                   |          |         |          |         |
|                    | $\Delta \log GDPt$  | 0.29             |        |         |         |        | 0.01              |          |         |          |         |
|                    | $\Delta \log REST$  | -1.93            |        |         |         |        |                   | 1.18**   | 1.09**  | 0.45     |         |
| SK                 | $\Delta \log CO_2t$ | -0.02            | -0.29  | -0.69** | -0.57** |        | -0.33**           | -0.34*** | -0.23** | -0.13*** |         |
|                    | $\Delta \log LECt$  |                  | -0.26  |         |         |        | -0.06             | 0.04     | -0.14*  |          |         |
|                    | $\Delta \log GDPt$  | 0.03             | 0.18   | 0.45**  | 0.34**  |        | 0.21**            | 0.22***  | 0.14*** | 0.08**   |         |
|                    | $\Delta \log REST$  | 1.26             |        |         |         |        |                   |          |         |          |         |
| PL                 | $\Delta \log CO_2t$ |                  |        |         |         |        |                   |          |         |          |         |
|                    | $\Delta \log LECt$  |                  | 0.62** | 0.42*   |         |        | -0.08*            |          |         |          |         |
|                    | $\Delta \log GDPt$  | 0.05             | 0.20*  | 0.38**  | -0.05   | 0.26   | -0.03             | 0.04     | 0.07    | -0.06*   | -0.05*  |
|                    | $\Delta \log REST$  | -1.43            | 2.17   | 6.30    | -1.60   | 3.23   |                   | 0.86     | 1.52*   | -0.85    | -1.07   |
| HU                 | $\Delta \log CO_2t$ | 1.85**           | 1.55** | -0.11   | -0.65   | 1.87** | 0.05              | -0.23**  | 0.34**  | -0.33**  | 0.42**  |
|                    | $\Delta \log LECt$  |                  | -0.28  | -0.49** | -0.34   | -0.22* | 0.03*             | 0.03*    | -0.01   | 0.04*    | -0.04   |
|                    | $\Delta \log GDPt$  | 0.15             | -0.26  | 0.35    | 0.22    | -0.24* | -0.02             | 0.06*    | -0.09** | 0.07*    | -0.10** |
|                    | $\Delta \log REST$  |                  |        |         |         |        |                   | 0.48*    |         |          |         |

Note: The significance of the coefficients is indicated by an asterisks in the tables where “\*”, “\*\*”, “\*\*\*” denotes 5%, 1%, and 0.1% significance level.

## Discussion

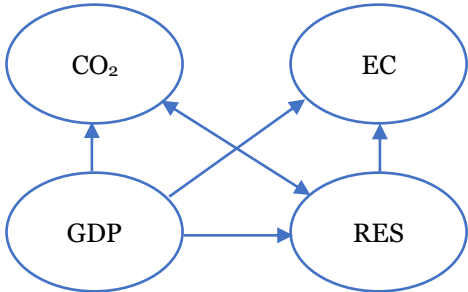
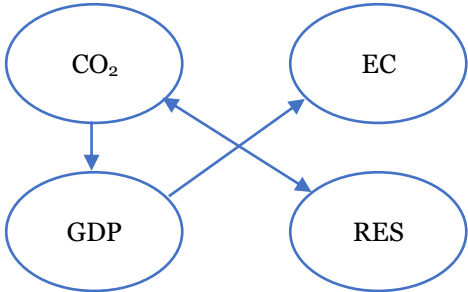
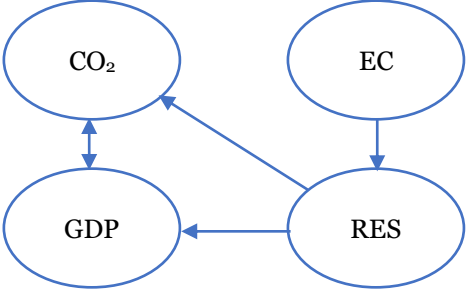
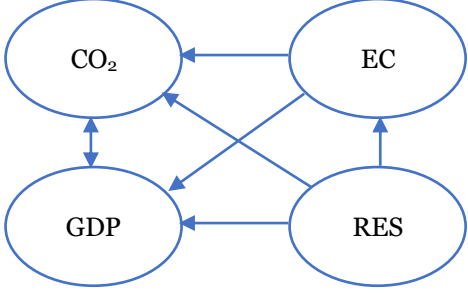
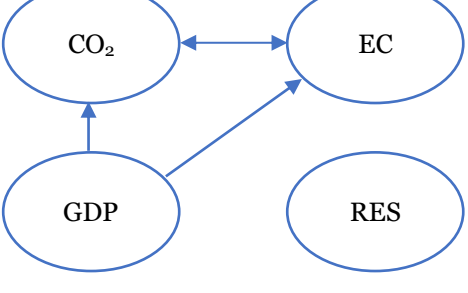
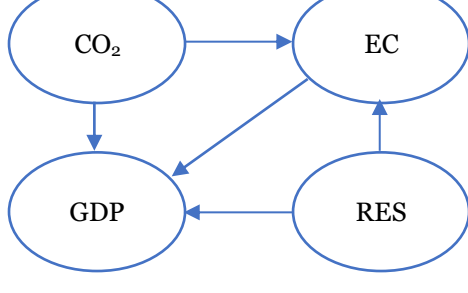
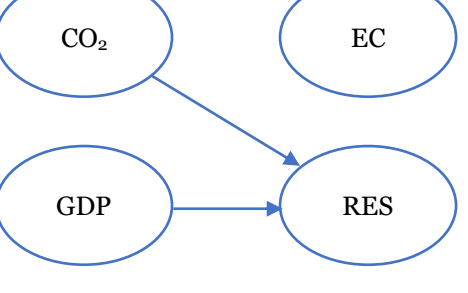
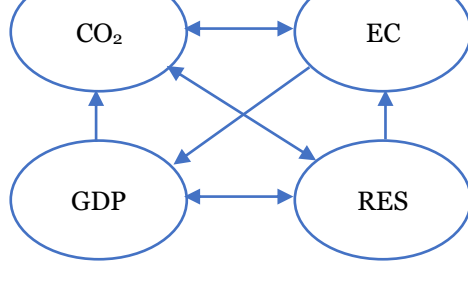
As shown in Tables 4 and 5, the analysis of the long-run and short-run relationships among four variables economic growth, energy consumption, carbon emissions, and renewables in the V4 countries reveals contrasting findings. To better understand these complex relationships, we have captured them graphically in table 6.

From the long-run perspective, the results for Czechia show the existence of a bi-directional relationship between renewables and carbon emissions, indicating that these two variables are jointly determined and affect each other, which supports the feedback hypothesis (Aydin, 2019). Economic growth has a positive effect on energy consumption, CO<sub>2</sub> and renewables. This implies that conservation policies aimed at energy efficiency and promoting the use of renewable energy sources do not influence economic growth (Menegaki & Tugcu, 2016). A bi-directional relationship between renewables and carbon emissions is also present in the short run.

Bi-directional long-run causality between economic growth and carbon emissions was found only in the case of Slovakia. This relationship was also confirmed in the study by Al-Mulali & Che Sab (2018) for South Korea. Renewables have a positive effect on GDP and CO<sub>2</sub>, where uni-directional long-run causality can be observed. However, energy consumption negatively affects the share of renewable energy. Similarly, a bi-directional relationship between economic growth and carbon emissions is present in terms of a short-run relationship. In the short run, the negative effect of energy consumption

on the production of CO<sub>2</sub> emissions is also evident. Renewables contribute to a decline in CO<sub>2</sub> emissions and have a positive effect on the economic growth of the country in the short-term perspective. The wider adoption of renewable energy sources in this case brings multiple benefits – it improves the quality of the environment and public health and supports economic development. In a broader perspective, it presents a possible path for the V4 countries in meeting the climate neutrality targets set at the EU level (Hafner & Raimondi, 2020).

Table 6 Relationship between variables

| Country         | Long-run relationship                                                               | Short-run relationship                                                               |
|-----------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| <b>Czechia</b>  |    |    |
| <b>Slovakia</b> |   |   |
| <b>Poland</b>   |  |  |
| <b>Hungary</b>  |  |  |

Note 1:  Uni-directional long-run relationship

 Bi-directional long-run relationship

Note 2: GDP – gross domestic product, CO<sub>2</sub> – carbon dioxide, EC – energy consumption, RES – renewable energy sources.



Results for Poland show a positive uni-directional relationship between GDP and energy consumption, suggesting that an increase in GDP causes an increase in energy consumption in the long run. Similar results were achieved by Ozturk et al. (2010) in their study, where this relationship applied to low-income countries. The introduction of decarbonisation and energy efficiency measures will play an important role in this country. The negative uni-directional relationship between economic growth and CO<sub>2</sub> emissions implies that with a growing economy, CO<sub>2</sub> emissions decrease. This may be due to technological advancement and/or structural changes in the economy. This fact supports the EKC hypothesis, suggesting that at a certain level of economic development countries invest more in environmental measures, which is reflected in improving the quality of the environment. A feedback effect is evident between energy consumption and carbon emissions. The neutrality hypothesis applies to renewables, where there is no relationship between other variables in the long run, which complies with the findings of Menegaki (2011) for EU 27 countries. In the short run, CO<sub>2</sub> emissions affect negatively the economic growth of the country.

From a long-term perspective, we can observe only two uni-directional relations in the case of Hungary: the positive effect of economic growth on renewable energy sources and the negative effect of CO<sub>2</sub> on renewables. However, short-run relations are more complex. Feedback effects can be observed between renewables and CO<sub>2</sub> emissions, economic growth and renewables, as well as CO<sub>2</sub> emissions and energy consumption, implying that these variables affect each other. In the short term, unidirectional relationships can be observed running from GDP to CO<sub>2</sub> emissions, from energy consumption to GDP, and from renewables to energy consumption.

## Conclusions

In the context of escalating global environmental pressures, it has become increasingly clear that Europe's prevailing model of economic development — based on steadily growing resource use and harmful emissions — cannot be sustained in the long term. Therefore, one of the priorities of the European Union and the V4 countries that are the subject of our research is the transition to a resource-efficient and a low-carbon society.

This study examines the long- and short-run relationships and causality between economic growth, energy consumption, and carbon emissions in V4 countries, including renewable energy, in a multivariate framework.

The ARDL bounds reliably confirm long-run cointegration between CO<sub>2</sub> emissions, energy consumption, economic growth, and renewables in Czechia, Slovakia, and Poland. Economic growth impacts significantly the levels of CO<sub>2</sub> emissions in the long run in all of these three countries. Also, energy consumption is a strong driver for carbon emissions in the long-run in Poland. However, renewables significantly impact carbon emissions in Czechia and Slovakia. In the short run, the impact of economic growth and energy consumption is significant in Slovakia and Hungary. The impact of renewables in Czechia, Slovakia and Hungary is also significant. Likewise, when examining cointegration between carbon emissions, energy consumption, economic growth, and renewables in the short run, a significant contribution of CO<sub>2</sub> emissions to energy consumption in Poland and Hungary was detected as a result of four models.

The analysis confirmed the existence of heterogeneous relationships between the examined variables in the individual V4 countries. Revealing the interrelationships between these variables represents an important knowledge base for decision-makers and other stakeholders responsible for the formulation of new and revision of existing climate and energy policies.

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# DEVELOPMENT OF SLOVAK CAPITAL IN TAX HAVENS

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**ABSTRACT.** Countries with tax benefits are still attractive for business entities operating in the conditions of the Slovak Republic. The paper aims to quantify the number of offshore companies based on data from the financial report of the Ministry of Finance of the Slovak Republic and Bisnode A Dun & Bradstreet Company and evaluate the development of Slovak companies in tax havens in 2008-2020. The second aim is to verify the hypothesis about statistically significant differences in the number of Slovak offshore companies in analyzed countries between 2020 and 2008. The development of the number of Slovak companies is assessed in absolute and relative terms using a chain index, a base index, a growth rate, and a geometric mean. The stated hypothesis is tested using Wilcoxon Signed-Rank Test. The results showed that the number of companies in tax havens increased to the greatest extent in 2020. The highest average annual growth rate in the tax haven countries was 52.85% in the Marshall Islands and the lowest average annual growth rate for the analyzed period was in the Netherlands Antilles (3.75%). The USA, the Netherlands and Cyprus are the countries of tax havens with the highest value of Slovak capital.

**Keywords:** company, tax haven, tax, index

**JEL Classification:** F38, H26

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## Introduction

Offshore companies are an integral part of the global financial world. Tax havens are often referred to as a tax oasis, as they represent a low-tax country or an opportunity for businesses to avoid tax liabilities. When defining tax havens, it is necessary to respect economic dependencies and, at the same time, the legal environment. There is no general definition of tax havens. Still, it is most often said to be an area or country where incomes and wealth are subject to low or no taxes and have developed antitrust legislation. Therefore, asset management is extremely advantageous there. The term "tax haven" or "tax paradise" is associated with several other terms, e.g., "offshore", "offshore financial center" ("OFC") and "onshore". Individual entities represent legal entities that arise in offshore countries, the so-called tax havens, and are registered under the legislation of that country. Countries attract entrepreneurs from all over the world to very favorable conditions, especially regarding taxation. Offshore companies are used mainly for legal tax optimization, to create the structures necessary for the efficient operation of international companies and to protect assets. The aim of the paper is to quantify the number of offshore companies based on data from the financial report of the Ministry of Finance of the Slovak Republic and Bisnode A Dun & Bradstreet Company and evaluate the development of Slovak companies in tax havens in 2008-2020. The second aim is to verify the hypothesis about statistically significant differences in the number of Slovak offshore companies in analyzed countries between 2020 and 2008.

## Theoretical background

Tax havens have been the research subject of many studies. Babčák (2018) examines the issue of tax havens in detail. Stojáková (2018) deals with the current issue of introducing sanctions for tax havens, focusing on the advantages, disadvantages, and risks associated with doing business in tax havens. Bujňáková (2018) points out selected measures and forms of combating the effects of tax havens. Červená and Romanová (2018) study the history of tax havens. Korečko (2012) deals with the issue of tax harmonization and tax competition, which affect the existence of tax havens. Finally, Slemrod and Wilson (2009) developed an equilibrium model of tax havens and tax competition.

The term tax haven is a general and, in fact, to some extent pejorative, with a particular ideological undertone, perceived as an island paradise only for the chosen ones. Such a definition had its partial justification only in the beginnings of the existence of tax havens (Babčák, 2018, p. 16). The existence of tax havens does not, in principle, undermine the effects of indirect taxes, as they are harmonized in the EU (notwithstanding the difficulties that the current harmonization system currently causes). However, a possible harmonization of income taxation would not completely solve the problem of the existence of tax havens, but it would bring to the system of corporate income taxation in the EU a much higher expected level of balance (Babčák, 2018, p. 31).

In 1998, the OECD (1998) characterized four key factors that a country should meet to become a tax haven:

- no or nominal tax on the relevant income (does not apply to domestic),
- lack of effective exchange of information,
- lack of transparency,
- no substantial activities.

Mara (2015) identified the major determinants of tax havens in the actual economic context. Logistic regression reveals the most important factors that favor a country's tax haven status.

Tax and non-tax benefits tend to divert financial capital from other countries, which has a very detrimental effect on the income bases of other countries. Because tax havens offer a way to minimize taxes and gain financial secrecy, tax havens affect corporate and individual investors. In addition, tax havens provide a place to hold passive investments, provide a place where paper profits can be settled, and allow taxpayers' matters, especially their bank accounts, to be effectively protected from control by the tax authorities of other countries (Bujňáková 2018).

Červená and Romanová (2018, p. 142) summarize reasons why to operate in tax havens:

- no or nominal tax on the relevant income (does not apply to domestic),
- lack of effective exchange of information,
- lack of transparency,
- no substantial activities.
- high taxes in the country of residence of individuals,
- high (even prohibitive) tax rates for legal entities,



- high inheritance and donation taxes,
- the possibility of avoiding a high tax burden by implementing the relevant contract abroad,
- to avoid the problem of nationalization of assets or confiscation of movable property, which is also related to the desire for anonymity,
- protection of savings by depositing in countries that guarantee the protection of bank secrecy,
- choice of countries with low taxes in the selected geographical and climatic (more pleasant) environment,
- the political stability of a country that can offer long-term guarantees, a country with considerable freedom of trade and no foreign exchange restrictions,
- optimal tax planning enabled by countries that have numerous double taxation treaties,
- the possibility of obtaining cheap, skilled labor in countries that have easily accessible and achievable optimal structures,
- the period of validity of the preferential tax rates laid down by the laws of the country concerned,
- countries that offer special incentives for production and industrial initiatives to gain significant fiscal and financial benefits,
- countries, in which sophisticated laws apply to companies such as family foundations,
- private foundations or entrusted groups,
- the possibility to transfer capital in a short time and without particular difficulties of the company.

The use of tax havens to avoid taxes otherwise payable in countries with high tax rates is well documented (e.g., Hines & Rice, 1994; Graham & Tucker, 2006; Dyreng & Lindsey, 2009; Dyreng, Lindsey, & Thornock, 2013). Number of companies in tax havens was studied in Jenčová, Vašaničová, and Gombár (2020); Jenčová, Vašaničová, and Lukáčová (2021).

## Methodology

The aim of the paper is to quantify the number of offshore companies and evaluate the development of Slovak companies in tax havens in 2008-2020. The second aim is to verify the hypothesis about the existence of statistically significant differences in the number of Slovak offshore companies in analyzed countries between 2020 and 2008,

Used data are obtained from the financial report of the Ministry of Finance of the Slovak Republic and Bisnode A Dun & Bradstreet Company (Bisdone, 2020; Bisnode A Dun & Bradstreet Company, 2021). The development of the number of companies in tax havens is assessed in absolute and relative terms using a chain index (CI), a base index (BI), a growth rate (GR) and a geometric mean (G). Index (I) is a dimensionless number that arises from the ratio of two values of the same indicator, confronting the same indicator achieved at different times, thus indicating the development. The base index has the same base period as its basis. For the chain index, the base is shifted. The index is calculated as:

$$I_{X_{jk}} = \frac{X_k}{X_j} . \quad (1)$$

The average growth rate is determined by the geometric mean in the form of:

$$G = \sqrt[n]{I_1 \cdot I_2 \cdot \dots \cdot I_n} . \quad (2)$$

To verify the stated hypothesis, we use a nonparametric Wilcoxon Signed-Rank Test.

## Results and Discussion

At present, the owners have invested more than € 10.45 billion in the registered capital of companies in tax havens. According to Olexová (2018), there are significant differences in the estimates of world wealth in tax havens. Nevertheless, all estimates lead to the conclusion that the property in tax havens is increasing.

Leontiev (2020) states the legal, semi-legal and illegal reason for founding a company. The legal reason is to establish a company in a state whose laws, e.g., allow for the advantageous arrangement of property in the event of the divorce of its owner or the event of his death. Semi-legal reasons for companies can be different tax-optimization schemes, i.e., if it is a holding company in a state, where income from equity participations is object to no or only low taxes. The illegal reason can be the establishment of a company for the purpose of money laundering or covering up real owners who would have a conflict of interest in trading with the state.

The number of Slovak business entities in the countries of tax havens since 2008 is increasing. In 2020, the number of Slovak companies in tax havens reached 5,274, which is an increase of 3,271 companies compared to the year 2008. In 2008, only 2,003 Slovak companies were in tax havens.

Table 1. Development of the number of Slovak companies in tax haven countries

| Country                  | 2008 | 2009 | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | 2016  | 2017  | 2018  | 2019  | 2020 |
|--------------------------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| USA                      | 470  | 559  | 601   | 671   | 760   | 859   | 1 028 | 1 064 | 1 028 | 989   | 1 068 | 1 228 | 1406 |
| Netherlands              | 750  | 975  | 1 050 | 1 052 | 1 110 | 1 124 | 1 154 | 1 140 | 1 142 | 1 139 | 1 154 | 1 163 | 1166 |
| Cyprus                   | 319  | 413  | 535   | 600   | 767   | 755   | 750   | 917   | 1 066 | 1 106 | 1 099 | 1 059 | 944  |
| Luxembourg               | 227  | 291  | 318   | 344   | 392   | 354   | 393   | 411   | 402   | 414   | 412   | 420   | 411  |
| United Arab Emirates     | 17   | 22   | 32    | 37    | 41    | 53    | 67    | 80    | 127   | 157   | 174   | 172   | 170  |
| Latvia                   | 6    | 11   | 16    | 26    | 44    | 49    | 69    | 71    | 92    | 112   | 126   | 144   | 180  |
| Panama                   | 29   | 32   | 25    | 38    | 62    | 6     | 5     | 6     | 153   | 145   | 146   | 137   | 149  |
| Malta                    | 30   | 28   | 33    | 36    | 45    | 54    | 83    | 131   | 92    | 102   | 109   | 118   | 118  |
| Republic of Seychelles   | 2    | 7    | 18    | 65    | 180   | 220   | 205   | 254   | 207   | 169   | 141   | 112   | 320  |
| British Virgin Islands   | 60   | 72   | 78    | 81    | 78    | 88    | 101   | 138   | 127   | 122   | 107   | 100   | 85   |
| Lichtenstein             | 4    | 13   | 15    | 18    | 28    | 32    | 36    | 62    | 82    | 84    | 84    | 83    | 81   |
| Belize                   | 26   | 33   | 51    | 75    | 96    | 117   | 114   | 98    | 91    | 91    | 86    | 82    | 76   |
| Hongkong                 | 15   | 16   | 20    | 25    | 30    | 35    | 36    | 35    | 41    | 39    | 50    | 51    | 50   |
| Marshall Islands         | 0    | 0    | 0     | 0     | 2     | 2     | 24    | 46    | 21    | 24    | 39    | 39    | 37   |
| Monaco                   | 13   | 12   | 11    | 16    | 18    | 60    | 2     | 19    | 40    | 37    | 22    | 24    | 24   |
| Gibraltar                | 9    | 16   | 23    | 17    | 7     | 8     | 16    | 14    | 15    | 14    | 14    | 16    | 15   |
| Jersey (Great Britain)   | 4    | 10   | 11    | 9     | 16    | 13    | 10    | 10    | 14    | 15    | 12    | 14    | 14   |
| Bahamas                  | 4    | 5    | 5     | 4     | 7     | 15    | 13    | 11    | 10    | 10    | 10    | 9     | 7    |
| Guernsey (Great Britain) | 2    | 3    | 7     | 6     | 6     | 6     | 10    | 9     | 10    | 9     | 10    | 9     | 5    |
| Cayman Islands           | 2    | 2    | 2     | 3     | 3     | 6     | 4     | 5     | 7     | 8     | 7     | 6     | 7    |
| Isle of Man              | 11   | 17   | 25    | 38    | 62    | 94    | 158   | 174   | 5     | 5     | 6     | 5     | 4    |
| Netherlands Antilles     | 2    | 2    | 2     | 2     | 4     | 3     | 3     | 5     | 4     | 3     | 3     | 3     | 3    |
| Bermuda Islands          | 1    | 1    | 0     | 0     | 0     | 0     | 0     | 1     | 1     | 2     | 2     | 2     | 2    |

Source: *own processing*

Table 2. Development of growth rate (in %) in tax haven countries

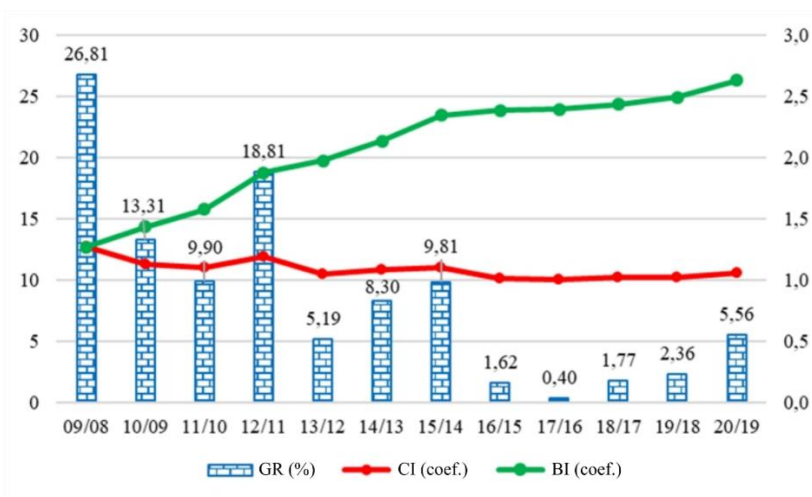
| Country                  | 09/08 | 10/09  | 11/10 | 12/11 | 13/12 | 14/13  | 15/14 | 16/15  | 17/16 | 18/17 | 19/18 | 20/19 |
|--------------------------|-------|--------|-------|-------|-------|--------|-------|--------|-------|-------|-------|-------|
| USA                      | 18.9  | 7.5    | 11.6  | 13.3  | 13.0  | 19.7   | 3.5   | -3.4   | -3.8  | 8.0   | 15.0  | 14.5  |
| Netherlands              | 30.0  | 7.7    | 0.2   | 5.5   | 1.3   | 2.7    | -1.2  | 0.2    | -0.3  | 1.3   | 0.8   | 0.3   |
| Cyprus                   | 29.5  | 29.5   | 12.1  | 27.8  | -1.6  | -0.7   | 22.3  | 16.2   | 3.8   | -0.6  | -3.6  | -10.9 |
| Luxembourg               | 28.2  | 9.3    | 8.2   | 14.0  | -9.7  | 11.0   | 4.6   | -2.2   | 3.0   | -0.5  | 1.9   | -2.1  |
| United Arab Emirates     | 29.4  | 45.5   | 15.6  | 10.8  | 29.3  | 26.4   | 19.4  | 58.8   | 23.6  | 10.8  | -1.1  | -1.2  |
| Latvia                   | 83.3  | 45.5   | 62.5  | 69.2  | 11.4  | 40.8   | 2.9   | 29.6   | 21.7  | 12.5  | 14.3  | 25.0  |
| Panama                   | 10.3  | -21.9  | 52.0  | 63.2  | -90.3 | -16.7  | 20.0  | 2450.0 | -5.2  | 0.7   | -6.2  | 8.8   |
| Malta                    | -6.7  | 17.9   | 9.1   | 25.0  | 20.0  | 53.7   | 57.8  | -29.8  | 10.9  | 6.9   | 8.3   | 0.0   |
| Republic of Seychelles   | 250.0 | 157.1  | 261.1 | 176.9 | 22.2  | -6.8   | 23.9  | -18.5  | -18.4 | -16.6 | -20.6 | 185.7 |
| British Virgin Islands   | 20.0  | 8.3    | 3.8   | -3.7  | 12.8  | 14.8   | 36.6  | -8.0   | -3.9  | -12.3 | -6.5  | -15.0 |
| Lichtenstein             | 225.0 | 15.4   | 20.0  | 55.6  | 14.3  | 12.5   | 72.2  | 32.3   | 2.4   | 0.0   | -1.2  | -2.4  |
| Belize                   | 26.9  | 54.5   | 47.1  | 28.0  | 21.9  | -2.6   | -14.0 | -7.1   | 0.0   | -5.5  | -4.7  | -7.3  |
| Hongkong                 | 6.7   | 25.0   | 25.0  | 20.0  | 16.7  | 2.9    | -2.8  | 17.1   | -4.9  | 28.2  | 2.0   | -2.0  |
| Marshall Islands         | -     | -      | -     | -     | 0.0   | 1100.0 | 91.7  | -54.3  | 14.3  | 62.5  | 0.0   | -5.1  |
| Monaco                   | -7.7  | -8.3   | 45.5  | 12.5  | 233.3 | -96.7  | 850.0 | 110.5  | -7.5  | -40.5 | 9.1   | 0.0   |
| Gibraltar                | 77.8  | 43.8   | -26.1 | -58.8 | 14.3  | 100.0  | -12.5 | 7.1    | -6.7  | 0.0   | 14.3  | -6.3  |
| Jersey (Great Britain)   | 150.0 | 10.0   | -18.2 | 77.8  | -18.8 | -23.1  | 0.0   | 40.0   | 7.1   | -20.0 | 16.7  | 0.0   |
| Bahamas                  | 25.0  | 0.0    | -20.0 | 75.0  | 114.3 | -13.3  | -15.4 | -9.1   | 0.0   | 0.0   | -10.0 | -22.2 |
| Guernsey (Great Britain) | 50.0  | 133.3  | -14.3 | 0.0   | 0.0   | 66.7   | -10.0 | 11.1   | -10.0 | 11.1  | -10.0 | -44.4 |
| Cayman Islands           | 0.0   | 0.0    | 50.0  | 0.0   | 100.0 | -33.3  | 25.0  | 40.0   | 14.3  | -12.5 | -14.3 | 16.7  |
| Isle of Man              | 54.5  | 47.1   | 52.0  | 63.2  | 51.6  | 68.1   | 10.1  | -97.1  | 0.0   | 20.0  | -16.7 | -20.0 |
| Netherlands Antilles     | 0.0   | 0.0    | 0.0   | 100.0 | -25.0 | 0.0    | 66.7  | -20.0  | -25.0 | 0.0   | 0.0   | 0.0   |
| Bermuda Islands          | 0.0   | -100.0 | -     | -     | -     | -      | -     | 0.0    | 100.0 | 0.0   | 0.0   | 0.0   |

Source: *own processing*

Table 1 shows the development of the number of Slovak companies in tax havens from 2008 to 2020, with the most significant number of offshore companies in 2018 in the Netherlands. In 2019 and 2020, there was a change, while most offshore companies were in the USA. Table 2 presents the growth rates in each country, with the highest growth rate given in the blue cell.

According to Štěpánová (Bisdone, 2020), US business has been growing most significantly in recent months. While 57 new companies settled there in the first quarter of 2020, in the second quarter of 2020, it was 56 companies. Altogether, we register 1,341 companies with a Slovak owner in the USA; even though the USA is not a typical tax haven, but provides entrepreneurs with several business benefits, including better tax conditions than in Slovakia. On the other hand, a significant decline was recorded in Cyprus because 20 Slovak companies left this country in the first quarter of 2020 and 24 companies in the second quarter of 2020. This time, Bisnode registers a total of 944 Slovak entrepreneurs in Cyprus. Nevertheless, Cyprus is the third most popular tax haven for Slovak entrepreneurs, right after the USA and the Netherlands, where 1,166 companies are based (see TASR, 2020a; TASR, 2020b; TASR, 2020c).

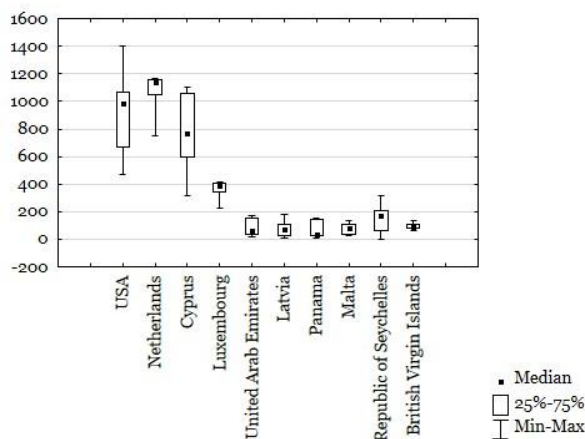
The development of the growth rate (GR), chain index (CI), and base index (BI) over the analyzed period is shown in Figure 1.



**Figure 1. Development of the growth rate, chain index, and base index of Slovak companies in tax havens**

Source: own processing

Differences among analyzed period 2008-2020 among TOP 10 tax havens are in Box and Whiskers plot in Figure 2. Table 3 presents the Wilcoxon Signed-Rank Test results that were used to verify the stated hypothesis: There are statistically significant differences in the number of Slovak offshore companies in analyzed countries between 2020 and 2008; the p-value of 0.0000 confirmed this hypothesis.



**Figure 2. Development of number of Slovak companies in TOP 10 tax havens**

Source: own processing

Table 3. Results of Wilcoxon Signed-Rank Test

| N  | W+  | W- | Z      | p-value |
|----|-----|----|--------|---------|
| 23 | 269 | 7  | 3.9692 | 0.0000  |

Source: *own processing*

A specific group of Slovak business entities involved in tax fraud intends to look for opportunities and ways to reduce their operating costs or ensure anonymity. The reason is the illusion of low or zero taxes and other benefits, the absence of excessive administration and bureaucracy, as these countries do not place much emphasis on bookkeeping and tax returns but also cover their property and keep the actual owner's secret. These are most often public figures with an impact on decision-making processes. Among the world's best-known cases in this context are, e.g., Panama Papers, Offshore Leaks, Luxleaks, which revealed unfair financial operations of various world politicians and other personalities (Kullová, 2020).

## Conclusion

During the analyzed period 2008-2020, most companies in tax havens were established in 2020. In 2020, most companies were established in the USA (1,406), where the number of companies increased by 178. The number of Slovak companies in 2019 that have owners in tax havens was 4,996, which is 115 companies more than in 2018 and 2,993 companies more than in 2008. The most significant year-on-year change occurred in 2012 when 595 companies were established, and the total number of companies was 3,758. The smallest year-on-year increase of 19 companies is recorded in 2017 (4,796 companies). The average annual growth rate in the tax haven countries was 52.85% in the Marshall Islands, followed by 44.18% in the Republic of Seychelles, 33.49% in Latvia and 31.74% in Liechtenstein. The lowest average growth rates for the analyzed period were in the Netherlands Antilles (3.75%), the British Virgin Islands (4.75%) and Gibraltar (5.36%). In 2020, the largest number of companies was recorded in the Republic of Seychelles, where the increase was almost 186%, the number of Slovak companies in the country reached 320.

In general, from a macroeconomic point of view, the prevailing view is that although the number of Slovak companies in tax havens is growing from year to year, tax havens have reached their ceiling. The owners have invested more than 10.45 billion € in the registered capital of companies in tax havens. Most Slovak companies established in tax havens do business in the field of wholesale and retail (970), in the field of professional and scientific activities (904) and the field of real estate (656). Further research will aim to analyze the impact of changes in the Income Tax Act, where measures were implemented to combat tax evasion so that individuals do not export their income to tax havens.

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# TALENT DEVELOPMENT IN TIME OF COVID-19 PREVENTION MEASURES IN THE SLOVAK REPUBLIC ORGANIZATIONS

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**ABSTRACT.** Nowadays, the work with talented employees has become one of the most important components of HRM and is gaining more and more attention, especially from organizations that strive for a highly professional workforce. The issue of talent development is arising, especially due to the introduction of anti-pandemic measures to prevent the spread of COVID-19 in the Slovak Republic. These restrictions prevent employees from participating in full-time training programs. These programs, therefore, had to be changed and adapted to reflect the current situation. The aim of this study is to identify the level of satisfaction of talented employees with talent development programs offered by their employers during the COVID-19 pandemic. The research sample consisted of 123 talented employees. The methods of descriptive statistics, Kruskal-Wallis test, and Spearman's correlation coefficient were used to achieve the goal of this study. The results showed that despite covid-19 prevention measures, the issue of talent development is still important for employers who secured talent development programs for their talented employees to enrich the portfolio of their knowledge and skills. The satisfaction level of talented employees with talent development programs was according to this research very high, especially within employees in charge.

**Keywords:** talent management, talent development, covid-19,

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## Introduction and literature review

The literature in the field provides very few outputs regarding talent development and education and global development which would set a deal with the issue of talents as high-performing employees put it into perspective. It is widely acknowledged that development and education are important parts of global talent management (Cook, 2010). Haskins and Shaffer (2010) talk about talent development and training, where each approach accepted by an organization supports four challenges. Talent-building efforts exercised by organizations should aim at the integrated future and also deliver measurable results. Prais (2011) states that talent development does not bring out the best only in organizations. The employee input largely complements organizational needs. However, information on education and development can give us insight into why investing in talent education and development is so important. The competitive advantage which leads to valuable, rare, inimitable changes in human resources can be divided into two groups: training as an integral part of human resource management and training related to talent retention. Schraeder (2009) states that sufficient time needs to be devoted to the development and training of employees so as to integrate them into the organization's strategy. However, the demand for alternative methods of development and education is coming to the fore. Trends in employee training in the current labor market point to the development and training of employees who are capable of increasing efficiency and improving the quality of services. This results in the need to change from planned to prompt and unplanned education, such as online courses and e-learning in order to acquire and gain knowledge and experience (Stachová and Stacho, 2013). It has been proven that education and development encourage employees to create an atmosphere of sustainable development only when the training needs of employees are aligned with the needs of the organization (Sojka and Tej, 2019). Human resource management practices can have a positive effect not only on knowledge, skills, and motivation but also on the retention of talent in organizations (Sirková et al., 2014). Reducing the gap between the current competencies of employees at different levels of management is a key goal in employee training, as it creates conditions for the effective performance of the tasks through effective and sustainable training of the workforce (Cagaňová et al., 2014).

Today's talent management methods often do not meet the needs of corporate executives who are concerned about the lack of talent in their organizations and whether there are opportunities to produce more talent. Even when there are answers to the questions of how to develop talents that will be ready for use, they cannot imagine transforming this knowledge into results. Enterprises and educational institutions around the world are rapidly adopting talent development methods and training systems at the enterprise level to keep their talented employees and students at the latest technological trends (Bednářová et al. 2014; Burgerová, Adamčíková 2016; Cimermanová 2018). The group of advisers and consultants B.K.S. (2018) considers the creation of a talent development program (TDP) to be a key point for the development of talents in a company, according to the following points: 1. defining goals, results, and outputs (these most often focus on maintaining one of the most important employees in the company, maximizing their performance, or preparation for another job position); 2. after defining the goals and the target group, there is a specification of the method of identification of this group, defining the content, forms and methods of work; 3. finally, an evaluation of the whole effort and the follow-up to the program. The next step is to determine the target group and development goals for the group. We most often encounter approaches aimed at: 1. development of future leaders - a vertical shift of a talented employee; 2. development of a group of experts - horizontal transfer of a talented employee; 3. a combination of both groups (Haskins, Shaffer, 2010).

Employee development and training are always very important for a company. Not only that they increase the skills, knowledge, and expertise of the workforce, they also increase and decrease fluctuation. Corporate leaders are currently exposed to a huge mass of people working from home, trying to adapt to the current situation and ensure that their companies can withstand these challenging times. On the other hand, employees see this as an opportunity to reassess yesterday's priorities and plan for the future according to what they really care about. Given how the work and private lives are changing, it is the employees who have the imaginary helm in their hands. Education and development should not be seen as a cost - it is an investment. If it is done correctly, we can expect organizations to receive a strong positive return on this investment. After all, it is the best way to increase the value of your most valuable assets to organizations. Fortunately, there are many ways to continue developing, managing, and educating during the COVID-19 crisis. Just because we can't send people to class doesn't mean we can't develop them. Baum et al. (2020) note that the most important concept in implementing plans may be the 70/20/10 rule, then the current crisis in fact offers many opportunities for exemplary

development experiences. Model 70-20-10 was first published by Morgan McCall and his colleagues at the Center for Creative Leadership over 30 years ago. After studying successful executives, McCall and his colleagues found that 70% of what we know and how to do is based on real-world experience. 20% come from other people (coaching and mentoring). The remaining 10% comes from classroom instruction. So even though we cannot send people to (personal) classrooms at the moment, 90% of our development should still come from other methods. What can the development of 70-20-10 during this crisis look like?

Haak-Saheem (2020) emphasizes that the most important part of this trinity is experiential learning. Not only it is still possible, but the crisis also offers many opportunities for experience planning that contributes to employee learning and optimizes work performance. Companies that manage people are increasingly thinking about how to redirect people in a way that will help them do their work and provide people with development opportunities to gain new experiences and new skills. Learning from others is an important part of developing each person's portfolio. The fact that most employees currently work from home does not mean that coaching and mentoring relationships cannot be established. However, too many mentoring relationships tend to be informal and often of little value over time. As in all aspects of staff development, coaching and mentoring should take place with a view to future planning. Each coaching or mentoring program should be accompanied by specific goals and milestones.

Allen (2020) states that most people think about learning and development, but few organization actually practices it. It is important to think that the rule 70-20-10 tells us that classroom learning is only a small (but vital) part of our developmental portfolio. Fortunately, the virtual world gives us as many (if not more) educational opportunities. Many experts claim that the 70-20-10 learning model is outdated because more employees will start devoting themselves to e-learning or stop interacting so much at work for a reason flexible plans and remote opportunities. They claim that the percentages of the model are incorrect and should adapt to the current nature of the workforce and the way people learn using technology. However, it could also be argued that technology does allow the model remains completely intact. Although employees may use it in the course of their work technology, they are gaining more and more powers to learn on their own, to devote themselves to development and career advancement, seek their own answers, cooperate with your collaborators through chat windows and social panels, etc. Even if it will maybe the numbers in the learning model 70-20-10 need to be slightly updated or adjusted, it seems that the model itself still has some strategic weight in terms of both employees and managers understanding and implementing training and development during the quarantine of COVID-19 (Kuckertz et al. 2020). Experience from education shows that it is more important than the exact percentage The share of education is the fact that education (talent) takes place permanently even in complex the current situation of companies and brings its results.

Online training is the easiest way to bring a more personal approach to each employee, set their studies, and monitor their progress. Hybrid education can also be a suitable way for companies that want to educate. It will continue to play an important role in it online. Especially thanks to the easy implementation and easy access to the lecturer content.

Here are some advantages of online training:

**Time flexibility.** Video courses can be taken anytime, anywhere, and are designed concisely. Thanks to short lessons, the student will better retain attention and remember the content. Therefore, employees can complete some topics in the comfort of their home, with the possibility of adjusting their time.

**Measurability.** Online education includes statistics that show the success of courses. For the employer, it is a great way to monitor the involvement of its employees and evaluate the effectiveness of the investment in training.

**Financial simplicity.** There are several costs that cannot be avoided during on-site training. Lecturer costs, travel, rental space, or food. Studying online is less demanding in this regard.

## Methodology

The aim of this paper was to identify the level of satisfaction of talented employees with the talent development programs (TDP) offered by their employers during the COVID-19 pandemic with regard to the imposed restrictive measures. Data were collected in February 2021 by the online self-administered questionnaire by the platform Google Forms. The sample consisted of 123 employees who

were identified by their HR managers or direct superiors. The replies to the items were formulated in the form of closed statements. The statements were to be evaluated by the respondents on a 5-point Likert scale (1-strongly disagree; 2-disagree; 3- neutral stance; 4- agree; 5- strongly agree). The results of the questionnaire survey were processed in Excel. The results were assessed in MS Excel and SPSS Statistics 20. Tests such as the Kruskal-Wallis test and the Spearman correlation coefficient were used to analyze the data obtained and to identify statistical significance between variables. The questionnaire was divided into two parts. In the first part, the respondents answered demographic questions aimed at identifying their age, gender, attained education. This was followed by information on the number of years worked in the organization and the question of whether the respondent has subordinates. The aim of the second part of the questionnaire was to determine talent development programs (TDP) and their opportunities to the talented employees during the COVID-19 pandemic based on the following closed items:

During the COVID-19 pandemic and given the restrictive measures to curb the spread of the virus, my organization:

1. gave me the opportunity to participate in a TDP in order to learn and gain new skills.
2. offered me participation in a TDP to help me grow professionally.
3. offered me participation in a TDP that helped me grow personally.
4. gave me time and space to take part in advanced educational activities and training.
5. offered me the TDP where I get knowledge, which helps me to do my job better.
6. provided me a time to engage in training despite my workload.
7. provided me with all the information needed about the offered TDP.
8. in addition to mandatory training, provided me and educational activities on my own initiative.
9. has tried to get information about my satisfaction with the TDP.

## Results

The self-administered questionnaire was distributed to 161 recipients. The return rate was 76.4%, i.e. 123 respondents took part in the research. Regarding demographics, the following characteristics were determined: the sample consisted of 83 men (67.5%) and 40 women (32.5%). The results of the research given in Figure 1 indicate that the youngest respondent was 21 years old, the oldest was 60, while the median age was 41 years.

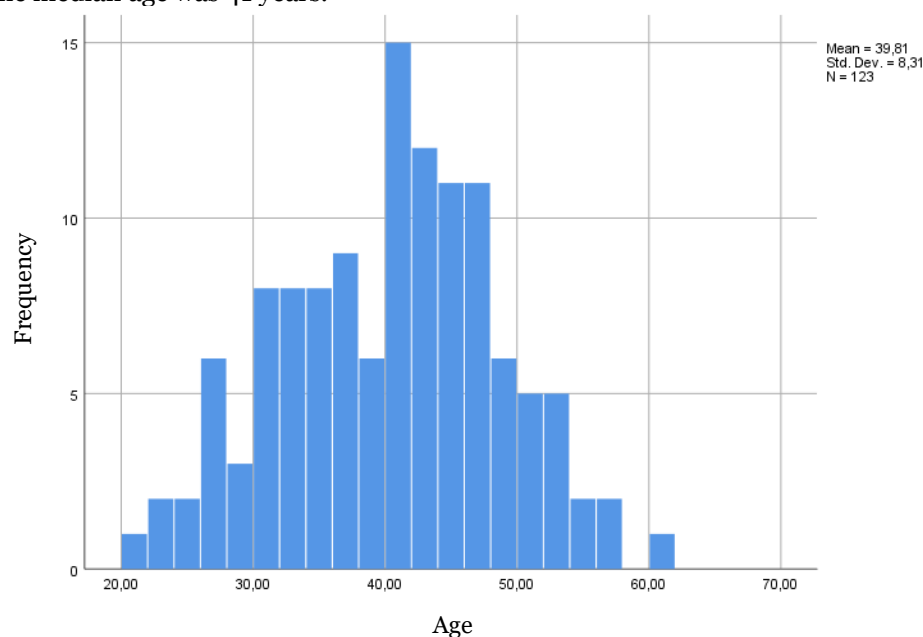


Figure 1. Age of respondents

Source: own data elaborated by the authors



Based on the information on the highest education attained, it can be stated that high school graduates (68.3%) dominated, followed by university graduates (MA) (26.8% of respondents). The questionnaire also inquired about the job position and whether the respondents had any subordinates, with 22% of respondents stating that they hold such a position. The minimum number of years worked at the organization was 0, although only one respondent picked this answer (it was probably a newly recruited talent from the external environment), the maximum was 35 years. As we can see from Figure 2, the median value of the number of years worked at the organization reached 9 years.

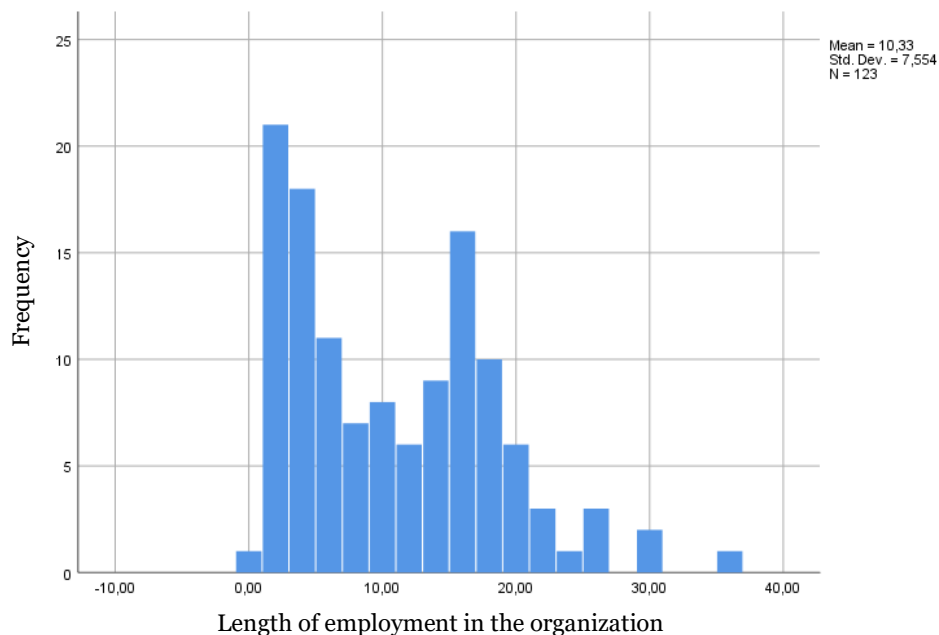


Figure 2. Length of employment in the organization of respondents

Source: own data elaborated by the authors

Table 1 shows the evaluation of the data obtained through the questionnaire using descriptive statistics tests. As many as 96.8% of respondents stated that during measures imposed by the government to curb the spread of COVID-19 their organization gave them the opportunity to participate in a TDP in order to learn and gain new skills. In the second item, respondents expressed a high degree of agreement with the statement that TDP helps them gain the knowledge necessary for their professional growth (this is the main purpose of talent development activities carried out by organizations).

The fourth item inquired whether the organization provides employees with sufficient time and space to take part in advanced educational activities and training (where the average score was 4.12 and the most frequently selected statement was “agree”). In comparison with the fourth item, the sixth item failed to generate such a high score. Despite the fact that the organization creates a space for training, the statement whether the employees “have time to engage in training despite their workload” generated a score of 3.8. On the other hand, 93.5% of respondents agreed and strongly agreed with statement no. 7. The most common reply was strong agreement. It can be stated that training courses and their forms were clearly defined.

The eighth item inquired how active were employers in providing educational activities in addition to mandatory training to their talented employees. By the application of the Kruskal-Wallis test, it was found that there is a significant difference in the expression of consent between employees who are in charge and those who are not in charge ( $p = 0.0218$ ). Based on the results of descriptive statistics, it can be stated that employees who are in charge take a more active approach towards training and educational activities. The last item in the questionnaire inquired the level of employee satisfaction with offered TDP. Using the Kruskal-Wallis test, the existence of a significant difference in the level of satisfaction was identified between the groups of employees who are in charge and those who are not in charge ( $p = 0.0449$ ), where talented employees in charge were significantly more satisfied with the TPD organized by their employer.

Table 1. The results of descriptive statistics measures

| Variables | Mean | Median | Modus | SD   |
|-----------|------|--------|-------|------|
| Item 1    | 4.50 | 5      | 5     | 0.59 |
| Item 2    | 4.46 | 5      | 5     | 0.68 |
| Item 3    | 4.25 | 4      | 4     | 0.74 |
| Item 4    | 4.12 | 4      | 4     | 0.81 |
| Item 5    | 4.50 | 5      | 5     | 0.55 |
| Item 6    | 3.80 | 4      | 4     | 0.85 |
| Item 7    | 4.41 | 4      | 5     | 0.64 |
| Item 8    | 3.50 | 4      | 4     | 0.99 |
| Item 9    | 4.34 | 4      | 4     | 0.63 |

Note: developed by the authors

The Spearman correlation coefficient was used to identify the dependencies of the ordinal variables. The Spearman correlation coefficient takes values -1 to 0 or 0 to 1. As with other measures of the association, the closer the coefficient is to 1, the stronger is the direct order dependence between the variables X and Y (Hanák, 2016).

Regarding the results of the Spearman correlation coefficient, only those values where the interdependence  $r \geq 0.5$ , which according to Cohen (1988, In: Rimančík (2007), p. 73) is a large dependence were interpreted. The maximum value of the correlation coefficient reached level 0.6290. Therefore, it could be stated that we could not observe a very large (value range 0.7-0.9) or even perfect dependence (value range 0.9-1) between the variables.

The values for statements number 3 and 4, where  $r = 0.6290$ , correlate most strongly, the same is true for statements number 2 and 4, where the coefficient  $r$  has stabilized at 0.5370. There is a strong correlation between the level of agreement on whether the organization offers the respondent TDP which helps them grow professionally and personally and the level of agreement on the item inquiring whether the organization creates space and time for the talented employee to take part in TD activities.

A strong correlation was observed in statement number 2 - whether the organization offers TDP that allows the respondent to grow professionally, with statement number 3, while the value of the correlation coefficient  $r = 0.6231$ . Similar replies to both items may be related to the organization's efforts to create work-life balance and ensure that employees can focus on their personal growth, too.

Furthermore, it has been found that statements number 5 and 7, i.e. "the knowledge I gained thanks to TDP helps me to do my job better and effective" and "my organization provided me all the information needed about the offered TDP" correlate positively at the coefficient  $r = 0.5996$ . 71 respondents chose the same reply in both items.

A high degree of interdependence ( $\geq 0.5$ ) is also present between statement number 4: "the organization gave me time and space to take part in educational activities and training" and the statements: "I still have time to engage in training despite my workload" ( $r = 0.5022$ ) and "the knowledge I gained during the training helps me to do my job better" ( $r = 0.5001$ ).

Table 2. The results of Spearman's correlation coefficient

| Var.   | Item 1  | Item 2 | Item 3 | Item 4  | Item 5 | Item 6  | Item 7  | Item 8  | Item 9 |
|--------|---------|--------|--------|---------|--------|---------|---------|---------|--------|
| Item 1 | 1.0000  | 0.0773 | 0.0267 | -0.0865 | 0.1001 | -0.0146 | -0.0452 | -0.0729 | 0.0061 |
| Item 2 | 0.0773  | 1.0000 | 0.6231 | 0.5370  | 0.4539 | 0.4420  | 0.3571  | 0.2917  | 0.2060 |
| Item 3 | 0.0267  | 0.6231 | 1.0000 | 0.6290  | 0.4438 | 0.3901  | 0.2471  | 0.2536  | 0.1109 |
| Item 4 | -0.0865 | 0.5370 | 0.6290 | 1.0000  | 0.5001 | 0.5022  | 0.3910  | 0.3387  | 0.2123 |
| Item 5 | 0.1001  | 0.4539 | 0.4438 | 0.5001  | 1.0000 | 0.3649  | 0.5996  | 0.3832  | 0.3191 |
| Item 6 | -0.0146 | 0.4420 | 0.3901 | 0.5022  | 0.3649 | 1.0000  | 0.3894  | 0.2996  | 0.2237 |
| Item 7 | -0.0452 | 0.3571 | 0.2471 | 0.3910  | 0.5996 | 0.3894  | 1.0000  | 0.2702  | 0.4604 |
| Item 8 | -0.0729 | 0.2917 | 0.2536 | 0.3387  | 0.3832 | 0.2996  | 0.2702  | 1.0000  | 0.2866 |
| Item 9 | 0.0061  | 0.2060 | 0.1109 | 0.2123  | 0.3191 | 0.2237  | 0.4604  | 0.2866  | 1.0000 |

Note: developed by the authors

## Discussion and Conclusion

Due to the investment in employees as potential talents, many managers are afraid that they will lose these employees sooner or later. However, it is worse than investing in staff training and education and losing them than not investing in their education and development and trying to keep them. One of the key tasks of an organization in an ever-changing market is to retain talented employees in organizations that strive to innovate and thus achieve competitiveness (Wang and Wang 2012). Talent development together with human resource management should provide the organization with the prerequisites through which it will want to be able to cope with the tasks it sets itself and those that result from the rapidly changing external environment.

The employees' time, either used by the organization or the employees themselves, appeared to be the most important factor influencing satisfaction with TDP provided during the time measures to curb the spread of COVID-19 were in place. By addressing this issue, employers can affect the employee perception of personal and professional growth and training provided. The time factor, perceived as a negative factor influencing satisfaction with TDP, was reported mainly by talented employees who are not in charge. These employees also expressed a significantly lower level of satisfaction with the way training is organized and a lower willingness to proactively seek TDP. Schraeder (2009) states that sufficient time needs to be devoted to talent development for employees to be able to integrate into the company's strategy. We assume that by changing the behavior of managers, emphasizing effective time management, or promoting delegation of tasks and powers organization might increase satisfaction with these factors and also motivate employees to seek further career development through the options offered. In this case, the implementation of training focused on time management, delegation, clear identification of responsibilities in case of unavailability of an employee could help. At the same time, superiors could ensure collaboration between departments in case an employee is unavailable. An employee present at the all-day on-site training should not be required to perform other tasks for other departments at the time of training. With regard to the results of our research, we conclude that the level of satisfaction of talented employees with the availability of education and training at the organization they work for during the time measures aimed at curbing the spread of COVID-19 reached high levels. It is crucial for talented employees at lower positions to have the opportunity to set aside time to take part in training programs with an emphasis on the development of their talent. Future research could focus on identifying aspects and factors affecting the satisfaction of these employees with the organization of training (form of training, time, and place of training, etc.) in order to increase the interest of talented employees in training. The main limitation of this research is the limited geographical territory - the Slovak Republic.

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# ECOLOGICAL COMMUNICATION CHALLENGES IN WASTE MANAGEMENT

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**ABSTRACT.** Waste management has become a key issue in environment protection recently. The area is accompanied by various kinds of lobbying activities all around the world and it has the potential of directly affecting the everyday life of people and corporations. We analyse the factors that may influence social consciousness in the long run and what communication tools opinion leaders can use to reach out to the various social platforms. The objective of the research was to reveal hidden correlations in the field of waste management that influence societal awareness in Hungary and the relation between consumers and waste. We conducted the research by combining two methodologies, the REP-test (Role Construct Repertory) and the Storyline research methodology. Research has shown tension between the profession and the public sector, the main reason being the lack of communication and the different perception of the priorities of waste-related matters. The phenomenon of interests vs stakeholders also became a recurring element, according to which only those topics in the waste management profession are embraced where there are underlying interests present or there is money behind them.

**Keywords:** social communication, sustainable development, environmental protection, ecological communication

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## Introduction

Waste management in Hungary sees a number of transformations year after year, significantly influencing the prioritisation of the various fields of specialty, and in turn, the way these are communicated. The possible outcomes resulting from the various legal and proprietorship changes are as yet unpredictable, but the elite of the trade nevertheless bears the onus of what extent they are able to influence the present government's decision-makers in positively shaping our society's relation to waste. The waste pyramid defining and directing the waste management of European countries includes the hierarchy of fields that handle, dispose of, and (re)use wastes. The assessment and level of acceptance of these areas show tremendous variances both among the general population and in professional circles, also demonstrated by the not representative, nevertheless special qualitative niche survey we have conducted. Within environment protection, waste management has grown into a key area in its own right, with a multitude of lobbying activities connected to it worldwide, and with the ability to directly influence the everyday life of people and businesses. From the aspect of the future of waste management, it is necessary to examine when and how, what, through what, and to whom should be communicated. It is necessary to map the attitudes of the various classes of society, to enable efficient communication with them. The question is what means are utilised to achieve this, i.e. what are the driving forces and groups of society in Hungary, and are there any differences at all, or is this region driven by the same set of principles and organisational powers as our European neighbours? What communication means does this field have, how is a residential perception shaped, and how should this be supplemented? Do Hungary and the Eastern European region have any chance of catching up in this area – are we lagging behind in the first place – and if so to what demonstrable extent in comparison to the developed Western European states? I believe it is important to obtain a comprehensive picture of the current societal paradigm shaping process, and in that the communication background, from where a number of conclusions can be derived regarding future tendencies. Below I have drafted the stakeholder map of the area, i.e. the specific forces having a significant influence on this profession. Advancing on this basis, I have examined leading officers of the profession, and I have explored the topic using their system of terms and definitions. The research covers ecological communication and the opinion of several professional decision-makers of Hungarian waste management, by unifying two special research methodologies.

## Literature review

This year will also bring several changes regarding waste management in Hungary that will profoundly influence the prioritisation and accordingly the communication of different fields. It is impossible to foresee all consequences of these transitions in the legal and ownership status; furthermore, it is also up to the professional elite in the field, to what extent they can influence the policy-makers within the current government so that the attitude of our society regarding waste should change in a positive way in the future. In European countries, waste management is determined and guided by the waste hierarchy that contains the hierarchy of fields that manage, dispose of, recycle and recover waste. (National Waste Management Plan, 2014-2020.)

Appreciation and acceptance of these fields are greatly varied among the population and the professional circles as well. This is well reflected in a non-representative, nevertheless gap-filling qualitative survey that we carried out earlier this year. Considering the future of waste management, we have to investigate what, when, how, in what media, and to what audience is worth communicating. (Kovács et al, 2019) We also need to map the attitudes of different social layers in order to reach out to them with efficient communication. The question is, what tools are available to reach our goals, which social groups, tendencies are the driving forces in Hungary? Is there a difference between us and Hungary's neighbours in Europe, or are we motivated by the same drives and organizing forces? What channels of communications are open and available for the education and mind framing of the population, and how can we broaden these channels? Do we and does the East-European region have a chance to catch up, are we lagging behind at all compared to the developed West-European states?



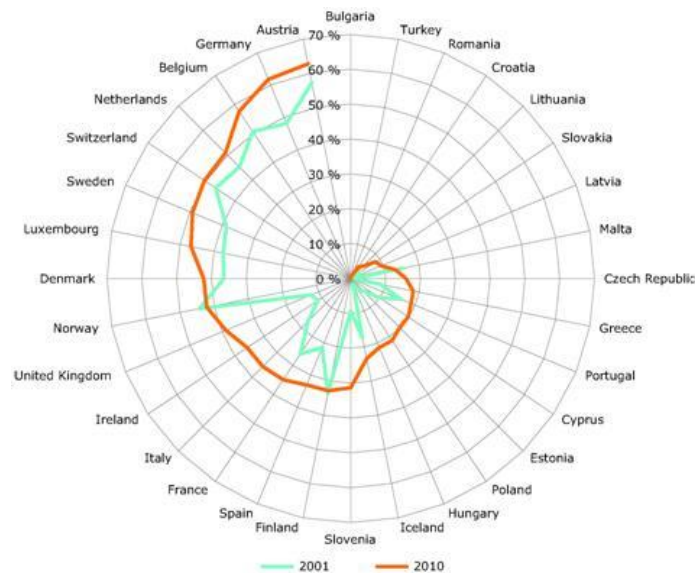


Figure 1. Municipal waste recycling rates in 32 European countries (eea.europa.eu, 2013.)

If yes, to what clearly recognisable degree and in what area? We hope to answer all these and most probably some further questions during our research. We think it is important to shape an overall image of the current public awareness programmes and especially their communication background that allows us to draw conclusions in reference to future trends. We also found it important to select a survey method that can achieve results beyond those produced by in-depth interviews based on pre-prepared questionnaires. Last year we ventured to map the stakeholder relations of the field in relation to what driving forces have considerable impact in this profession. Based on the results and moving on, this year we have examined the leaders of the profession and civil servants in relevant executive positions, focusing the subject based on their own set of concepts. (Kovács et al, 2019) Our survey refers to ecological communication, in particular certain opinions of several managers and decision-makers of Hungarian waste management, utilizing a combination of two specific research methods. The survey aims at exploring hidden relationships within the field of waste management that can influence social consciousness in Hungary and the consumers' relationship to waste. We also found it important to select a survey method that can achieve results beyond those produced by in-depth interviews based on pre-prepared questionnaires. Observing the specific field through the personal set of concepts of the subject plays a key role in this issue. Random comparison of individual concepts encourages a new way of thinking that has the potential of emerging new aspects, relationships, hidden dimensions. Thus we could reveal what can be communicated to the public, what the priorities are according to the management, what can be told and what not, and what kind of misconceptions dwell among the population. Due to our research, we can assert that we have an extensive overview of the professional aspects of our thesis, and step by step we can get fully involved with the establishment of our theory. (European environment agency, 2015) These three countries are relatively small and underdeveloped in terms of their geographical size and population, geopolitical importance, market size and aggregate demand, production, investment, export, and technological potential. According to many non-economic indicators (political stability, democratization, liberalization and institutionalization of society, law, infrastructure development, safety, security, investment, compliance with environmental and social standards, efficiency of the legal system, human rights respect, etc.), as well as economic indicators (purchasing power, rate of economic growth, foreign trade balance, current account deficit, public debt, inflation rate, unemployment rate, public expenditure, investments, etc.), they are characterized by a long-term transitional crisis of structural type. (Kovács et al, 2019)

## Methodological approach

The objective of the research was to reveal hidden correlations in the field of waste management that influence societal awareness in Hungary and the relation between consumers and waste. It is important to select a research methodology that may exceed the results achieved by depth interviews

by exploring such depths in the subjects that the party conducting the research/asking the questions is unable to explore by asking questions compiled beforehand. The key to this is to examine the field in question using the subject's own system of concepts. The random comparison of the particular concepts prompts the subjects to adopt a way of thinking that brings new aspects, correlations, and hidden dimensions to the surface. This allows exploring what can be communicated from the perspective of mind framing how the profession perceives the priorities and what misconceptions the population holds. We conducted the research by combining two methodologies, the REP-test (Role Construct Repertory) and the Storyline research methodology. Using these, we described fifteen concepts with the research subjects, identified by the subjects, then they explored the constructs and contrasts of these, and analysed them, supplementing them by telling a case study or story. Finally, we consolidated the results obtained and contextually compared them. Therefore, the topic of the interview was given by the research subjects, and there was no questionnaire prepared in advance apart from the REP table. This is the essence of qualitative market research: it is not the researcher who determines the key features (constructs) of the particular topics; they are determined instead by the research subjects, the features of the topic in question being "extracted" from the subject.

## The hypothesis of the research

### RH 1.

On the one hand, our hypothesis is built on communication concerns, and in waste management, we see the root cause of the problem in the disproportionate popularisation attempts of waste processing activities. On the other hand, from the social science perspective, whether the coordination of this perception management process is managed appropriately through the societal systems concerned.

Here, we see points calling for development along the politics-education axis, and in accordance with my hypothesis, the topic is being deliberately postponed at the highest decision-making levels, not receiving the emphasis it should. As we specifically selected the decision-makers as the subjects of our research, I had confidence I would be able to map this situation.

### RH 2.

In Hungary, the most popular activity promoting environmental awareness in the field of waste management is the selective waste collection, which is not expedient in connection with perception management.

Our greatest concern and problem prior to our research was the following, which also provided the fundamental hypothesis for my dissertation:

By popularising selective waste collection:

- Will consumers become environment-conscious?
- Will they understand the waste management system through this?
- Do they understand the path waste covers?
- Are they aware of the consequences of their waste-related habits?
- Why is only the importance of one particular waste stream emphasized? Hungarian households consume an average of 125 beverage cartons each year. Only 21% of this, i.e. about 26 beverage cartons are collected selectively and recycled. This proportion is about 35-40 in the member states of the European Union, but in certain member states, it can even reach 65 pieces.

Therefore, we examined the focus of communication with the present research, because I believe this is not right and in my opinion, the holistic opportunities the topic holds are not being utilised to their fullest potential in popularising communication activities, it is, therefore, no coincidence that the attitude change of the population has not shown any substantial change for decades.

### RH 3.

According to our hypothesis, the professional elite is most suitable for exploring the hidden correlations; representative research covering the general population would only touch this topic superficially and the system of notions currently shaping the general situation could not be mapped fully.

Several studies surveyed over the recent years the environmental awareness of students of tertiary educational institutions and pupils of secondary schools and elementary schools, and their attitudes with respect to a particular environmental topic. Several groups of researchers survey at present the environmental attitudes of the pupils attending the forest school, with the help of questionnaires, concept maps, and other methods. One such research group (under the direction of

Viktória KÖVECSES GŐSI, Bálint LAMPERT, Mrs. Tibor PETZ, and Mrs. Lajos CSENGER) examined how young people leaving the public education system thin of environmental questions and what behaviour they exercise in their connections with the environment. Data were recorded at nine faculties of Széchenyi István University in September 2019. The objective of the research was to assess the environmental attitude of the first-year students enrolling in the university, concerning sustainability and their knowledge of environmental issues, and to map their behavioural habits and emotions regarding the subject. Therefore, due to the availability of these researches, we did not start any representative research work, as these are available in our field.

RH 4.

According to our hypothesis, thermal utilisation should be a key element in waste perception management in Hungary but does not yet receive the political support it should.

RH 5.

The surrounding western states are further down this path according to our hypothesis, and we intended to prove - or contradict - this through research and processing of literature.

## Application of the REP and Storyline research methodologies

REP parameters

George Kelly was the first personality theorist who regarded the cognitive and informational aspects of human existence as the dominant features of personality. According to his theoretical system titled *The Psychology of Personal Constructs*, a human is essentially a scientist, who, to achieve efficiency in life, strives to understand, interpret, anticipate, and control his personal world. The hallmark of Kelly's theory is the statement that likens the nature of human behaviour to that of a scientist. Kelly's Repertory Grid Technique is a qualitative market research method that can be broadly applied, although it is not in wide use in Hungary. The focal question of Kelly's cognitive theory is: how individuals perceive and interpret people and things in their surroundings. Kelly's approach called "personal construct theory" focuses on processes that enable a person to arrange and understand the events of his life. His theory is a modern cognitive approach, targeting the examination of the personality. In this respect, the emphasis is on how individuals perceive and interpret people and things in their surroundings. The construct theory focuses on the processes that enable people to understand their psychological living space. From this cognitive perspective, Kelly recommends a personality model based on the analogy that a human is like a scientist. It assumes that a human individual, just as a scientist studying him, establishes work hypotheses on reality, based on which it attempts to anticipate and control the events of his life. According to Kelly, therefore, life is characterised by people continuously fighting to understand the tangible world of their experiences. Man perceives his world through certain translucent, self-constructed patterns and schemes, and attempts to reconcile these schemes with the reality the world is made up of. These two do not always match perfectly. Without such patterns, however, the world seems to be an undifferentiated, homogeneous unity, which man is unable to comprehend. These "translucent patterns and schemes" were referred to by Kelly as constructs. In other words: a construct is a category of thinking, with the help of which the individual shapes and interprets the world of his/her experiences. This is a consistent way for man to make certain aspects of reality sensible. According to Kelly, man forecasts and constructs his personal experiences by creating their replicas. The significance of this process lies in that it provides a tangible basis for the individual to build expectations on the probably emerging events and to interpret their meanings. In the early stages of construction, the individual observes the general flow of processes and interprets them. Then he recognises a pattern of the events and their repetition in a field of experience. Finally, he devises a structure or meaning for the events experienced. This temporal flow of experience, interpretation and construction is known as the process of construction, i.e. the capacity of the individual to generalise his experiences in a meaningful form. The constructs are therefore significant from the perspective of forecast and control, as they enable the individual to anticipate the upcoming events through expectations. Without constructs, the life of the individual would be chaotic; he would not be able to sense the world consistently. If he were incapable of devising expectations for the future, the ongoing events would become intangible. The personal constructs enable the individual to create some sort of an order, rendering his world foreseeable. The constructs are not only bipolar, but they are also dichotomous. Kelly imagined that constructs are used as a yes-no nature, and not along the stages of a continuity. While he recognised that people know several dimensional stages, he handled this in a unique way. He presumed that the stages are the

products of the organisation of dichotomous constructs. Organisation allows increasingly delicate distinctions as soon as the higher-level dichotomous decisions are followed by new decisions at lower levels. More specifically, when the events are experienced, the person observes that certain events seem to be similar to one another, have common features, and are different from other events. This cognitive process of observing similarities and differences leads to the creation of personal constructs. This means that only three elements (events or things) are required for the formation of a construct: two elements of a construct must be detected as similar and a third one as different from the former two. The mode as two elements are created as similar is called a construct or the similarity pole of the construct dimension and as the third element opposes the former two is known as the contrast pole of the construct dimension. It follows from this that every construct has a similarity pole and a contrast pole. Construct theory motivates one to discover how people interpret and anticipate their experiences in terms of similarities and contrasts. Based on this theory, Kelly developed the REP test to identify the important constructs that an individual uses to construct persons playing significant roles in the said individual's life. Summarizing the above, REP originally is a projective psychological test that targeted the exploration of important categories in the individual construction of social situations. Originally, a so-called list format was developed, later to be further developed into the grid format. To analyse the Grid – although Kelly did set up a mathematical scheme – software support is required, therefore the method could only gain popularity with the development of information technology and applied software. With the help of the method, the personal constructs of particular consumers can be explored and their detection and mental maps can be drawn. Its advantage is the quantification of the qualitative results, inherently ensuring the integration of qualitative-quantitative market research. Since the Repertory Grid Technique rather seeks to answer “How?” instead of “How many?”, it helps to establish how a consumer thinks and detects, and what subconscious motivations guide his choices. A key advantage of the method over the interviews is that it completely eliminates the researcher's influence. In other cases, the researcher would always set out from his/her own system of constructs, inevitably influencing the outcome of the interview. The research is made up of two parts, first, the consumer is requested to select important/relevant notions from the research topic in question. Following this, the elements are examined, three at a time, compare the triads by identifying the feature in which two of the three elements are similar, while the third is the opposite of the other two. This created a dimension, determined by the consumer, on one of whose poles similarities is positioned (similarity of two elements against a third one), and the other pole contains the difference of the third element. For traceability's sake, the two similar elements are marked (X), and the third, bearing the feature of difference, is left unmarked. (O) In the test, a notion is compared with others on three occasions in a random manner, based on the points positioned as the array of a matrix. In addition, the test may also play a useful role in selecting the communication or convincing strategies, as a consequence of which, the parties are aware of the other person's constructs, or can at least deduce them. The exploration of the constructs allows studying the dimensions the consumer uses in judging the topic in question. This exploration is however far from sufficient to describe how the system of mental constructs of the consumer functions. Two persons may identify the same construct, and yet we may use it quite differently, and thus, beyond verbal statements, we also find out that they may associate it with different meanings. To explore the use of constructs, the so-called “full grid” must be performed. For this, it is advisable not to regard the similarity and contrast poles of the construct as simple pairs of words, but a five-point scale.

The summary parameters and impressions of our REP research based on the above are:

1. 15x15 mesh, randomly positioned mesh in a matrix arrangement.
2. Points indicate in the row in question what is being compared to what.
3. 1 concept is compared 3x with the others.
4. The system of test aspects are the constructs and the contrast.
5. The subjects are not influenced in nominating the 15 notions; they define their own scope of concepts within waste management. we considered this important because examining the topic through the communication expert's eye, topics and correlations may be overlooked that might have helped the topic advance.
6. The duration of running the survey on 1 subject lasts 60-90 minutes.
7. The start of the survey is a monotonous and slow process, as the majority of subjects clarify the concepts and their background processes and situations upon comparing the first 3-4 of them. About halfway through the process, things accelerate, and all concepts and correlations overlap to about 90%, and the stories begin to be more interesting at this point. This is because of going deeper, the subjects loses awareness of being recorded, and the system of concepts expounded beforehand lets the subject's inner world unfold with respect to the topic. (KELLY 1969)



## Storyline parameters

Storyline is not identical to storytelling, although they are built on one another, and are related methods. Storytelling supports communication through the power of the stories, while the storyline is the framework itself, the path leading to storytelling. Storytelling is as old as the history of mankind. Listening to stories stimulates the functioning of the right cerebral hemisphere, which is responsible for creativity, sensing and even for one's sense of humour. We can understand other people's emotions through stories. We connect to one another through stories: we tell what happened to us, we gossip, we tell stories and quote anecdotes. Our brain senses imaginary experiences and emotions in the same way as real events: be it a good book, theatre piece, film or a moving conversation with friends; if the story is good, we identify with the personae. Of late, new procedures appeared in the field of futurology that are on the one hand based on creativity, and on group thinking on the other. The storytelling method grew popular because the problems of the present and the future cannot be solved within the confines of the conventional system of values. Bringing new values to the surface may be greatly aided by the so-called storytellers, who, through their own subjective perception, may draft new events of the future. The mindset of storytellers is heavily oriented towards global awareness and openness, while their stories and visions of the future also express the versatility and diversity of the world. The storyline method was first developed at Jordanhill College in Scotland in the mid-60, which is today part of Strathclyde University. The objective of the creators of the method (Steve Bell, Sallie Harkness and Fred Rendeli) was to develop an integrated approach of curricula that may be subdivided into parts A characteristic of the method is that it focuses on a story. This story or tale is wound around key questions. Key questions raise a problem each, which the students must solve, which carries the story forward. That's how students become part of the story. So, in order to progress, the active contribution is required, making even the unmotivated students motivated. A great advantage of this method is that it is not only linked to a particular subject but more than one subject may be concentrated into one topic. Child-orientedness was put in the focus, and their primary objective was to create appropriate classroom conditions for the students, promoting the acquisition of skills that are indispensable for learning. In the course of applying the method, students acquaint themselves with strategies that are equally applicable to the class, group, or individual works. The parts and episodes in the method are built on one another, ensuring progress and flexibility, and as the story progresses, the part of curricula to learn also unfolds. The participating students are urged to find the answers themselves, so they are made to face problematic situations, which they must solve with the help of their own knowledge and various sources of information. (MIKO 2017) In Hungary, it was the Institute of Educational Research and Development (Oktatáskutató és Fejlesztő Intézet, OFI) that compiled a guide in the Hungarian language, introducing the application of the storyline method to pedagogists. The Storyline method became accredited training in Hungary in 2015. (KÖVECSESNÉ 2015) In the research we conducted, achieving a similar openness in the subjects, we explored the present and future dimensions of waste management through the REP system of concepts. Therefore, this research method is capable of exploring deeper correlation in combination with the REP test than a depth interview would alone, as the subject uses his/her system of concepts to dig deep into the topic, analysing, evaluating, or expounding them. And in the research part of the Storyline method, the person conducting the research can urge the respondent to seek deeper connections. The integration of these two methods made it possible to obtain a comprehensive picture of the current waste management scenario's evolution in Hungary.

## Subjects of the survey

We selected fifteen professional leaders, currently holding high and relevant positions in the state and local government sector, and also from the non-profit and the civic sector. Supplementing it with a testing nature – to ensure whether they exercise influence over the result of the research – we had the test filled by two additional persons. A consumer who identifies him/herself as waste-conscious, is well-read in the topic, and myself, too. Eventually, as the answers given by us would not have altered the result of the research in any way, we left my concepts in the core material of the research.

## Conducting research and results

The research has revealed what can be communicated in terms of societal mind framing, what the elite of the profession thinks, what the public can be told, and what misconceptions are present. How far can consciousness go in the present situation? Research has shown tension between the profession and the public sector, the main reason being the lack of communication and the different perception of the priorities of waste-related matters. Based on the reports by the professionals, it became evident that the problems of combustion and composting stand out by far. That every subject revealed a similar system of concepts and problem curve during the conversations, confirmed the appropriate selection of the subjects. The phenomenon of interests vs stakeholders also became a recurring element, according to which only those topics in the waste management profession are embraced where there are underlying interests present or there is money behind them: this is why there is no mobile composting, for instance, because there is no company that would manage it. The REP test created 255 concepts related or associated with waste, based on which 31.5 hours of audio material and 65 pages of storyline supplementation were also created. From these, we filtered out three concepts referenced with outstandingly higher frequency: selective waste collection, utilisability of the material of the waste, utilisability for energy purposes, i.e. waste incineration, as it is more commonly known. As the first three had been mentioned more frequently than the others – and compiling their roles with the Storyline material – I think our research materials pointed out the most important or most problematic topics with the help of this method of highlighting.

The most outstanding result of the research is that based on the answers given by the research subjects, the Hungarian waste pyramid is different in comparison to those of our Western European neighbours and those of the Hungarian Waste Framework Directive as well. Recycling, i.e. selective waste collection is of a higher priority than the utilisation of the waste material. Although utilisation for energy purposes was only the third most frequently mentioned REP concept, it can be clearly demonstrated from the Storyline part that professionals opine the current decision-makers should place far greater emphasis on waste incineration. Further investments in this direction and the development of the already existing facilities/systems may be the way for Hungary to emerge and establish sustainable environment-conscious development.

The thought that health-consciousness is related to waste – these being built on one another and closely correlated in fact – was born as a comprehensive result of the research. It is not possible for an individual to be waste-conscious without checking the quality of the goods purchased, the effect it may have on human health, or what the product has been packaged into. It is interesting to examine the environment-conscious developmental curve that evolves in a consumer. First, messages find and convince the consumer on consciousness related to energy consumption, as individual involvement and interest is generated by demonstrably saving money through dedicated attention to the matter. Furthermore, if the principles of these (not only financial return) are incorporated in the individual's everyday life, but the individual may also become susceptible to activities such as selective waste collection or individually tailored healthy lifestyle programmes. These are interrelated, supplementing one another, shaping the individual behaving responsibly vis-à-vis the environment. Therefore, the various topics of environmental protection should in no way be separated and they should be communicated separately to the public.

This is how the situation we observe nowadays develops: people think there is an order of priority among the various topics. Unfortunately, the organisations of the various environmental protection areas, using different systems of concepts, bombard the public with different messages on what to do in order to behave responsibly for the environment.

Holistic thinking is unfortunately not characteristic of the environment protection trade, in spite of the fact that this would result in the better management of the respective topics of the operators, and that a systematic approach would have a far greater effect on consumers. In their own lives, they are able to easily and relevantly incorporate the means of protecting the environment and preventing damage. Adults conveniently push the responsibility on their children by quoting "the next generation will solve it". This is the attitude that calls for change. There is, however, no efficient platform available to them as the kindergarten or school for children, where such environment-conscious activities are incorporated into their everyday lives as fundamental schemes. Adults, on the other hand, if involved as part of internal communication activity in a green office programme and are "obligated" following internal information to exercise daily attention to it, they demonstrate assertive resistance, cooperation (even feigned cooperation) being out of the question. Employees who live a priori environment-consciously, such initiatives work perfectly, and they are the ones who quite probably switched off their computers when they left the office for more than half an hour even before the corresponding notification was issued. Looking at the communication of for-profit companies, they



are likewise segmented, embracing specific topics only. They have appropriations and objectives, and they will make the specific environmental protection matter connected to their area serve these objectives.

In their communication, they will segment the target group, those concerned and the corresponding messages and set of instruments as per their own interests. To set up a strategy in which everyone is in the target group is impossible on the one hand (or is a question of money), and inefficient on the other.

At the same time, the emphasis is not on selecting the target group, but to support the consumers with this holistic environmental thinking, within which it is possible to highlight our topic of preference. It should be the obligation of everyone to back this up with a system, one that would help understanding as well as better reception of the matter. If substantive CSR (corporate social responsibility) were going on in Hungary today, all profit-oriented enterprises targeting a larger public would incorporate efforts related to sustainable development and environmental projects in their strategies. Of course, nothing is easy when one is to go it alone, hence the non-profit and civic organisations who already have experience in this holistic environmental way of thinking await companies with open arms to join their efforts in this direction. Governmental policies are not helping the situation at present.

With the help of the concepts and their functions introduced by Luhmann, we can model a communication system that can clarify how individual social subsystems (economy, law, science, politics, art, religion, education) map issues related to ecological problems, and which subsystem can take action and at what depth. The author, relying on his own system theory, identifies the challenge in relation to this subject mainly in the question of how the social subsystems can offer solutions to ecological problems.

Table 1. Subsystems of Luhmann (own compilation)

| SUBSYSTEM        | FUNCTION                                 | MEDIUM                  | CODE                                         |
|------------------|------------------------------------------|-------------------------|----------------------------------------------|
| <b>Economy</b>   | Reducing scarcity                        | Money                   | Payment/non-payment                          |
| <b>Law</b>       | Ensuring the fulfillment of expectations | Law, jurisdiction       | Legal/illegal                                |
| <b>Science</b>   | Producing new knowledge                  | Truth                   | True/false                                   |
| <b>Politics</b>  | Producing collectively binding decisions | Power                   | Power/powerlessness<br>government/opposition |
| <b>Art</b>       | Representing the world                   | forming,<br>work of art | convincing/unconvincing<br>beautiful/ugly    |
| <b>Education</b> | Selecting for the career                 | Career                  | Praise/reproof                               |
| <b>Religion</b>  | Eliminating contingency                  | Belief                  | Immanent/transcendent                        |

Currently, the tool-sets of social systems have no direct effects on solving ecological problems, they only have social dimensions. Among the subsystems, according to Luhmann, politics has the biggest effect and highest influencing potential in relation to the other subsystems. Politics cannot put anything into effect directly, yet this scene is still the best choice of forum for ecological communication since politics has the largest influence on all the other social subsystems. Our current research verified this. Through centralized planning, hand-held direction, and dominantly one-way communication, the government owns control and removes such collaborations that were already present in the Hungarian market. Though Luhmann has clearly stated that his work (and its system theory background) is not suitable for solving ecological problems, in my opinion, he still took a significant step forward by successfully specifying through his model the social subsystems that are able to become its driving force. (Luhmann, 2010) I agree with him that the political scenery has such huge influence on other subsystems that using leverage or even perhaps pressure, it can promote the state of affairs.

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# IMPLEMENTATION OF TRENDS IN HUMAN RESOURCES MANAGEMENT AS A PRECONDITION FOR BUSINESS PERFORMANCE

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**ABSTRACT.** The transforming world, globalization, dynamic technological development and the massive impact of the pandemic on economic development have forced companies to make a rapid transition from a traditional to a modern approach to managing and implementing innovations and trends. This new progressive worldview on the formation of the new generations, with attributes and values typical for the past, has contributed to the process of adapting and responding to business challenges in human resources management. This article aims to analyze statistically significant differences in implementation trends of human resources practices, more specifically in the conditions of multinational companies operating in the European area as a precondition for business sustainability and increasing their performance potential in pandemic times. We will focus on trends in human resource management - outsourcing, onboarding, age management, knowledge management and talent management in terms of the effectiveness of their implementation in the conditions of 161 multinational companies. The reason for choosing this type of companies and testing in the multinational environment is its uniqueness related to cultural diversity, workforce, communication and sharing the knowledge and innovations.

**Keywords:** management, human resource, performance, trends, covid-19

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## Introduction

The main problem in the human resource management of multinational companies is the ability to effectively transfer human resources management practices and procedures (i.e., those that have proven to be an efficient tool in the parent company) to foreign subsidiaries. Those companies that can prove this ability dispose of one of the most significant characteristics for successful multinational companies (Taylor, 1996 In: Riege, 2007).

This fact has significant practical meaning to managers of multinational companies (Minbaeva, 2005) in the field of human resources management because that transfer may also constitute some form of competitive advantage for multinational companies, and thus their other competing companies will not be able to emulate them (Flood, 2003 In: Riege, 2007). Schawbel (2014), in his predictions related to trends in the labor market, pointed out the fact that: "While most companies are still trying to focus to understand the specification and the contribution with representants of generation Y, some of the companies are already preparing to invest heavily into generation Z in the form of internships or scholarship for the greatest talents "(those born in 1994-2010, and while the oldest one from this group are already at the universities at that time) (Mudrik et al, 2020).

Whether the practitioners or theorists, both agree that human resources are the most influential in the vast majority of the firms and make a decision about their success or failure (Cocuľová, Svetozarovová, & Bertová 2020). The main tasks of human resources are a determination of all the plans and goals for the companies. Without human resources, the companies will not operate in a fully and quality state (Svetozarovová & Sojka, 2015).

The impact of the pandemic forces companies to make an immediate transition to emergency mode, austerity measures, cost elimination and optimization of human resource management processes.

## From Traditional to Modern Human Resource Management - Innovation and Trends

Dianhua (2007) states that "human resource management is an expression of diverse characteristics in different countries, different professions and different companies" and reflects the need for a responsible approach to implementing the best human resource management practices and methods. The evaluation performance methods should be included and consider any specificities related to the company's nature or the country itself (Nastišin et al., 2018). At present, the contribution of human resource management in improving a firm's performance and in the overall success of any organization (alongside other factors) is being highlighted in the literature (Schuler & Jackson, 2005; 2007). John Storey (2007) states that it has been recognized from the outset that this term uses in two different ways. On the one hand, HRM is a general term that refers to any approach to employment management. On the other hand, HRM refers to one particular and probably the least helpful form of employment management approach. Both ways are defensible and both are currently used. Each of them uses its advantages and has its limitations.

To cope with the ever-changing and global world, an organization must use trends in its management. Kocianová (2012) states that the area of people management has developed relatively quickly in recent years, both worldwide and in our country, and thus approaches and personnel management methods have changed. Personnel management currently requires understandable organizational processes that affect organizational performance. The importance of people for an organization grows with increasing costs and investment in human capital; additionally, the importance of skills growth, motivation and flexibility of employees in organizational performance and its effectiveness to use the other sources (Svetozarovová et al., 2020). The rapidly transforming business environment means that there are currently many human resource management issues and challenges that are likely to continue in the coming years. Tom Marsden, director of professional services for Alexander Mann Solutions, said that human resources departments need to add real value to their organizations. "Even the restrictions of recession have not ended yet, the organizations are aware to take steps to sustain their workforce, by the emphasis to increase the importance of programs for training and engagement or investments into the areas that optimize costs such as integrated systems of technology or improved systems to attract the applicants. All indications point that human resources departments are preparing to maximize their resources and employees as organizations grow" (BISK, 2016).

According to Chiavento (2001), the new philosophy is inevitable in the new millennium. The concept "Human resources management" should be replaced by new terms "Personnel management", within the growing responsibility of middle management. People can primarily be considered human beings and not as resources for organizations. This concept means that employees at all levels should be engaged in organizations' business and yet responsible for the business outcomes. To be responsible means that all employees have and use all available information, apply their knowledge and skills, and manage their decisions to achieve desired success.

Human resources management is a very intensively discussed issue in terms of practices, business sustainability and organizational effectiveness in pandemic times. Many studies have been carried out in this regard (Caligiuri et al., 2020; Gigauri, 2020; Meri, 2020) verified the positive statistically significant relationship between trends in human resources management – practices and effectiveness in the most part. Nevertheless, this relationship remains insufficiently clarified. It seems that without presenting the benefits of investment into human resources practices, the decisions will be based on no exact explanations (Sojka et al., 2016). Even the methodology for evaluating practices values in human resources to efficiency has not yet been solved.

Even during these pandemic times, it is inevitable to do research focusing on the relationship between effective performance management and sustainability of organizations, and its importance is valued both for national and international standards. To know facts/situations in which an organization is successful and (because) its practices are systematically and adequately chosen, it unconditionally requires the evaluation of performance and competitiveness (Svetozarovová et al., 2020). Many studies prove the positive effects of realization for sustainable business in organizations (Ključnikov et al., 2019). The further it goes, the more the recognition of integrating sustainability into business is recognized in the benefits of creating unique added value and competitiveness of the company through effective human resource management. The individual benefits, such as organization reputation, improved employee's moral and competitive reinforcement influence in organizational performance (Crowther, 2012). The individual studies conducted by different authors from different geographical and time periods have confirmed the relationship between management, sustainability, and performance. The vast majority of them proved a positive correlation. Based on the statistically significant existence of correlation, it is clear that as a result of this relationship, companies implement sustainability strategies more than ever, and therefore the new impacts on an individual area of organizational performance result in increasing competitive potential of companies in the market. The impact of implementing a business sustainability strategy on the organizational performance of companies was a matter of research by Deloitte organization (2011, 2012, 2013).

Implementation of the trends in human resources management practices as a precondition for the business sustainability and increment of their performance potential is needed even during this pandemic when the organizations must continuously react to new challenges in human resources management. The method of outsourcing has been well known and implemented for several years, but at present, a new trend that pays attention to is IT outsourcing, in which it is possible to look at some perspectives of development when the outsourcing market is becoming more professional, centralized and more widely spread. The top management task in terms of outsourcing is to identify key processes to gain a competitive advantage. These processes should be implemented by their own resources, while others can be outsourced and regularly reviewed (Dvořáček & Tyll, 2010).

One of the other most significant trends of today is onboarding. The precondition of onboarding is the proactive approach of a new employee (Cooper-Thomas et al., 2006). From the point of view of human capital, the sooner and to a greater extent new employees can acquire specific knowledge, understand corporate culture and distinguish other unique aspects of the organization, the sooner these employees will then be able to contribute to organization success and success of the organization among its competitors (Klein et al., 2015).

The greatest assets in many organizations are the talents, knowledge and skills of employees in a continuously changing world (Lewis & Heckman, 2006; Collings & Mellahi, 2009). Many authors agree that talent management is the most challenging requirement for organizations nowadays (Scullion, Collings, & Caligiuri, 2010). According to authors Mellahi & Collings (2009), in a global context, talent management can be understood as the practice of human resources management that aims to balance various multi-directionally market power, the employee's needs and economic interests. The condition for the effective functioning of talent management in organizations is its initiatives and support from the management and its links to an organization's business strategy. The results of this strategy and practical tool for managing talented employees are then the individual talent management processes – acquirement, development and talent sustainability. Pruis (2011)



states that talent development does not bring out the best only in organizations. The employee input largely complements organizational needs. However, information on education and development can give us insight into why investing in talent education and development is so important. The competitive advantage which leads to valuable, rare, inimitable changes in human resources can be divided into two groups: training as an integral part of human resource management and training related to talent retention

The key to success in the competitive environment of the global economy becomes the effective use of people's knowledge, skills and creativity. A response to mentioned requirements is the new discipline: knowledge management, in which all recent developmental trends have concentrated and, what's more, is systematically developing the way of intellectual capital, identification, acquirements, sustainability. It is a mutual exchange of knowledge that significantly supports the active involvement of the subject in knowledgeable society, i.e., transition to a knowledgeable organization (Čarnický & Mesároš, 2006).

The problem of an ageing workforce and situations of ageing workers and organizations that employ those workers has come to considerable attention recently. Thus, age management is considered a new trend in human resources management. Age management is nowadays developing in terms of human active ageing, management diversity and the concept of social responsibility to a healthy organization. It focuses on the conflict against discrimination based on age and unemployment, promoting adequate human resources management and ensuring suitable working conditions (Kuperus et al., 2011; Novotný et al., 2014).

## Methodology

This article aims to analyze statistically significant differences in trends implementation of human resources management practices, specifically in the condition of multinational companies as a precondition of business sustainability and increasing the potential of their performance. According to aim, the hypothesis was formulated:

*H1: We assume statistically significant differences in the use of the individual trends in human resources management in terms of the performance of multinational companies.*

We will focus on the trends in human resources management – outsourcing, onboarding, age management, knowledge management and talent management, in terms of their implementation level and effectiveness of practice realization during the pandemic time. For this research, the individual trends were asset into several characteristics that we would evaluate which of them within the trends is the most used. We also tested the individual characteristics among themselves, whether there are any statistical differences in use between them. We use a nonparametric statistic for the statistical measure, specifically the Friedman test between dependent variables. We aim to compare several and more dependent variables in terms of analyses of variance. The test results report the value  $p$  as probability, which has to be lower than the selected level of significance, which of value is less than 0.05. The statistical differences increase significantly with decreasing  $p$ -value ( $p < 0.05$ ). To interpret the results, we applied the convention of indicating a level of statistical significance  $p < 0.05$  = low level of significance,  $p < 0.01$  = medium level of significance and  $p < 0.001$  = high level of significance.

## Results

Our research results of using the practices in multinational companies were as follows. The multinational companies with a higher percentage use Outsourcing (80.1%;  $n=129$ ) as the most common trend in human resources. After it is followed by Age management (73.3%;  $n=118$ ), Knowledge management (68.9%;  $n=111$ ), Onboarding (55.3%;  $n=89$ ) and Talent management (34.2%;  $n=55$ ). As stated earlier, we researched the existence of statistically significant differences in using individual trends in human resources management regarding their impact on effectiveness and business sustainability. The values of averages are balanced between the individual trends, as presented in the following tables.

Table 1. Relationship trend outsourcing selected characteristics and performance

| Friedman's ANOVA (N = 129, df = 6) = 73.89297 p = .00004<br>Kendall's coefficient = .09547 r = .08840 |               |              |          |          |
|-------------------------------------------------------------------------------------------------------|---------------|--------------|----------|----------|
|                                                                                                       | Average order | Sum of order | M        | SD       |
| Recruitment                                                                                           | 4.348837      | 561.0000     | 101.9922 | 0.914263 |
| Training                                                                                              | 4.496124      | 580.0000     | 102.2016 | 0.764238 |
| Coaching                                                                                              | 4.244186      | 547.5000     | 101.9767 | 1.034296 |
| Accounting                                                                                            | 3.957364      | 510.5000     | 102.0310 | 1.217952 |
| Legal advice                                                                                          | 3.895349      | 502.5000     | 102.0233 | 1.201985 |
| External suppliers                                                                                    | 4.313953      | 556.5000     | 101.9767 | 0.785266 |
| Other                                                                                                 | 2.744186      | 354.0000     | 101.3721 | 0.781323 |

Source: own processing

We found out that outsourcing as a trend in human resource management is used in the case of 80.1% (n = 129) in a sample of multinational companies. To assess the outsourcing trend, in terms of impact on efficiency, 7 variables were identified - the areas that companies do not carry out at their own expense, such as recruitment, training, coaching, etc. Based on the results of Friedman's ANOVA and Kendall's coefficient of agreement, a statistically significant difference between the individual characteristics in terms of impact on companies efficiency and business sustainability was confirmed in the case of trend outsourcing (p = .00004), as the value of probability p is lower than the selected level of significance 0.05.

Table 2. Relationship trend onboarding selected characteristics and performance

| Friedman's ANOVA (N = 89, df = 5) = 17.05854 p = .00439<br>Kendall's coefficient = .03833 r = .02741 |               |              |          |          |
|------------------------------------------------------------------------------------------------------|---------------|--------------|----------|----------|
|                                                                                                      | Average order | Sum of order | M        | SD       |
| Inclusion in the team and acquaintance with the closest colleagues                                   | 3.578652      | 318.5000     | 102.0449 | 0.767376 |
| Integration into the work process                                                                    | 3.426966      | 305.0000     | 102.0112 | 0.804736 |
| The right information - about the company, the basic rules and culture                               | 3.713483      | 330.5000     | 102.0899 | 1.062164 |
| The right information - about the method of evaluation and remuneration                              | 3.741573      | 333.0000     | 102.0674 | 1.020224 |
| Detailed information about the acquired job description                                              | 2.932584      | 261.0000     | 101.7079 | 0.800600 |
| Setting basic working conditions                                                                     | 3.606742      | 321.0000     | 102.1011 | 1.168186 |

Source: own processing

The relationship between onboarding as another significant trend in human resource management and the degree of efficiency is presented in more detail in Table 2. A total of six selected characteristics of onboarding were tested, such as integration into the team and acquaintance with the closest collaborators, integration into the work process, or setting the basic working conditions. We can state that onboarding is used by more than half of multinational companies, namely 55.3% (n = 89). The results of Friedman's ANOVA and Kendall's coefficient of agreement indicate the existence of statistically significant differences in the use of onboarding as one of the trends in human resource management in the conditions of multinational companies operating in Europe during the pandemic, as p = .00439, p selected significance level 0.05.

Table 3. Relationship trend age management selected characteristics and performance

| Friedman's ANOVA (N = 118, df = 5) = 60.71568 p = .00001<br>Kendall's coefficient = .10291 r = .09524 |               |              |          |          |
|-------------------------------------------------------------------------------------------------------|---------------|--------------|----------|----------|
|                                                                                                       | Average order | Sum of order | M        | SD       |
| A fair approach to aging and better information on aging                                              | 3.855932      | 455.0000     | 102.6441 | 1.250815 |
| Supporting work ability and performance                                                               | 4.330508      | 511.0000     | 102.9746 | 1.229703 |
| Lifelong learning, including non - formal education                                                   | 3.364407      | 397.0000     | 102.2542 | 1.206722 |
| Age-friendly working conditions                                                                       | 3.449153      | 407.0000     | 102.2712 | 1.251741 |
| Management of age issues included in human resources policy                                           | 3.055085      | 360.5000     | 102.1441 | 1.006606 |
| Safe and dignified retirement                                                                         | 2.944915      | 347.5000     | 102.0000 | 0.886750 |

Source: own processing

The equitable approach to ageing and better information on ageing, supporting working ability and performance, lifelong learning including informal training, age-friendly working conditions, management of age issues in the human resources policy, safe and dignified transition to retirement: are the all selected characteristics that were tested in the relationship to the effectiveness in terms of age management practices. A total of six activities were again selected and tested, and they should be provided in the company in terms of age management, which based on results from questionnaire survey used in a total of 73.3% (n=118) of selected companies. In the case of testing above relationship, we can determine that p has a value of .00001, i. statistically significant difference between the individual characteristics determining trend management in terms of the impact on the efficiency of companies and the sustainability of the business in times of pandemic.

Table 4. Relationship trend knowledge management selected characteristics and performance

| Friedman's ANOVA (N = 111, df = 5) = 9.319265 p = .09699<br>Kendall's coefficient = .01679 r = .00785 |               |              |          |          |
|-------------------------------------------------------------------------------------------------------|---------------|--------------|----------|----------|
|                                                                                                       | Average order | Sum of order | M        | SD       |
| Knowledge sharing - technological infrastructure                                                      | 3.567568      | 396.0000     | 101.9550 | 0.975960 |
| Connecting people - selling knowledge, communication                                                  | 3.202703      | 355.5000     | 101.7838 | 1.003679 |
| Established processes to simplify knowledge sharing                                                   | 3.378378      | 375.0000     | 101.9459 | 0.980147 |
| Training of educated employees                                                                        | 3.518018      | 390.5000     | 101.8919 | 0.918015 |
| Support of mutual education from top management                                                       | 3.837838      | 426.0000     | 102.3964 | 1.515251 |
| Established employee knowledge management system                                                      | 3.495495      | 388.0000     | 101.8919 | 0.897991 |

Source: own processing

The test results of the related knowledge management as a trend in human resources management and the efficiency level are presented in table 4 in more detail. We can mention the selected individual characteristics of knowledge management: sharing the knowledge, connecting people – passing on knowledge, support of mutual training from top management, training of educated employees, and others. Knowledge management is used by a total of 68.9% (n=111) of multinational companies operating in the EU area. The results of Friedman's ANOVA and Kendall's coefficient of agreement indicate the existence of statistically significant differences in the use of onboarding as one of the trends in human resource management in the conditions of multinational companies operating in Europe during the pandemic, as  $p = .09699$  is higher than 0.005, and therefore statistically significant difference has not been confirmed in this case.

Table 5. Relationship trend talent management selected characteristics and performance

| Friedman's ANOVA (N = 55, df = 6) = 11.25361 p = .12794<br>Kendall's coefficient = .02923 r = .01125 |               |              |          |          |
|------------------------------------------------------------------------------------------------------|---------------|--------------|----------|----------|
|                                                                                                      | Average order | Sum of order | M        | SD       |
| When recruiting employees, their talent is taken into account                                        | 4.072727      | 224.0000     | 1.981818 | 0.971652 |
| When motivating employees, their talent is taken into account                                        | 3.972727      | 218.5000     | 1.945455 | 0.869614 |
| When retaining employees, their talent is taken into account                                         | 4.690909      | 258.0000     | 2.127273 | 0.794764 |
| When evaluating employees, their talent is taken into account                                        | 4.445455      | 244.5000     | 2.090909 | 1.110101 |
| The organization supports the talent of individuals                                                  | 4.690909      | 258.0000     | 2.200000 | 0.910840 |
| The organization perceives the talent of employees as a competitive advantage                        | 4.754545      | 261.5000     | 2.200000 | 0.969918 |
| Talent is a tool for managing the careers of individuals                                             | 4.754545      | 261.5000     | 2.163636 | 1.032143 |

Source: own processing

The relation of talent management and its selected characteristics, regarding the efficiency point of view based on the results of Friedman's ANOVA and Kendall's coefficient of the agreement, were not confirmed (the value  $p = .12794$ ). A total of seven selected characteristics of talent management were tested. Based on the results, we can state that the selected researched companies use talent management the least, precisely 34.2% (n = 55).

## Discussion

Human resources management can be comprehended as a significant and integral part of the company. After all, the fulfillment of the organization's goals depends on human capital. The new innovative trends in human resources management, as many other trends, are taking part in the modern globalized world (Schuler & Jackson, 2005; 2007). For the needs of our research we have chosen five trends or modern management tools that are currently the most recognized and implemented in organizations. The majority of respondents consider using the new human resources

management trends as remarkably part of working with people. From the questionnaire results, it is clear that the most used trends are outsourcing and age management. As part of outsourcing, the most often used range of trends in multinational companies are the recruitment of employees, employees training and coaching of managers. Therefore we can state that most companies implement their project through outsourcing and to be informed about IT outsourcing as the current trend is highly demanding, but no studies can prove that IT outsourcing is the best management method (Xi et al., 2013). The reasons for adopting Age Management don't stop there. By improving their policies, companies can benefit from their worker's age diversity by having a better adjustment to various client groups (broken down by age, affluence, etc.) (Liwiński & Sztanderska, 2010 In: Fabisiak & Prokurat, 2012).

According to results, talent management is used the least, especially only 34.2% of respondents confirmed using the mentioned trends actively. However, when the multinational company already uses this trend, it is principally satisfied with it and evaluates it as very efficient in its impact on the employees. Within talent management is the most often used, when motivating employees and retaining employees and their talent is taken into account in both characteristics. Schraeder (2009) states that sufficient time needs to be devoted to the development and training of employees to integrate them into the organization's strategy. However, the demand for alternative methods of development and education is coming to the fore.

Knowledge management, as the concept is not known for many people, in any event of this, its practices are very often used in multinational companies. The procedures of connecting people - passing on knowledge, communication - seems to be the most effective within the given trend. Approximately half of the respondents indicated that the onboarding trend is used actively within their company, but they did not evaluate it effectively. As we look at the results, we can see that the practice as the right information - about the company, basic rules and culture within onboarding is not widely used, and the respondents evaluate it negatively. According to Singh and Sharma, knowledge management and organizational learning have a positive relationship and by extension, with employee's performance (Singh & Sharma, 2011 In: Ho 2018). In order to improve the employee's performance, knowledge management systems must be enhanced and organizations must have to adopt different policies to enhance their learning capabilities.

As the difference between the identified set of human resource management trends, in terms of impact on efficiency and sustainability of the business within multinational companies, was not confirmed in all five cases. Only in three named (onboarding, outsourcing and age management), we cannot accept the hypothesis and for this reason, reject it. Looking at the overall results of the analysis, we can say that most multinational companies use new trends and consider them to be effective in terms of impact on employees. We believe in improvements, and every company can use recent trends much more effectively because innovations in human resource management lead the company to better competitiveness.

## Conclusion

In the early beginning of the 20th century, companies began to realize the need for human resource management. They understood that just people as a resource are a competitive advantage for their company. Over time, various approaches, processes and functions of human resource management developed. Different models of human resources management have been created in the company, in which the management influence on the performance of employees was pointed out. The new type of coronavirus has affected the whole world and caused a global pandemic, but above all, it has influenced the current unstable time in which many trends and challenges still exist. The organizations, both in the domestic or multinational working market environment, will not respond promptly and practically enough, which may cause fatal consequences. Therefore, it is necessary to consider which trends are inevitable to use currently because some of them are unnecessary in every organization. On the other hand, innovative trends have to be supported and improved.

The challenges companies are currently facing should be resisted to survive in the global market. The global integration trend points out the standard recruitment, management and development of human resources - talents, to secure their competitive advantages. The organization should accept the best global and local approaches to human resources management. Every organization should make more effort to use modern managerial methods and tools, as its goal is to sustain in the market. It should follow the latest trends in leadership, decision making, organizing and controlling. Also, try to motivate employees and gain qualified, talented and highly performed employees who are willing to respect trends and challenges in the business environment, even during pandemic times.



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**Review****EDUCATION MANAGEMENT.****Theoretical, empirical and praxeological aspects of the management of educational institutions****Reviewer:**

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Education management in the current time period is a key area in the management of educational institutions. The process of education itself as well as the final result - education can be viewed from two perspectives - economic and non-economic. From a non-economic point of view, education is an important part of the living standards of the population, which makes it essentially a necessary part of their lives. From an economic point of view, it represents the basic determinant of the economic development of the territory. Therefore, it is important within the management of education to identify all the influences that significantly affect the management of educational institutions. Monograph "Education Management. Theoretical, empirical and praxeological aspects of the management of educational institutions" is a comprehensive publication dealing with individual aspects of educational management.

The originality of the publication lies in the fact that it fills a gap in the market of applied management and provides the reader with the opportunity to penetrate into the secrets of the management of educational institutions. At the same time, it obtains the issue of management from a professional point of view also in the field of education, as one of the most important representatives of public services. If the product of pedagogically oriented faculties is to be a teacher focused on the practice of education, it is necessary that in accordance with the current requirements of practice he is acquainted (educated) in economics, education management, business opportunities in the education sector.

In terms of content, the publication is divided into 9 separate chapters, which logically follow each other. These are chapters that place the process of education management in the historical framework of management theories and schools, but also correctly integrates the issue into the context of public administration, where since 1989 there have been several radical changes in the management of the school system. The next chapters present the latest information on economic, financial and socio-cultural aspects of the management of educational institutions, including managerial functions, human resources management. The authors did not miss project management and extremely current trends in ICT education. I highly value the included research results in the form of an empirical-comparative study of a descriptive nature and especially a study addressing the relationship between the variables of education, e.g. at the level of managerial training of school principals. The individual chapters allow the reader to obtain chronologically and sufficiently comprehensive information regarding the second most important factor of education - its management. Appropriately chosen structure of the publication brings the reader easier orientation in the relatively demanding issues of education management. The monograph is an original work that will fill a persistent gap in the professional market and help educators to look beyond teaching. Graphic expressions that enrich and illustrate the text have a high descriptive power.

The monograph will certainly find a place in the professional educational institutions, with the founders as well as with students of the pedagogical unions, as the assessed text provides comprehensive information concerning the management of education.

At the same time, it also creates preconditions for making the study of pedagogy more attractive, because in addition to pedagogical aspects, it also provides a managerial and economic view of the field of education. The aspect of education management and the pedagogical aspect are in a very balanced state in this work.

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