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# Research Articles

## THE CZECH REPUBLIC WITHIN THE CONTEXT OF MEETING THE R&D&I TARGETS SET OUT IN THE EUROPE 2020 STRATEGY

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### Abstract

This article aims to assess the development and structure of gross domestic expenditure on research and development (GERD) concerning the Europe 2020 strategy (Strategy) and the Czech government's targets. Four research tasks are outlined: 1. Assessing if the EU met the 3% GDP R&D investment target set by the Strategy. 2. Determining if the Czech Republic met its national R&D expenditure target. 3. Verifying the statistical relationship between GERD and the Summary Innovation Index (SII). 4. Examining the statistical relationship between GERD components and SII. Findings reveal that neither the Strategy nor the Czech Republic's targets were achieved. Correlation analysis indicates a significant relationship between total GERD and SII. Further analysis shows a strong correlation between the pairs of business enterprise expenditure on R&D and SII, as well as between government expenditure on R&D and SII.

### Keywords

R&D&I; Gross expenditure on research and development; GERD; R&D intensity; SII; Europe 2020.

### Introduction

Over the last few decades, theoretical and empirical research has paid considerable attention to the issues of economic growth, productivity growth, and increasing competitiveness. Since the very beginning of economics as a science, all major theoretical trends have been devoted to the issue of economic growth. Economists have tried to find answers to such questions as the source of growth, why some countries are rich and others are poor, etc. Each of these theoretical approaches offered different answers. In the late 1980s, endogenous growth models dominated economic theory and influenced the direction of economic thinking in subsequent years. These models identified research, development and innovation, or R&D&I spending, as one of the main sources of growth. Their importance and relevance are reinforced by the fact that R&D&I is one of the most important priorities in the strategic development documents of all developed countries.

This article aims to assess the development and structure of gross domestic expenditure on research and development (GERD) with respect to the achievement of R&D&I targets set by the Europe 2020 strategy (Strategy) and the Czech government.

It proceeds from the general to the specific. The introductory part of the article is devoted to the theoretical background of economic growth or the importance of R&D&I for economic

growth, especially in the framework of endogenous models. Attention is also paid to science, research and innovation in the strategic documents of the European Union and the government of the Czech Republic. In the main analytical part of the article, four research tasks are formulated with regard to the fulfilment of the above aim. The data were obtained from publicly available sources. They were first analyzed using descriptive statistics, and then comparative and correlation analysis methods were used to verify the relationship between the selected variables. The conclusion summarizes the findings and formulates answers to the individual research questions.

## **1 Literature Review and Theoretical Background of the Issue under Investigation**

Investments in science, research, development and innovation, together with investments in education, are considered the main sources of economic growth, productivity growth, and increasing competitiveness in modern economies. Mainly in the last twenty years, the awareness of this fact has become more important, and the area of research, development and innovation (hereinafter R&D&I or R&D) has been at the top of the priorities of regional, national and supranational policies. Macroeconomic growth theories are the theoretical basis for this thesis of economic development based on knowledge and innovation, and for the emergence of new policies that intensively support R&D. According to modern macroeconomic theory, the main factors affecting economic growth include labor efficiency, which is the result of technological progress, qualitative changes in economic, institutional and social organization, and capital intensity. Two main approaches can be identified as the most important of the growth theories, namely the neoclassical models, the most famous of which is the growth model of R. M. Solow, and the later constructed endogenous growth models.

It is useful to recall the most important conclusions of Solow's model (Solow, 1956, 1957). Solow argues that mere capital accumulation increases output per worker only up to the steady-state level; when capital accumulation is supported by an equally large increase in labor, the result is an increase in output, but not in output per worker, and that the only factor in long-run growth is technological progress, which determines the growth of labor productivity. In this model, however, technological progress is an exogenous quantity, i.e. unexplained by the model. Technological progress and innovation are only random events in the model and can only be expressed as the residual growth after the effect of the factors on which the model is based has been subtracted. It can, therefore, be argued that the Solow model does not adequately explain economic growth and does not capture the factors that are key to the development of today's knowledge-based economies.

In response to the shortcomings of neoclassical models and their inability to explain empirically the differences in wealth between countries, endogenous growth theories emerged in the late 1980s and early 1990s. One of the main exponents is R. Romer (Romer, 1986, 1990). Endogenous growth theories are characterized primarily by the extension of the concept of capital to include so-called knowledge capital, which arises as a result of investments in R&D of new technologies, process and product innovations, as well as investments in human capital. They attribute increasing returns to investments in R&D and human capital due to the existence of so-called positive externalities of these investments in knowledge capital, which bring social benefits that can exceed the initial investment costs several times over. As a result, aggregate returns on total capital may be at least constant, possibly even increasing, but certainly not decreasing as predicted by the neoclassical model. Thanks to rising returns, capital, and dependence on it, the output can thus grow essentially indefinitely. (Romer, 1986). Technological change is endogenized in these models, identified



with the growth of knowledge capital, which is a function of the growth of investment in new technology and human capital.

Some empirical studies conducted in the 1990s refute the assumption of increasing returns. For example, Jones (1995a, 1995b, 1999) argues through US statistics that although the number of scientific researchers has multiplied over the last half century due to a substantial increase in R&D funding, the growth in output per capita has been much lower. On the basis of these arguments, the assumption of increasing returns to scale has been removed from the models, and these models tend to be referred to as “second-generation” endogenous models (Dinopoulos and Sener, 2007).

Models that seek to explain the origins of new technology and innovation are referred to as Schumpeterian growth models. Schumpeterian growth theory is based on the idea that economic growth is driven primarily by technological progress generated by the endogenous process of product and process innovation. The word endogenous here means innovation arising from the conscious actions of economic agents to maximize their utility. (Holman, 2000). The theory is based on the well-known assumption of the existence of the so-called process of creative destruction, which was first described by Schumpeter in 1942. This is the idea that economic development is continuously pushed forward by invention and the introduction of new technologies and innovations, from which some economic units benefit and others are harmed. A newly introduced product or technology upsets the previous equilibrium in the markets and thus has a disruptive effect on companies or entire sectors, which are unable to adapt to the new situation and lose competitiveness. The whole process is, however, a recovery process for the economy, as it ensures the survival of the better, more competitive businesses and lets the weaker ones fail. Over time, the economy then reaches a new equilibrium at a higher level. Thus, competition in such an economy is actually a kind of Darwinian struggle for survival, where the ability to produce, adopt and continuously improve new technologies and the ability to adapt to constant change is the guarantee of success and the sustainability of competitiveness.

The Schumpeterian theories of endogenous growth also provide suggestions for economic policy. Romer (1990) and his followers (Aghion and Howitt, 1992) argue that government policies that promote scientific research activities, whether in the private or public sector, together with policies that promote education, can contribute to economic growth in both the short and long run. Technological progress is considered to be the result of a number of factors, such as in particular: the level of investment in physical and knowledge capital (i.e. technology and human capital), openness to international trade, the quality of property rights provision, government consumption, population growth, and the level of government regulation.

The EU has placed increasing emphasis on innovation as the main means of increasing competitiveness since around the mid-1990s. Innovation can be seen as an expression of creativity and the creative process. It is very diverse. It can be the result of science and research, entrepreneurial and managerial skills, or organizational, social, and administrative skills. Innovation means the successful use of new ideas in any environment. It can be the discovery of a new cure for Covid 19, the creation of a new product, or a change in a production process. In March 2000, the European Council announced the objective that the European Union should become the most competitive and dynamic knowledge-based economic area in the world by 2010 - an area capable of sustained economic growth, with more and better jobs and greater social cohesion. (European Commission, 2000)

This was, in effect, a set of interacting reforms whereby it was assumed that measures implemented in one Member State would be much more effective if implemented in other

Member States. The problem was that the Lisbon Strategy was too broad to be seen as a coherent whole. The Lisbon Strategy dealt with everything and, in principle, nothing in particular; everyone was responsible, but no one in particular.

The time horizon for the Lisbon Strategy expired in 2010. It was replaced by a new long-term strategy, Europe 2020. This strategy responded not only to the economic crisis at the time but also to other long-term problems, such as the ageing population in Europe and pressure on resources.

In this strategy, the EU sets out three priorities - smart growth, i.e. to develop an economy based on knowledge and innovation; sustainable growth, i.e. to promote a more competitive, greener and less resource-intensive economy; and inclusive growth, i.e. to promote a high-employment economy characterized by social and territorial cohesion. These priorities are then concretized in the five headline targets that the EU wanted to achieve by 2020, one of which is the target to invest 3% of EU GDP in research and development. (European Commission, 2010)

The Czech Republic has long lacked a systematic and coordinated state policy aimed at creating an overall pro-innovation environment. The only relevant document since the establishment of the independent Czech Republic has been the National Innovation Strategy of 24 March 2004. On its basis, the National Innovation Policy for 2005-2010 (Vláda ČR, 2006) was prepared, which set itself the task of creating conditions for a systematic and coordinated state policy aimed at creating an overall pro-innovative environment, especially for the business sector, which is decisively linked to the innovation process. In the conditions of a globalized world, strategies of the “low-cost economy” type, using low costs (e.g. low wages, a low exchange rate, etc.) as a source of competitive advantage, are proving unsustainable for the Czech Republic in the future. Therefore, the innovative capacity of enterprises, the growing quality of human resources, research and technology, which are considered to be the key to the growth of European competitiveness, must increasingly come to the fore as a source of advantage.

The National Innovation Policy proposed four strategic objectives for the development of innovation and sustainable growth, namely to strengthen research and development as a source of innovation; to create functional cooperation between the public and private sectors; to provide human resources for innovation; and to improve the efficiency of government performance in research, development and innovation.

Czech firms, especially SMEs, generally invest significantly fewer resources in R&D than large firms and their innovation activity is relatively low. Most R&D activities are carried out by foreign multinationals. Therefore, it is necessary to create instruments to support research and development aimed at young dynamic companies.

The Europe 2020 strategy has been the EU’s main economic strategy over the past decade. In line with the June 2010 European Council conclusions, Member States were to set national targets in cooperation with the European Commission and taking into account their national economic and social specificities. This is what the Czech government has done. In the following period, these targets were subsequently expanded and adjusted during the course of the strategy’s validity. With regard to R&D funding, the target was set to obtain a share of public support for R&D equal to 1% of gross domestic product. (Vláda ČR, 2021)

In 2019, the Czech government presented a new innovation strategy for the Czech Republic - “Innovation Strategy of the Czech Republic 2019-2030”. Here it is stated that the share of total R&D and innovation spending in the Czech Republic in 2019 was 1.79% of GDP, of which business sources are 60%, government and EU sources 40%. The R&D funding targets,

measured as a % of GDP, are 2.0% in 2020, 2.5% in 2025 and 3.0% in 2030. This, therefore, assumes an increase of 0.1 p.p. each year, with public sources increasing to 1%, followed by business sources increasing to 1.5% in 2025 and 2% in 2030. (Rada pro výzkum, vývoj a inovace, 2019), (Vláda ČR, 2022)

The way the strategy is managed and monitored is crucial for its future success. This is where most national strategic plans have ended up in the past. Between 2022 and 2026, extra resources of CZK 12.5 billion should be drawn from the European Union for science and research, which should contribute to meeting the 2.5% target in 2025.

Another document adopted by the Government is the National Policy on Research, Development and Innovation of the Czech Republic 2021+. The National Policy represents an overarching strategic document at the national level for the development of all components of research, development and innovation in the Czech Republic. The document contributes to the fulfilment of certain criteria essential for the possibility of drawing funds from the European Union in the programming period 2021-2027. (Rada pro výzkum, vývoj a inovace, 2020)

## **2 Research Objectives**

The aim of this article is to assess the development and structure of gross domestic expenditure on research and development in the Czech Republic in relation to the achievement of the set R&D&I targets. The following research tasks were formulated:

1. To determine whether the European Union met the target set by the Europe 2020 strategy to invest at least 3% of GDP in research and development.
2. To determine whether the Czech Republic met the national target set in the context of the Europe 2020 strategy for public expenditure on research and development to reach at least 1% of GDP.
3. To verify whether there is a statistically significant relationship between GERD and the Summary Innovation Index.
4. To verify whether there is a statistically significant relationship between the individual components of GERD and the Summary Innovation Index.

## **3 Data and Methodology**

Secondary data were obtained from publicly available sources. Data concerning the Czech Republic were obtained from the Czech Statistical Office. Data concerning the EU28 Member States (including the United Kingdom, which is not an EU Member State as of 2020), some candidate countries (Montenegro, the Republic of North Macedonia, Serbia and Turkey), potential candidates (Bosnia and Herzegovina), neighboring countries (Iceland, Norway and Switzerland) and other major economies (Russia, United States, and China (except Hong Kong), as well as Japan and South Korea) were obtained from the Eurostat database. The analysis is extended to include selected non-EU countries for comparison with major economies, whose inclusion in the analysis increases the predictive value of the results.

The period covered is 2000 to 2019. The reason for choosing this time frame is that the data for the following years are impacted by the crisis caused by the Covid-19 pandemic. This ensures that the analysis is unaffected by the exceptional fiscal measures and disruptions associated with the pandemic, thus providing a more accurate assessment of trends in GERD. In addition, the focus on this period allows for a comprehensive assessment of pre-pandemic, pandemic, and post-pandemic patterns in this area.

The data were analyzed using the Statgraphics software program. Table 1 describes all variables used in the analysis.

**Tab. 1:** Description of variables examined in the analysis

Variable	Description	Source
GDP per capita	gross domestic product per capita	(Eurostat, 2022)
GERD	gross domestic expenditure on R&D	
GERD per capita	gross domestic expenditure on R&D per capita	
Business enterprise expenditure on R&D (BERD)	intramural GERD in the business enterprise sector	
Government expenditure on R&D (GOVERD)	intramural GERD in the government sector	
Higher education expenditure on R&D (HERD)	intramural GERD in the higher education sector	
Private non-profit expenditure on R&D (PNPRD)	intramural GERD in the private non-profit sector	
R&D intensity	ratio of GERD to GDP	
Summary Innovation Index (SII)	composite indicator: 32 innovation-related indicators are divided into four main groups: framework conditions, innovation activities, investments, and impacts.	
Public sources of GERD in the Czech Republic	public sources of gross domestic expenditure on R&D in the Czech Republic	(ČSÚ, 2022)

Source: Own

The evolution of the two most commonly used indicators of innovation performance is monitored and analyzed through descriptive statistics, which were employed to describe the variables and illustrate their trends over the observed period. These indicators are GERD and R&D intensity. GERD, the primary indicator for international comparison of R&D activity, “covers all expenditures for R&D performed in the national territory during a specific reference period.” (OECD, 2015) It is a crucial indicator for assessing the investment level in research and development activities and determining whether the targets set by the Europe 2020 strategy and the Czech government are met.

According to OECD (2021): “Gross domestic spending on R&D is defined as the total expenditure (current and capital) on R&D carried out by all resident companies, research institutes, university and government laboratories, etc., in a country. It includes R&D funded from abroad, but excludes domestic funds for R&D performed outside the domestic economy.”

The structure of GERD can be viewed from two basic perspectives, which are described in more detail in the Frascati Manual (OECD, 2015). According to the first aspect, i.e., funding sector, which can be the business enterprise sector, government sector, higher education sector, private non-profit sector, and the rest of the world. The second aspect, performing sector, again breaks down GERD by the sectors mentioned above, omitting only the rest of the world sector. According to the Frascati Manual, these are business enterprise expenditure on R&D (BERD), government expenditure on R&D (GOVERD), higher education expenditure on R&D (HERD), and private non-profit expenditure on R&D (PNPRD).

GERD as a share of gross domestic product (R&D intensity) measures R&D expenditure as a percentage of GDP. This indicator does not assess the structure of GERD or its absolute amount. It indicates the relative importance of R&D investments compared to the overall economy. Higher R&D intensity is often associated with greater innovation potential and economic growth.

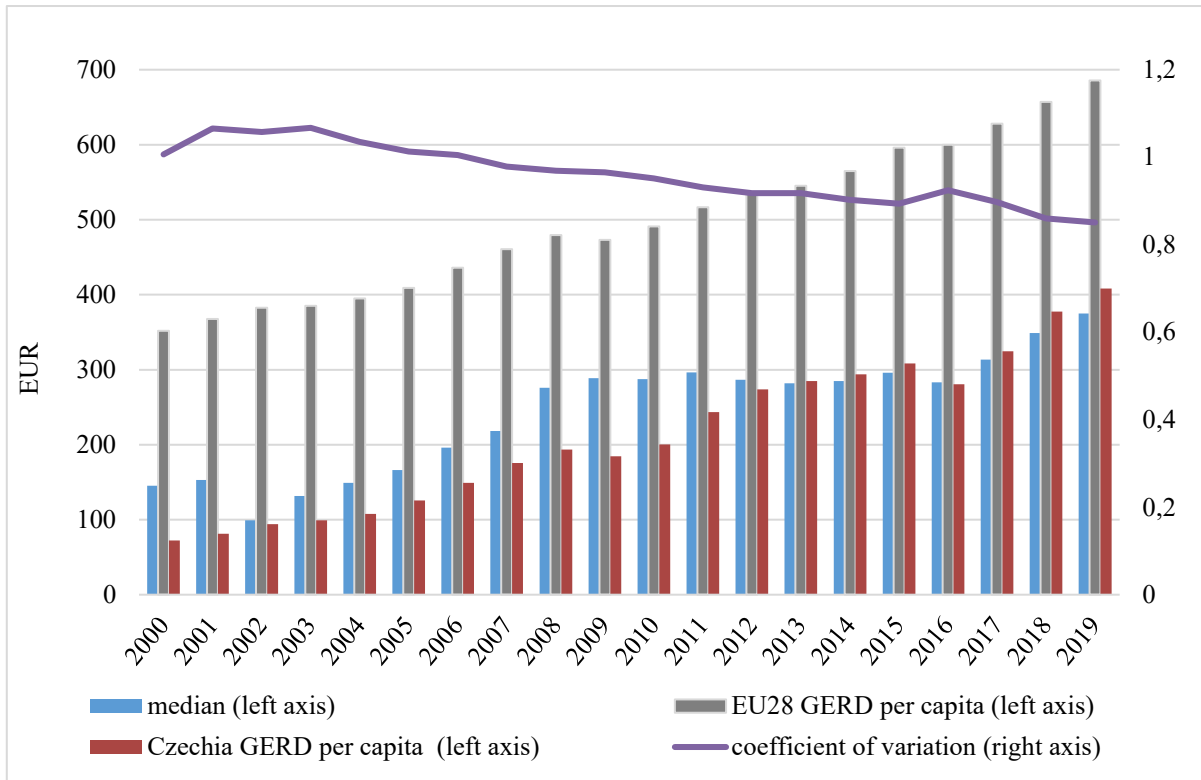
The analysis of these two indicators of innovation performance is further enhanced by the correlation analysis, which was employed to verify the relationship between R&D expenditures and the innovation index. This analysis provides insights into the impact of investments in research and development on overall innovation performance. The Summary Innovation Index (SII), which was first published by the European Commission in 2001, was chosen for this analysis. The SII is a composite indicator that reflects the overall performance of a country's innovation system. It encompasses various dimensions, including human resources, research systems, finance and support, firm investments, and economic impacts. The relevance of SII in the study lies in its ability to provide a comprehensive overview of the innovation landscape and its correlation with R&D expenditure. According to the value of SII, countries are divided into four categories on the European Innovation Scoreboard (innovation leader, strong innovator, moderate innovator, and emerging innovator). Not only EU Member States but also selected third countries are rated by SII. (European Commission, 2020)

The variable of public sources of GERD is important for the comprehension of the impact of government policies on R&D funding, driving innovation, and economic growth. This variable helps to analyze the extent of governmental support for R&D activities, the effectiveness of policy measures in fostering a conducive environment for scientific and technological advancements, and their subsequent impact on the country's economic development.

The methodological limitations of this study include a reliance on secondary data sources, which may be subject to inaccuracies and inconsistencies that affect the reliability of the findings. While the utilization of descriptive statistics and correlation analysis is beneficial for the identification of trends, it does not establish causality. The implementation of more sophisticated models could facilitate a deeper understanding of the subject matter. The focus on specific indicators, such as GERD and the SII, may result in the overlooking of other influential variables, including political stability and the regulatory environment. Furthermore, the findings are based on EU countries, which may limit their generalizability to other regions with disparate economic structures and innovation ecosystems. Addressing these limitations in future research could enhance the robustness and applicability of the findings.

#### **4 Empirical Results and Discussion**

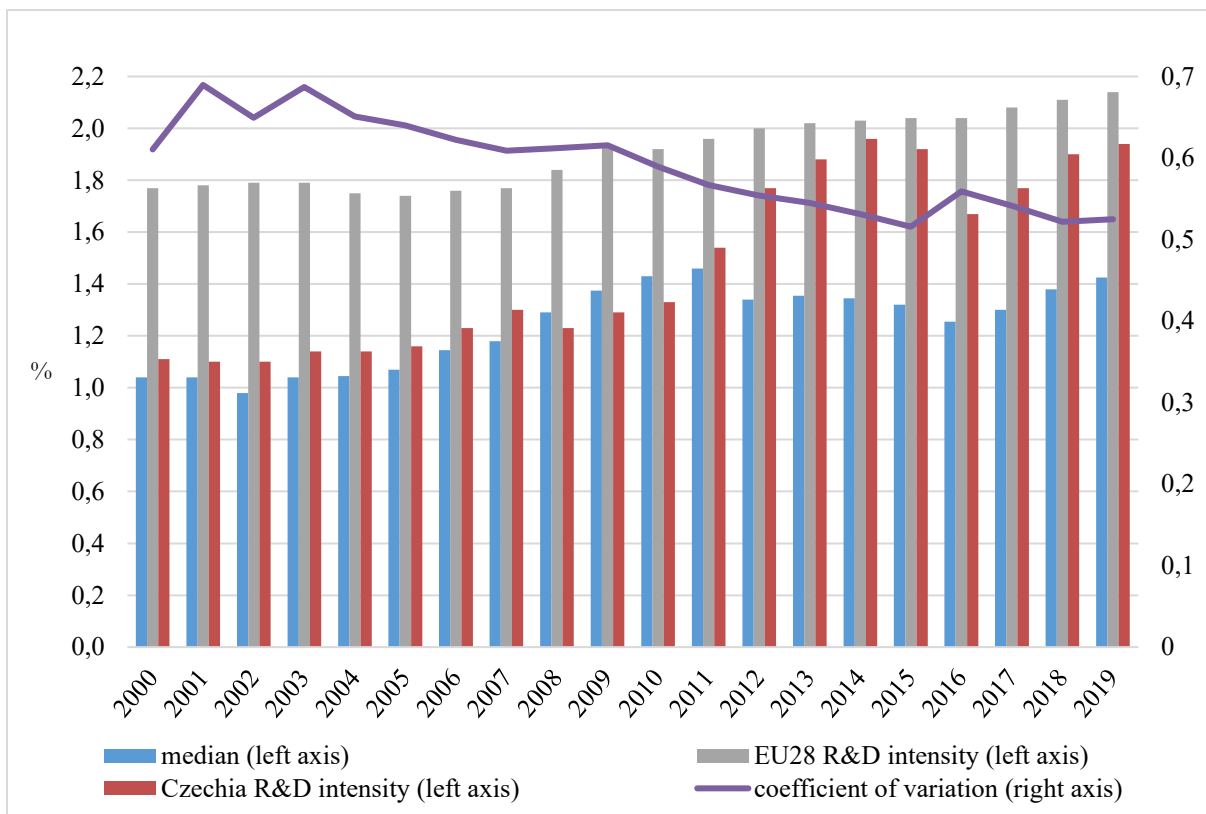
Firstly, the evolution of GERD per capita is assessed. As can be seen from Figure 1, the coefficient of variation calculated for the EU28 as a whole has a decreasing trend over the period under review, which means that the differences between Member States are decreasing. The GERD per capita value for the Czech Republic has been above the median since 2013 (except in 2016, when the median was €283.15, compared to €280.8 in the Czech Republic). Compared to values for the EU28 as a whole, the Czech Republic lags significantly behind.



Source: Own calculation using (Eurostat, 2022)

**Fig. 1:** GERD per capita

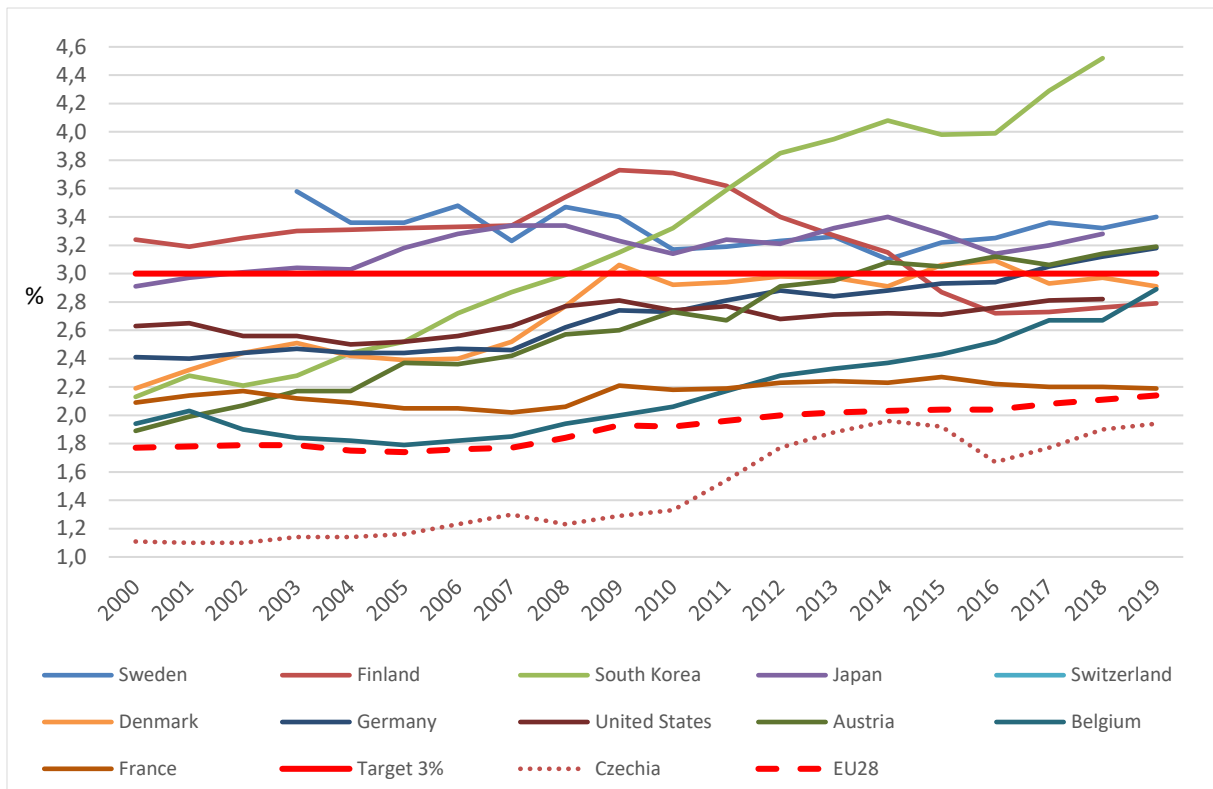
The following Figure 2 shows the evolution of GERD as a percentage of GDP, or R&D intensity. As can be seen from the figure, the coefficient of variation calculated for the EU28 as a whole also has a decreasing trend over the period under review, which means that the differences between Member States are also decreasing in terms of this indicator. The R&D intensity value for the Czech Republic is above the median throughout the whole period, except for the years 2008-2010. Compared to the values for the EU28 as a whole, the Czech Republic is not lagging as far behind as in the case of GERD per capita. Although the trend in R&D intensity for the EU as a whole (i.e., EU28 R&D intensity) is increasing, the 3% target was not met over the period. In 2019, the R&D intensity value was the highest, namely 2.14%. Based on the findings of research task 1, it can be concluded that the EU has not invested at least 3% of its GDP in R&D, as set by the Europe 2020 strategy. Therefore, the target has not been achieved.



Source: Own calculation using (Eurostat, 2022)

**Fig. 2:** GERD as a percentage of GDP (R&D intensity)

In terms of individual EU Member States, Sweden has the highest R&D intensity. Its average R&D intensity for the period 2000 to 2019 is 3.35%. Figure 3 shows the evolution of R&D intensity for countries that have reached or are close to the Europe 2020 target. Finland is among the EU Member States with a high R&D intensity for most of the period under review. However, there was a downward trend in 2010 and since 2015 R&D intensity has been below the target, partly due to problems with the ICT sector (European Commission, 2016). Despite this, Finland ranks among the countries with the highest R&D intensity. For Denmark, Germany, Austria, and also Belgium, an increasing trend can be seen. As for the Czech Republic, it has not exceeded the 2% threshold throughout the period under review. The significant decrease in 2016 was caused by the transition to the next programming period of the absorption of European structural and investment funds and the related reduction of foreign public sources. Thus, from the long-term development of R&D intensity, it can be concluded that the Czech Republic's accession to the EU had a positive impact and a continued upward trend can be expected in the future.

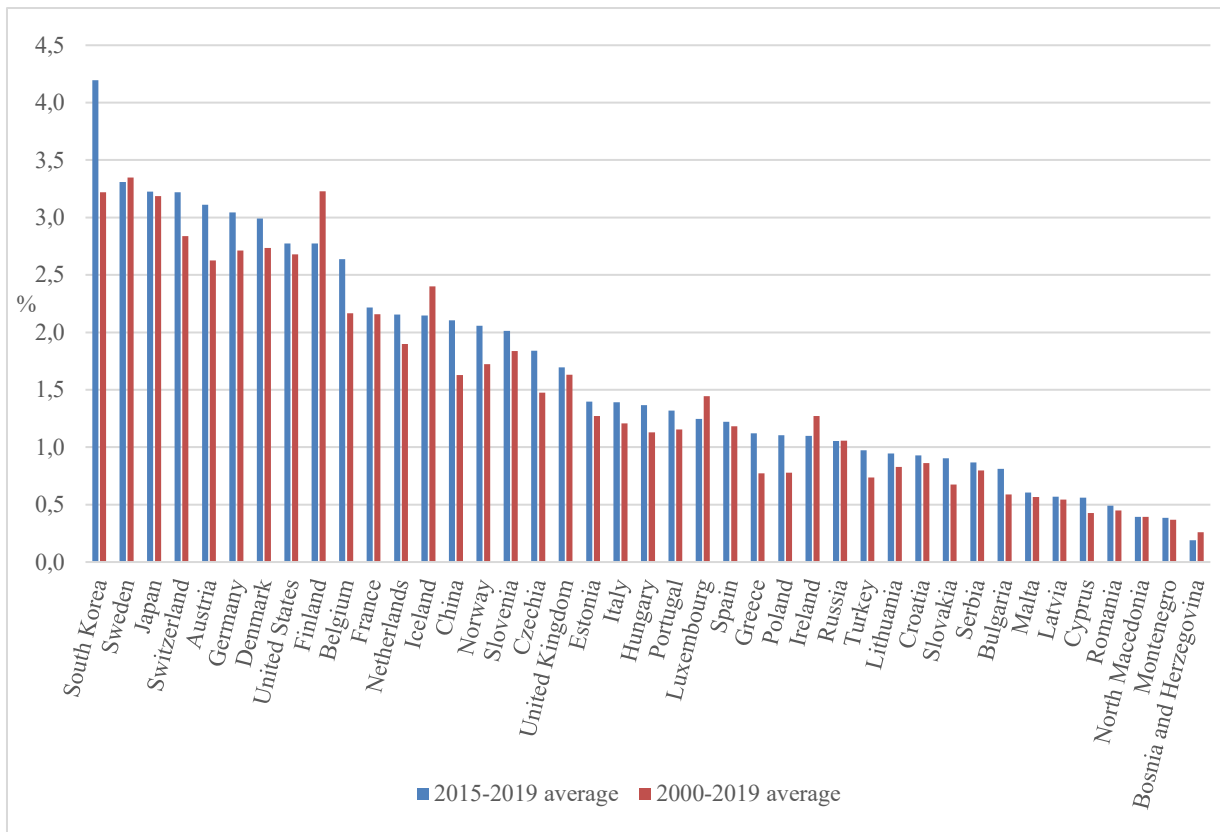


Source: (Eurostat, 2022)

**Fig. 3:** R&D intensity development, selected countries, 2000 – 2019

Figure 4 below shows the average R&D intensity over the whole period (2000 to 2019) and over the last five years (2015 to 2019). The latter period was chosen to compare the long-term R&D intensity with that of recent years. In addition to the EU Member States, the table includes data from selected non-EU countries. The countries are ranked in descending order of the average of the last five years, i.e., the 2015-2019 average. For most countries, there has been an increase in average R&D intensity over the last five years, which means that the ratio of GERD to GDP has been increasing in recent years. The most significant change is observed for South Korea, followed by Austria, China and Belgium. On the other hand, the largest decrease has occurred in Finland. Other countries that have reduced R&D intensity over the last five years include Iceland, Luxembourg, Ireland, and Bosnia and Herzegovina.

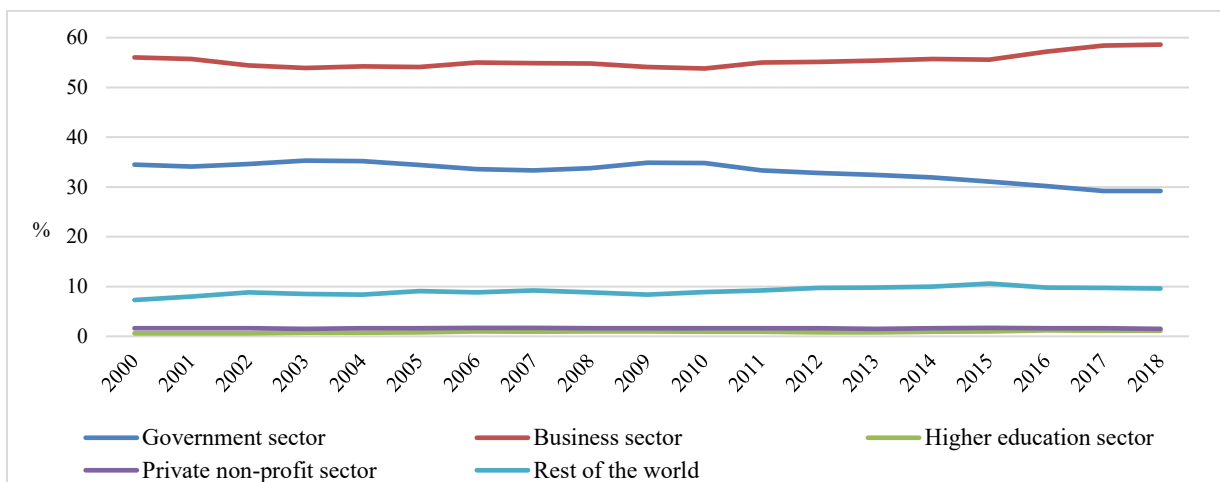




Source: Own calculation using (Eurostat, 2022)

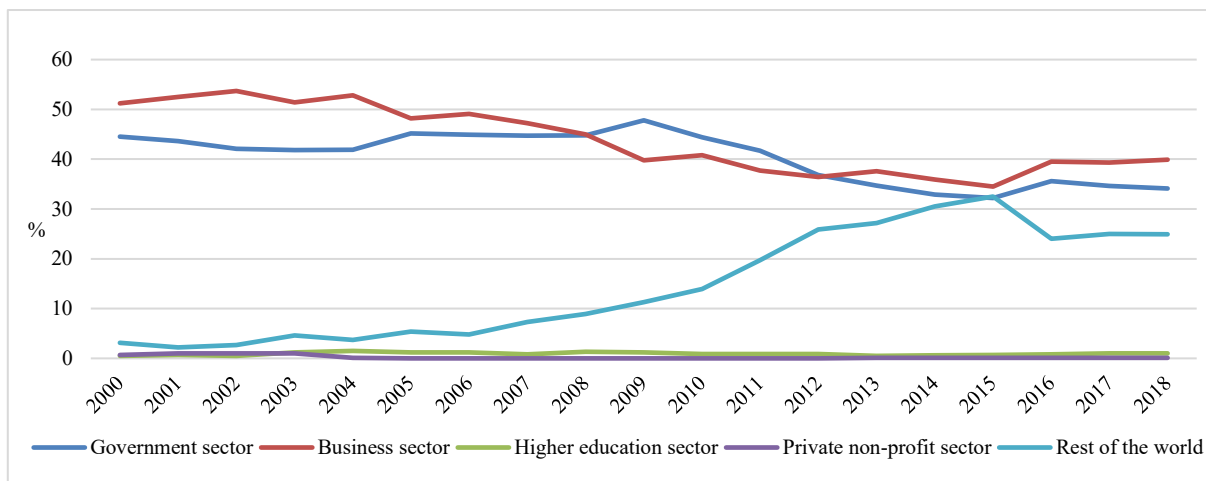
**Fig. 4:** R&D intensity, 2000-2019 average versus 2015-2019 average development

The following Figures 5 and 6 show the structure of GERD by source (funding sector) as a percentage of the total. Across the EU27, sources from the business sector are the most significant (almost 60% of the total). This is followed by the government sector (around 30% of the total). With around 10%, the rest of the world is also quite significant. The private non-profit and higher education sectors account for around 1 to 2 % of the total.



Source: (Eurostat, 2022)

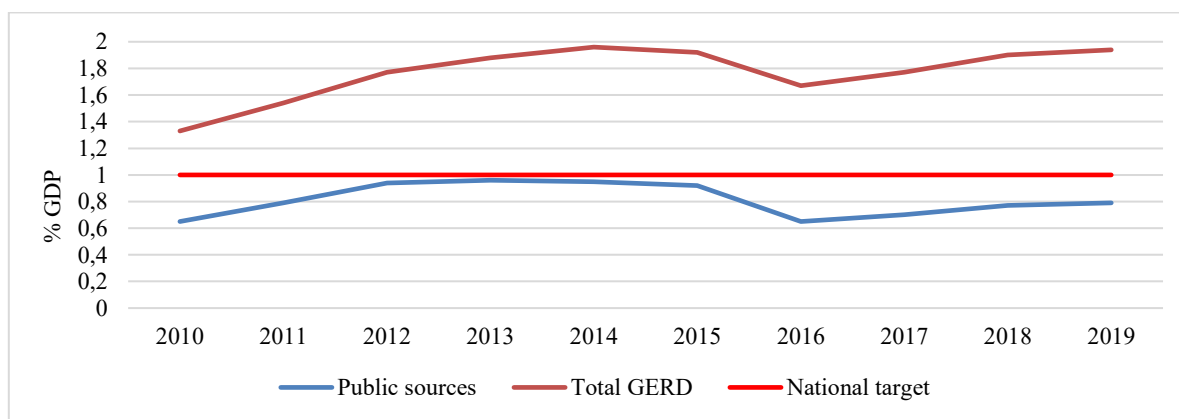
**Fig. 5:** Structure of GERD in the EU28 (funding sector)



Source: (Eurostat, 2022)

**Fig. 6:** Structure of GERD in the Czech Republic (funding sector)

In addition to the aforementioned breakdown of GERD according to the Frascati Manual, it is also important, from the point of view of the national target of the Czech Republic (research task 2), to observe the breakdown of GERD according to the sources of funding into public, business and other. Figure 7 shows the evolution of public sources of GERD in the Czech Republic between 2010 and 2019 as a percentage of GDP. The Czech Republic's national target set under the Europe 2020 strategy for public spending on R&D to reach the 1% of GDP target was not achieved throughout the period under review. The Czech Republic came closest to this target between 2012 and 2015. The significant decrease in 2016 was caused by the transition to the next programming period of the European structural and investment funds and the related reduction of foreign public resources. As mentioned above, the significant decrease in 2016 was caused by the transition to the next programming period of the absorption of European structural and investment funds.



Source: (ČSÚ, 2022)

**Fig. 7:** National target of the Czech Republic

To assess the relationship between GERD and the innovation performance of the Czech Republic as expressed by the Summary Innovation Index (SII), a correlation coefficient test was performed. The relationship was assessed not only between total GERD and SII but also between the individual components of GERD, i.e., business enterprise expenditure on R&D (BERD), government expenditure on R&D (GOVERD), higher education expenditure on R&D (HERD) and private non-profit expenditure on R&D (PNPRD).

Table 2 captures the results of the correlation analysis to test the third and fourth research tasks. The sample correlation  $r(\text{GERD}, \text{SII}) = 0.985$  with  $p\text{-value} = 0.00$ . Therefore, we reject

the hypothesis of independence; the variables are positively correlated. Regarding a more detailed analysis and assessment of the relationship between the individual components of GERD and SII, we again report only the values of the sample correlation and the corresponding *p*-value. The results presented in the table show that the first two pairs exhibit a statistically significant relationship and are positively correlated. Based on Evans' correlation strength scale (Evans, 1996), we are talking about a very strong correlation. On the other hand, the second two pairs can be considered as independent variables because the *p*-value for each is greater than the 5% significance level.

**Tab. 2:** *Correlation matrix of GERD and SII*

<b>Variable</b>	<b>r</b>	<b>p-Value</b>
GERD, SII	0.985	0.00
BERD, SII	0.981	0.00
GOVERD, SII	0.864	0.01
HERD, SII	0.518	0.19
PNPRD, SII	-0.227	0.59

*Source: Own calculation*

As the correlation analysis showed a strong relationship between the business enterprise expenditure on R&D and the Summary Innovation Index, and also between the government expenditure on R&D and the Summary Innovation Index, it can be concluded that the growth of expenditure in the given sectors will lead to an increase in the position of the Czech Republic in its innovation index ranking.

The findings of our analysis are consistent with those outlined in the European Innovation Scoreboard (European Commission, 2020), particularly regarding the position of the Czech Republic as a moderate innovator. For instance, although R&D intensity in the Czech Republic has been above the median since 2011, it has not yet reached the target of 3% of GDP. Furthermore, the European Innovation Scoreboard 2020 emphasizes the importance of public sector support for R&D, a factor that is also highlighted in our study. The significant correlation between public R&D expenditure and innovation performance highlights the need for continued and enhanced government support to foster innovation and economic growth. In summary, the European Innovation Scoreboard 2020 findings support our conclusions on the crucial role of R&D investment in improving innovation performance.

Although the Europe 2020 Strategy was more focused on concrete, measurable objectives and more reflective of the need for sustainable and inclusive growth than the Lisbon Strategy, it has faced criticism for under-investment, fragmentation of national policies, complex administration and bureaucracy. A lack of coordination and cooperation between Member States has frequently resulted in the duplication of efforts and an inefficient use of research and development resources. Furthermore, there has been criticism of the lack of support for innovative projects in the case of small and medium-sized enterprises (SMEs) and start-ups. Additionally, there has been criticism of the weak cooperation between the public and private sectors and between research institutions and industry. This results in a gradual transfer of technology and knowledge from research institutions to practice, which impedes the commercialization of research results. These limitations were identified in the evaluation report of the Supreme Audit Office of the Czech Republic (NKÚ, 2022), among other sources. In light of these observations, it would be prudent to implement certain corrective measures in the Czech Republic and across the EU. It is of significant importance for the Czech Republic to augment its research and development funding in order to attain a minimum of 3% of its gross domestic product by the year 2030. It is necessary to strengthen

cooperation between research institutions and companies, to support the development of knowledge and skills needed for a knowledge-based economy, and to increase the attractiveness of scientific and technical fields for young people. Furthermore, the process of obtaining grants and subsidies for research and development projects must be simplified in both the Czech Republic and the EU, and project approval deadlines must be shortened. The digitalization of the single market should continue, data sharing should be promoted, and further investment in research and development of key technologies such as robotics, nanotechnology, and artificial intelligence should be strengthened. The role of regions and their involvement in innovation processes must be strengthened.

## **Conclusion**

The article examines the evolution and structure of gross domestic expenditure on research and development in the EU within the context of the target set by the European Union for R&D&I expenditure and the form in which this target has been implemented in the national policy of the Czech Republic.

Based on the analysis carried out, it was found that the target set by the Europe 2020 strategy of 3% of EU GDP has not been achieved. When the 3% threshold was applied to individual EU countries, it was found that only five Member States (Belgium, Sweden, Austria, Germany and Denmark) had reached it. Thirteen EU countries spent less than 1.5% of their GDP on R&D, of which six spent less than 1%.

The Czech Republic spent less than 2% of GDP on R&D throughout the period. It failed to reach the national target of 1% of GDP on R&D through public spending even once during the whole period under review, although it was very close to it between 2012 and 2015. Future research should focus on an analysis of GERD's public resources to provide insights into the funding structure, sectoral priorities and comparative international position. This analysis should also provide policy recommendations for future improvements. Furthermore, comparative studies involving other countries with different funding structures could be conducted in order to identify best practices and potential areas for reform. Such research could lead to more effective policy frameworks and better innovation performance.

Another task of this article was to examine the statistical significance of the relationship between GERD, and the individual components of GERD, and the Summary Innovation Index. For this purpose, a correlation coefficient test was performed. A positive correlation was found between total GERD and SII. A more detailed analysis then showed that there is a strong correlation between the pairs of business enterprise expenditure on R&D and the Summary Innovation Index, and also between government expenditure on R&D and the Summary Innovation Index. On the other hand, the pairs of higher education expenditure on R&D and the Summary Innovation Index, and private non-profit expenditure on R&D and the Summary Innovation Index can be considered independent variables. This analysis has been carried out only with data from the Czech Republic. It would be relevant to extend the analysis with data from selected countries occupying leading positions in the rankings compiled on the basis of the innovation indices to verify the relationships found.

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## ČESKÁ REPUBLIKA V KONTEXTU PLNĚNÍ CÍLŮ V OBLASTI VÝZKUMU, VÝVOJE A INOVACÍ STANOVENÝCH VE STRATEGII EVROPA 2020

Cílem tohoto článku je zhodnotit vývoj a strukturu celkových výdajů na výzkum a vývoj (GERD) v souvislosti se strategií Evropa 2020 (Strategie) a cíli české vlády. Jsou nastíněny čtyři výzkumné úkoly: 1. Posouzení, zda EU splnila cíl 3 % HDP na investice do výzkumu a vývoje stanovený ve Strategii. 2. Zjištění, zda Česká republika splnila svůj národní cíl výdajů na výzkum a vývoj (VaV). 3. Ověření statistického vztahu mezi GERD a souhrnným inovačním indexem (SII). 4. Prověření statistického vztahu mezi složkami GERD a SII. Zjištění ukazují, že ani Strategie, ani cíle České republiky nebyly splněny. Korelační analýza indikuje významný vztah mezi celkovým GERD a SII. Podrobnější analýza potvrzuje silnou korelaci mezi dvojicí výdajů podnikatelských subjektů na VaV a SII, a také mezi vládními výdaji na VaV a SII.

## DIE TSCHECHISCHE REPUBLIK IM ZUSAMMENHANG MIT DER ERFÜLLUNG DER IN DER STRATEGIE EUROPA 2020 FESTGELEGTE ZIELE IN DEN BEREICHEN FORSCHUNG, ENTWICKLUNG UND INNOVATION

Ziel dieses Artikels ist es, die Entwicklung und Struktur der Gesamtausgaben für Forschung und Entwicklung (GERD) im Kontext der Strategie Europa 2020 (Strategie) und der Ziele der tschechischen Regierung zu bewerten. Es werden vier Forschungsaufgaben skizziert: 1. Die Bewertung, ob die EU das in der Strategie festgelegte Ziel von 3 % des BIP für FuE-Investitionen erreicht hat. 2. Die Feststellung, ob die Tschechische Republik ihr Nationalziel der Ausgaben für FuE erfüllt hat. 3. Die Prüfung der statistischen Beziehung zwischen GERD und dem zusammenfassenden Innovationsindex (SII). 4. Die Prüfung der statistischen Beziehung zwischen den GERD-Komponenten und dem SII. Die Ergebnisse zeigen, dass weder die Strategie noch die Ziele der Tschechischen Republik erreicht worden sind. Die Korrelationsanalyse zeigt eine signifikante Beziehung zwischen GERD und SII. Eine detailliertere Analyse bestätigt eine starke Korrelation zwischen den FuE-Ausgaben der Unternehmen und dem SII sowie zwischen den FuE-Ausgaben des Staates und dem SII.

## REPUBLIKA CZESKA W KONTEKŚCIE REALIZACJI CELÓW W ZAKRESIE BADAŃ, ROZWOJU I INNOWACJI OKREŚLONYCH W STRATEGII EUROPA 2020

Celem niniejszego artykułu jest ocena rozwoju i struktury całkowitych nakładów na badania i rozwój (GERD) w kontekście Strategii Europa 2020 (Strategia) oraz celów czeskiego rządu. Przedstawiono cztery wyzwania badawcze: 1. Ocena, czy UE osiągnęła cel 3% PKB na inwestycje w badania i rozwój określony w Strategii. 2. Sprawdzenie, czy Republika Czeska spełniła swój cel krajowy dotyczący nakładów na badania i rozwój (BiR). 3. Sprawdzenie statystycznego związku między GERD a sumarycznym wskaźnikiem innowacyjności (SII). 4. Sprawdzenie statystycznego związku między składowymi GERD a SII. Wyniki pokazują, że ani strategia, ani cele Republiki Czeskiej nie zostały osiągnięte. Analiza korelacji wskazuje na istotny związek między całkowitym GERD a SII. Bardziej szczegółowa analiza potwierdza silną korelację między parą wydatków przedsiębiorstw na badania i rozwój a SII oraz między rządowymi wydatkami na badania i rozwój a SII.

## ASSESSMENT OF AWARENESS OF CONSUMER RIGHTS ON THE EXAMPLE OF THE KARKONOSZE REGION

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### Abstract

The aim of the article was to assess the awareness of consumer rights on the example of the residents of the Karkonosze district. The main goal was deagglomerated into specific goals, which are assessment of consumers' knowledge of the law and their skillful use, assessment of sellers' knowledge of the law, determining the frequency and specificity of problems with which consumers contact the Consumer Rights Adviser of the Region.

The main research hypothesis was that consumerism is one of the newest trends in consumption, and in the Karkonosze region, awareness of consumer rights is at a subjectively average level.

The analysis of research, which included a survey among the residents of the Karkonosze district, interviews with sellers and the Consumer Rights Adviser of the Region, and an analysis of secondary research, confirmed the hypothesis. The research also showed that the majority of respondents maintain a neutral attitude towards legal regulations, but they know how to use them correctly and are able to propose necessary changes.

### Keywords

Consumer behavior; Consumer protection; Consumer rights.

### Introduction

The aim of the article was to assess the awareness of consumer rights in the example of residents of the Karkonosze district. To confirm the article's main hypothesis, it is first necessary to analyze the source literature and explain basic phrases. The most important concept is the definition of the consumer. That is because we, as consumers, are influenced by numerous stimuli that can cause, among others: addiction to the latest consumption trends. It is, therefore, not surprising that it is becoming more and more important for producers to understand the reasoning behind consumers' behavior when shopping. Purchasing decisions affect the level of profits generated for entrepreneurs. In turn, from the consumer's point of view, it becomes important to make conscious and rational purchasing decisions and know one's rights.

The consumer is the subject of many economic studies because their behavior and mutual relationships with sellers contribute significantly to shaping the market. From an economic perspective, a consumer is a natural person who buys a service to meet personal needs. This also includes someone who makes a business investment and an entrepreneur who purchases a



service from another entrepreneur for purposes related to the operation of their own business, as long as they are not professional in terms of the goods they purchase (Rosa et al., 2015). In the Cambridge Dictionary, a consumer is defined as “*a person or organization that buys things or services from a shop or business*” (Cambridge Dictionary, 2024). This concept, however, is not universally accepted in the field of economics, which also defines the consumer as a user and buyer.

When a consumer makes a purchasing decision, when they become a buyer, it is worth taking into account the role of the seller. Their knowledge and knowledge of sales tactics can go a long way in helping a consumer make a purchase. This situation occurs mainly when the consumer is undecided about the choice of product/service and, therefore, is not a specialist in a given field but reports a demand resulting from a specific need. Currently, the role of a sales specialist is highly valued (Richardson, 2024), especially considering the increasing market competition and the variety of available services for potential consumers.

From an economic point of view, the consumer can also be defined as a value creator for the enterprise itself. This happens, for example, when purchasing a service. The consumer becomes a co-creator because, in most cases, they need to be present in the same location as the producer to obtain the product or service. In the case of cosmetic services, the client is the recipient of the service and contributes to the creation of the companies’ marketing activities through their reactions. The consumer assesses the quality of the services and ultimately adds economic value to the companies by engaging in transactions (Markiewicz, 2015). Therefore, it plays a key role for the company.

In order to create value for the consumer at the highest possible level, it is important to act in accordance with consumer orientation. It manifests itself mainly as the company's willingness to meet its needs (Widelska, 2020). Therefore, the consumer becomes the main object of interest of companies, which is why it is necessary to properly manage relationships with them and, above all, create appropriate consumer profiles and act in a dignified manner with them. Consumer relationship management (CRM) itself is understood as a focused marketing strategy on understanding customers and their needs, which contributes to gaining them and their loyalty in order to achieve increased profits (Moczydłowska & Bitkowska, 2020).

In turn, Polish law contained in the Civil Code defines a consumer as “*a natural person who enters into a legal transaction with an entrepreneur that is not directly related to his or her business or professional activity*” (ISAP, 2022). Additionally, the Constitution of the Republic of Poland includes a reference to the protection of consumer rights, specifying that “*public authorities protect consumers, users, and tenants against activities that threaten their health, privacy, and safety and against unfair market practices*” (ARSLEGE, 2024).

Polish law always puts the consumer first, considering them the weaker party in the event of a possible dispute with the seller. It guarantees him special legal protection through the activities of an institution called the Office of Competition and Consumer Protection (UOKiK) (bisnes.gov, 2023). Consumer rights guaranteed by Polish law include:

- warranty (possibility of complaint about a defective product/service),
- seller’s liability (a form of complaint in which the seller is responsible for the defects of the product/service; the consumer may support it with a disclosed physical or legal defect of the purchased goods),
- the right to return the goods (in the case of returns in stationary stores, it is specified in the company's sales policy) (bisnes.gov, 2023).

Due to globalization and increased consumption, it becomes important for companies to analyze consumer behavior, which, in the simplest sense, can be defined as the process of making purchasing and consumption decisions. Various scientific fields analyze these behaviors because they affect the development of relationships with sellers, their marketing and sales activities, and the market in general.

Each consumer is unique and has an individual impact on the previously mentioned phenomena due to their diverse psychological, social, cultural, and economic features. Therefore, an important issue is the use of an appropriate typology of consumers to better understand and predict their behavior and apply appropriate measures and actions toward them (Rosa et al., 2015).

From the perspective of economics, consumer behavior is analyzed in terms of the purchasing and consumption process and the rationality of the choices made. From the point of view of providing services, they can be defined as “*any observable reaction of consumers, i.e. service recipients (both natural persons and entrepreneurs representing various organizations), to stimuli from the environment*” (Rosa et al., 2015). Consumer behavior refers primarily to the “*study of how customers, both individuals and organizations, satisfy their needs and desires by selecting, buying, using, and disposing of goods, ideas, and services*” (AMA, 2024).

Consumer behavior is closely related to the purchasing process, which is commonly divided into five basic phases, including:

- sense of need,
- searching for information (using the experience of family/friends, reading reviews, watching advertisements),
- judgment of alternative options (comparing goods/services in terms of price, functionality, or taking into account criteria related to the rank of the brand),
- making a decision to make a purchase,
- post-purchase feelings (feeling of satisfaction or post-purchase dissonance- the appearance of a negative feeling towards the purchase) (Rosa et al., 2015).

Consumers' shopping is related to the rationality of their behavior and their economic knowledge. The existence of an information gap or uncertainty caused, for example, by an economic crisis, may contribute to the consumer refraining from making a purchase. At this point, the company itself can play an important role in shaping consumer behavior by disseminating reliable information about its services/products, or by having an efficiently functioning customer service department (Kiezel & Burgiel, 2017).

## **1 New Trends in Consumption**

Increasing consumer awareness and new sales techniques contribute to the emergence of new trends in consumption. Currently, with the development of modern technologies, the concept of an e-consumer as a person making a purchase is becoming popular via the Internet (Gajdzik et al., 2023). The prefix e comes from the word electronic, so it refers to the need to use the latest generation of devices, such as a telephone or laptop, which are involved in each phase of the purchase. The needs of such a consumer are therefore met thanks to services and products purchased on the Internet. Using websites to make purchases can provide many benefits to consumers. There are popular functions on sales portals that allow, for example, setting notifications about a change in the price of the observed offer or its return to the website. In turn, for the owners of such websites, the Internet is a source of a lot of information about consumers, which allows them to analyze their activities, draw appropriate

conclusions, and make changes necessary to improve the site. Thereby, some elements of business owners can be changed to virtual ones. For example, e-invoices and specially generated gift cards are becoming popular. You may also encounter the fact that loyalty points earned during online purchases are valued higher than those made in stationery stores, and the offer presented in stationery stores is often poorer than that on the website. Many aspects of running businesses and activities undertaken by consumers are slowly being redirected entirely to the Internet - this phenomenon is called virtualization (Wolny, 2015).

Another trend referring to the changing role of the consumer when shopping is the term “prosumer”. As the name suggests, it is a combination of two words: “consumption” and “production”. A prosumer is an individual who produces certain goods and then consumes them herself/himself – uses them for her/his own use. Prosumption may also consist of partnership cooperation with a production company, during which the consumer is involved in the process of creating the good and has the opportunity to personalize it and directly intervene (Szul, 2013). Therefore, it is a unique phenomenon taking into account globalization when manufactured goods are mass-produced and have a uniform character. Prosumers, therefore, care about standing out and cooperating with companies to which they become, in a sense, external employees. However, this constitutes a significant challenge for companies that must constantly adapt to the constantly changing environment and consumer requirements because a prosumer is a consumer who consciously makes purchasing decisions. The prefix e can also be added to the term prosumer because they also most often use the Internet in their activities (Szul, 2013).

Globalization related to consumption also contributes to an increase in the number of purchases made by consumers. This is related to the desire to catch up with Western countries in this respect, which are identified with wealth and abundance, understood as unlimited shopping offers. “*Consumers who wish to associate themselves with Western culture will consequently purchase more.*” (Śleszyńska-Świdorska, 2017).

This phenomenon is also manifested in newer products/companies penetrating Eastern and European countries - so-called global products appear, i.e. those available practically all over the world. This may cause, among others, change in the hierarchy of purchases and perception of needs (Śleszyńska-Świdorska, 2017). In this case, globalization has the opposite effect than it does for prosumers, who equate its effects with the need to stand out.

Consumerism is also related to the concept of globalization. Consumers make purchases not only to satisfy their needs – excessive consumption has come to be identified with a sense of happiness and fulfilment. Consumerism can be:

- public consumption,
- the result of a greedy lifestyle,
- the result of an uncontrolled need to buy (Kacprzak-Choińska, 2007).

The negative impact of mass consumption on the natural environment has also caused a trend called the greening of consumption. It may result from the availability of all kinds of information not only about the products/services themselves but also about their production process. This encourages producers to provide reliable information about their products and to conduct more eco-friendly activities. Consumers interested in such aspects are called conscious consumers. They are interested in the negative impact that companies can have on their environment, which may manifest itself, for example, in protests or actions promoting consumer awareness. Such consumer movement may contribute to deconsumption – consumers buying only necessary products, in sufficient quantities to meet needs (rational shopping) (Kacprzak-Choińska, 2007). Among operating enterprises, the option of paying an

additional fee (a small amount) for removing the negative impact of the carbon footprint (related to greenhouse gas emissions) generated during the production and delivery of the ordered goods is also becoming popular on the Internet (Vohs, 2023). In turn, in stationary stores, the practice of rewarding people who make purchases with their own bags is becoming popular – the goal is to reduce the consumption of environmentally harmful plastic (this is included, for example, in the compensation plan of H&M store club members).

A similar phenomenon is eco-Buddhism, which also focuses on the ecological aspects of consumption. It is mainly related to the consumption of organic food and saving electricity or fuel (Zalega, 2019).

Another trend related to consumption is the so-called smart shopping. Consumers, during the crisis or even when their financial situation changes for the worse, try to make purchases in a smarter way – looking for cheaper offers (mainly on the Internet) and analyzing which services/goods they are willing to give up. Smart shopping, therefore, involves creating a rational budget for essential expenses (Sobczyk, 2014).

Another interesting phenomenon that is gaining popularity is the sharing economy (SE). This economic model involves using the full potential of existing resources by renting or lending them, for free or for a fee. Thus, an entity that owns a given good, e.g. an apartment, can reduce its maintenance costs or achieve additional profits by renting it to a person called a user. An agent acting as a leasing agent may also participate in this process. SE entities often communicate with each other via the Internet, where many offers from various categories can be found on special platforms. In addition to housing, SE may concern, for example, car rental, sharing a specific means of transport (Uber) or an account on streaming platforms (Netflix). The sharing economy operates in accordance with the principles of rationalization of purchases, as this trend does not promote excessive consumerism and only benefits each side of supply and demand (P2P), creating micro-businesses and new jobs (Bednarikova & Kostalova, 2021).

## **2 Origin of the Idea of Customer Protection- Development of Consumerism**

After analyzing consumer behavior, it is necessary to examine the term “consumer protection”. It is worth recalling that the consumer is considered the weaker party when making market transactions, and therefore, she/he should be protected in some way.

The term “consumer protection” has developed over the years. Already in the 1920s, Americans conducted numerous studies on, for example, the negative effects of products on consumers' health, which were then published in brochures. All this was aimed at improving the consumer's position on the market and increasing consumer awareness (Światowy, 2006). However, consumer protection evolved most in the 1960s. The turning point occurred on March 15, 1962 (now World Consumer Rights Day), when the then President of the United States (John F. Kennedy) gave a speech. In his speech in front of Congress, the president described consumers as the most harmed group, unable to defend their rights and, therefore, the most helpless. Consumer protection in the USA has gained interest by considering this aspect as a constitutional and political problem, which resulted in the creation of laws on this subject (Samson, 2013). They included, among others, four basic consumer rights – the right to:

- being heard,
- safety,
- being informed,
- having a choice (out of goods and services) (Smyczek, S. 2019).

The most important consumer protection agencies in the United States include the FTC (Federal Trade Commission), which is mainly concerned with antitrust law compliance; CPSC (Consumer Product Safety Commission), which protects consumers from risks associated with products and services; NHTSA (National Highway Traffic Safety Administration), which deals with road safety by, for example, determining the acceptable condition of cars; FDA (Food and Drug Administration), which sets standards for the safety of food and drugs on the market; and EPA (Environmental Protection Agency), which focuses on eliminating the negative impact on the environment and enforcement of environmental protection laws (Światowy, 2006). The United States has undoubtedly become an example for the countries belonging to the European Economic Community. Thereby, there are three stages in the history of shaping consumer rights in the European Economic Community:

- the period until the 1980s (at that time, socially unfavorable transactions were concluded due to the lack of competition protection regulations, while an attractive aspect for consumers was the free flow of goods, people, and capital between Community countries; a common program was also created educate consumers about their rights, some of them are still in force today, but have, for example, been developed),
- the period covering the 1980s (consumers did not know the market at that time and did not have access to information, which resulted in their passive attitude toward the market; work on various types of standards was increased, which were aimed at improving the situation at that time, thereby the consumer gained, among others, the right to information about the origin of the purchased product),
- a period lasting to this day (Europe focused on creating laws ensuring consumer protection and on its absolute compliance by members of the Community, thereby consumer protection began to be recognized as an important aspect of the proper functioning of the market) (Samson, 2013).

The opening of the Community's state borders is considered a key moment for creating a common policy of the Member States in the field of consumer law. They were closed in the 1970s, which was the result of, among others, recession. Nevertheless, Member States have realized the need to harmonize the rules in this area.

The development of consumer rights protection in the European Economic Community has resulted in the fact that its countries are now considered to have the best consumer protection. They gain it, among others, thanks to state authorities such as:

- Directorate-General for Justice and Consumers (DG JUST),
- Consumers, Health, Agriculture and Food Executive Agency (CHAFAEA),
- European Consumer Centre (ECC) (Smyczek, 2019).

The actions presented above are called consumerism. This movement involves the functioning of numerous offices, agencies, and non-governmental organizations whose common goal is to improve the position of consumers in the market. It is, therefore, a kind of protest against unfair practices of producers, suppliers, and sellers. These organizations strive to protect consumers and their needs through, among others: proposing and introducing changes to legal provisions (Światowy, 2006).

### **3 Research Methodology**

The aim of this article is to investigate, as best as possible, the awareness of consumer rights and their violations in the analyzed region. To achieve this goal, research was carried out in the form of a survey (quantitative research), interviews (qualitative research), and secondary

research. Therefore, research triangulation took place, which involved the use of three research methods to achieve the highest possible quality of results.

The collected surveys enabled the analysis of the level of consumer awareness in the Karkonosze district (this region was chosen due to its location close to the border with the Czech Republic and the possibility of contacting the Consumer Rights Adviser of this region), for which an online survey questionnaire presented in Table 1 was used.

**Tab. 1:** *Survey among the residents of the Karkonosze district*

1. Gender	Female
	Male
2. Age	18-27
	28-35
	36-43
	44-60
	over 60
3. Professional status	Pupil
	Student
	Public sector employee
	Full-time employee
	Employee employed under a civil law contract
	Entrepreneur
	Farmer
	Unemployed
Pensioner	
4. Education	Primary
	Vocational
	Secondary
	Higher education
5. How do you rate your knowledge of consumer rights?	(on a scale from 1 to 5)
6. Please mark the statement with which you agree the most.	I pay less attention to advertisements and promotions, I am more critical of them
	It would be better for everyone if we consumed less
	I am interested in the consumer rights that I am entitled to
	I try to draw the attention of the staff if consumer rights are not respected
7. Within what time frame can a consumer withdraw from a distance contract without giving a reason?	Within seven days
	Within two weeks
	Within a month
8. What happens if the seller does not respond to the complaint within the time specified by law?	The consumer should re-submit the complaint
	The complaint is deemed to have been accepted
	The complaint is deemed to have been rejected
9. How long can a consumer withdraw from a contract concluded in a traditional store (stationary store) without giving a reason?	Within a week from the date of purchase
	Within two weeks from the date of purchase
	Within a month from the date of purchase
	Depends on the store/seller

10. Please mark the statement that you believe is false.	The seller's liability is mandatory, and the guarantee is voluntary
	The period of both the seller's liability and the guarantee is always two years
	In the seller's liability, the entity responsible for the non-conformity of the goods with the contract is the seller, in the guarantee the guarantor (usually the manufacturer)
	The seller's liability does not exclude the guarantee
11. Have you ever tried to abuse your consumer rights (e.g. return a product to an online store after using it when you no longer needed it)?	Yes, 1-2 times
	Yes, several times
	No, never
12. What product do you most often complain about?	Footwear
	Clothing
	Electronics and household appliances
	Food
	I have never complained
13. What other form of proof of purchase besides a receipt have you ever used, for example, when returning a product?	Confirmation of payment by card
	Invoice
	Purchase agreement
	Bank statement
	I have never used another form of proof of purchase
	Other form of proof including a shopping app and a loyalty card
14. How do you assess the change in the legal provision concerning the obligation to display, in addition to the price and the unit price, information about the last reduced price of goods and services in the last 30 days?	(Omnibus directive)
15. Have you ever purchased a faulty product?	Yes
	No
16. Have you ever filed a complaint about a defective product?	Yes
	No
17. What were the usual results of filing a complaint about a defective product?	Most complaints were accepted
	Most complaints were not accepted
18. Why have you never filed a complaint regarding the purchase of a defective product?	I believe that the product has already fulfilled its role properly
	The benefit resulting from a recognized complaint would be relatively low compared, for example, to the commitment necessary to file it
19. Have you reported to the Consumer Rights Adviser of the Region?	Yes, in what matter did you happen to report to the Consumer Rights Adviser of the Region?
	No, why not?

20. What new legal regulations regarding consumer rights do you think should be introduced in Poland?	(Open question)
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*Source: Own*

The group of respondents consisted of people living in the studied district, and the surveys were completed voluntarily (the sampling method was contingent). This form allowed for obtaining 100 responses quickly and reliably. The survey was sent to the potential respondents on January 21st, 2024, and was closed on March 18th, 2024 (the author of the study received a sufficient number of responses). The respondents were asked about their knowledge of consumer rights, their skillful application in reality, and possible legal aspects that, in their opinion, should be improved.

To assess the violation of consumer rights in the examined region, an in-depth interview was used, conducted with the current (for the year 2024) Consumer Rights Adviser of the Region, Mr. Michał Słomski. The questions asked during the interview included problems that consumers most often address and legal aspects that, according to the Consumer Rights Adviser of the Region, require improvement. The chosen interview format allowed for asking a wide range of questions and adapting each subsequent question to the answer obtained to collect as much information as possible.

The conversation with the region's Consumer Rights Adviser also allowed us to obtain district data regarding legal advice and information provided (in person, by phone, and in writing) between 2021 and 2023. The article analyses the problems with which consumers most often contacted the Consumer Rights Adviser during the period under study.

The next stage of research in the article was interviews with five salespeople (4 women, 1 man) aged 24-38. The sellers represented the following industries:

- construction (1 person),
- food (1 person),
- clothing (3 people).

The purpose of these interviews was, among others, to determine unethical behavior of consumers, their abuse of their rights, as well as proposals to introduce new legal regulations regulating consumer-seller relations.

#### **4 Aim of the Research**

As said before, the article aimed to assess consumer rights awareness among residents of the Karkonosze district. The fundamental research goal was to obtain answers to the following research questions:

- What is the level of knowledge of the law among consumers and sellers?
- What problems do consumers most often contact the Consumer Rights Adviser of the Region with?
- How often and in what way are consumer rights violated?

The research presented in the methodology allowed the achievement of the research goal.

#### **5 Research Results**

The research results are presented in the following subsections:

- investigating violations of consumer rights, where the data from the survey was analyzed,



- violations of consumer rights in the Karkonosze region, where data from the Consumer Rights Adviser of the Region was analyzed,
- unethical consumer behavior in the Karkonosze region, where data from salespeople was analyzed.

### 5.1 Investigating Violations of Customer Rights

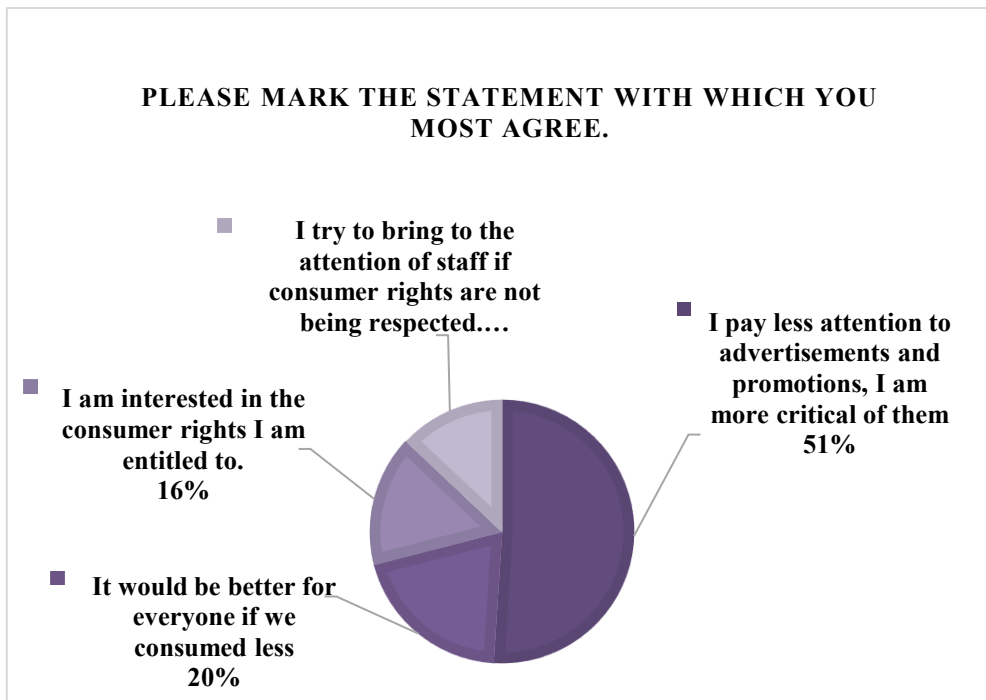
In a study to assess consumer awareness, 100 participants were involved, with the majority being women (75%). This could be attributed to the likelihood of women participating in research surveys. The participants were categorized into five age groups, with the largest group being 18-27 years old (41 people), and the smallest group being those over 60 (only 4 people). The participants were also questioned about their current employment status and educational background. Most of them were full-time employees (28 people) or students (26 people). None of the participants were farmers or unemployed. The majority of the respondents had either a university education (55 people) or secondary education (38 people), while no one reported having a primary education. The first question, which was intended to directly assess the level of consumer awareness of the respondents, was: How do you assess your knowledge of consumer rights? The scale of the response was from 1 to 5, meaning 1-respondent thinks that he knows his/her rights at a very low level; 5- respondent thinks that he knows his/her rights at a very good level. The majority of respondents (42 people) rated this level as 3. Only 11 people stated that they knew their consumer rights at a very good level, and 3 people indicated that they knew them at a level of 1. These results are illustrated by Figure 1.



Source: Own

**Fig. 1:** Assessment of knowledge of consumer rights among respondents

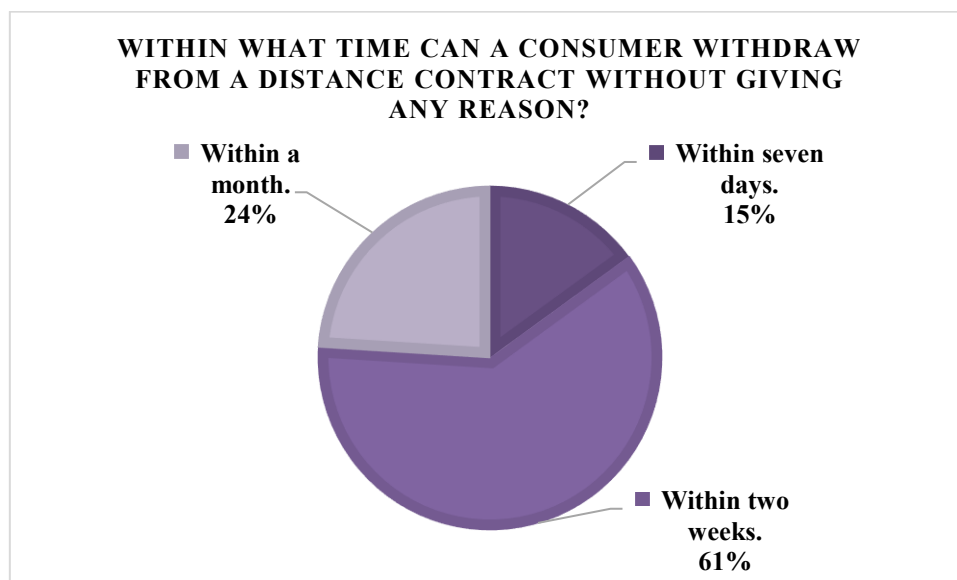
The respondents were then asked to choose the statement with which they most agreed. The majority of respondents (51 people) said that they pay less attention to advertisements and promotions and that they are more critical of them. The fewest people said that they try to draw the staff's attention if consumer rights are not respected (13 people) and that they are interested in the consumer rights they are entitled to (16 people). These results are illustrated by Figure 2.



Source: Own

**Fig. 2:** Statements with which respondents agree most

The next section of questions was strictly aimed at assessing the respondents' knowledge of consumer rights. They were asked to choose the correct answers regarding the applicable legal provisions. Therefore, the first question concerned the time within which the consumer may withdraw from a distance contract without giving a reason. Most respondents marked the correct answer "within two weeks". However, a total of 39 people incorrectly believed that it was 7 days or a month. These results are illustrated by Figure 3.

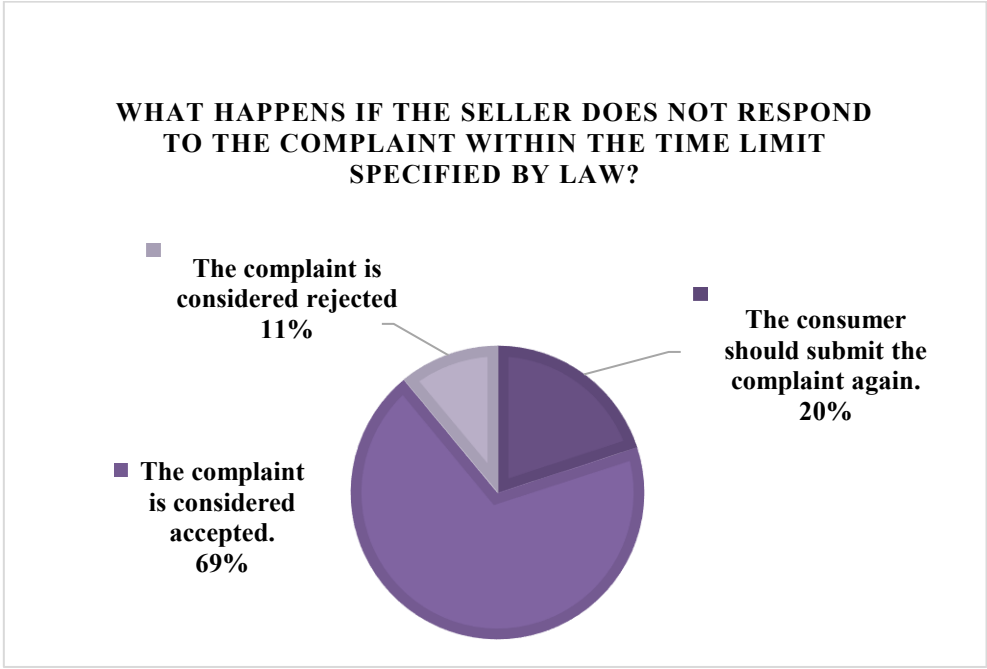


Source: Own

**Fig. 3:** The time within which a consumer may withdraw from a distance contract without giving any reason

The next question concerned the seller's failure to respond to the reported complaint within the time prescribed by law. The vast majority marked correctly that complaints are considered accepted. The answer "The consumer should submit the complaint again" was marked by

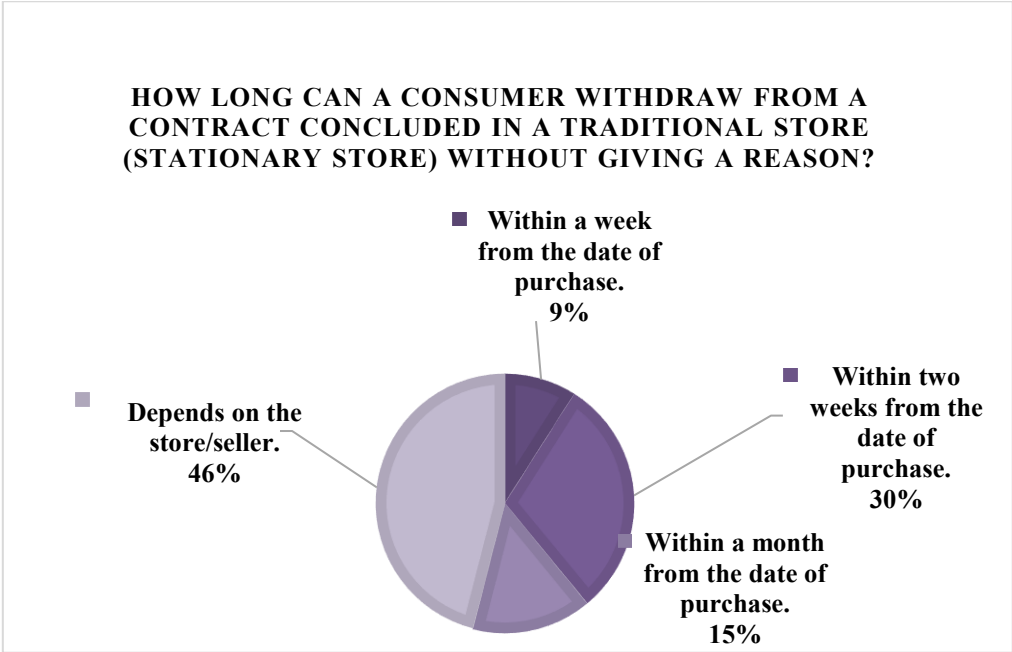
20 people, and “The complaint is considered rejected” by 11 people. These results are illustrated by Figure 4.



Source: Own

**Fig. 4:** Consequences of the seller’s failure to respond to the complaint within the time limit set by law

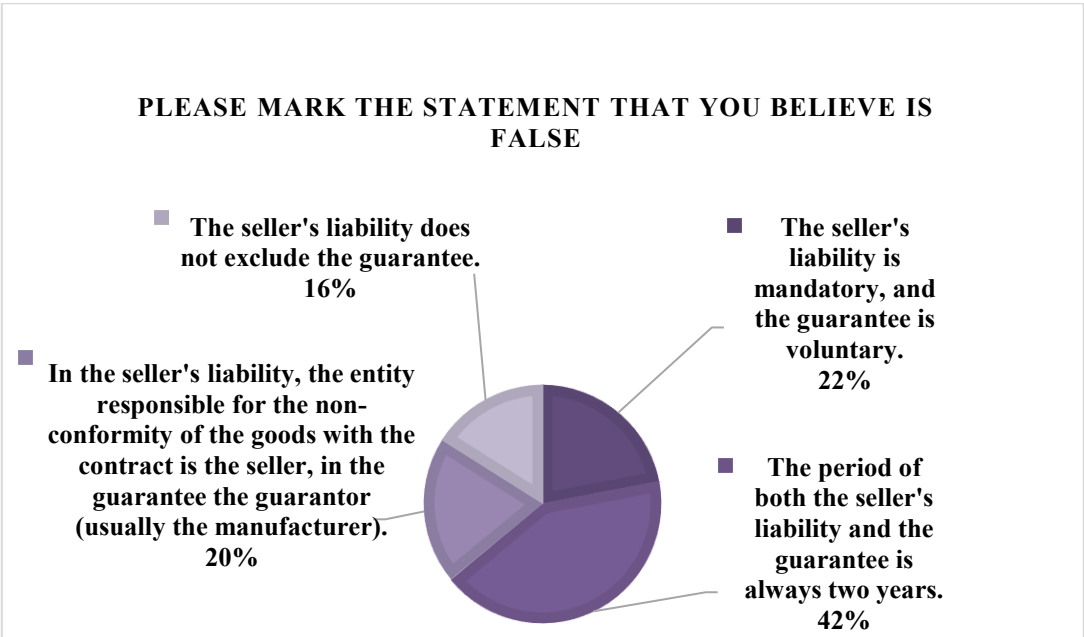
The respondents were also asked about the time they had to withdraw from the concluded contract in a stationary store without giving a reason. Only 46 people marked the correct answer “It depends on the store/seller”. The remaining people stated that it is a period of one week (9 people), it is two weeks (30 people) or it is a month (15 people). These results are illustrated by Figure 5.



Source: Own

**Fig. 5:** The time within which a consumer may withdraw from a contract concluded in a stationary (traditional) store without giving a reason

The last question in this section concerned the concept of seller’s liability and guarantee. The respondents’ task was to mark the statement they considered false. Only 42 people marked the correct answer “The period of both the seller’s liability and the warranty is always two years.” These results are illustrated by Figure 6.



Source: Own

**Fig. 6:** False statement according to respondents

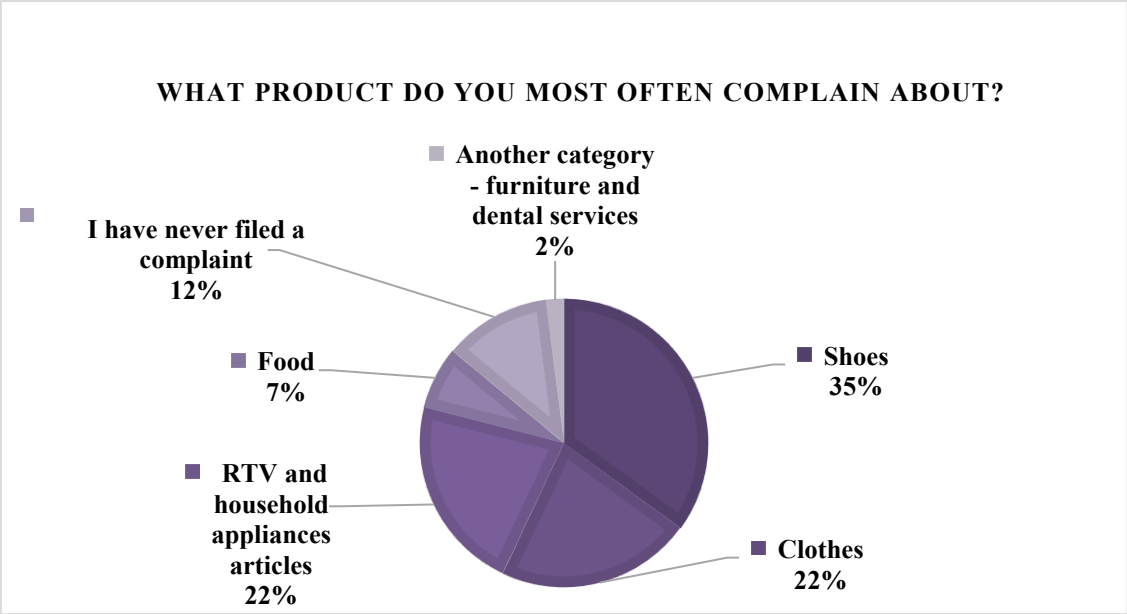
The next part of the survey concerned respondents’ shopping behavior. The respondents were asked whether they had ever tried to abuse their consumer rights. The vast majority responded that such a situation had never occurred. However, 7 people answered that it happened to them 1-2 times, and 8 people declared that they did it several times. These results are illustrated by Figure 7.



Source: Own

**Fig. 7:** Respondents who have abused their consumer rights (e.g. returned a product to an online store after using it and no longer needed it)

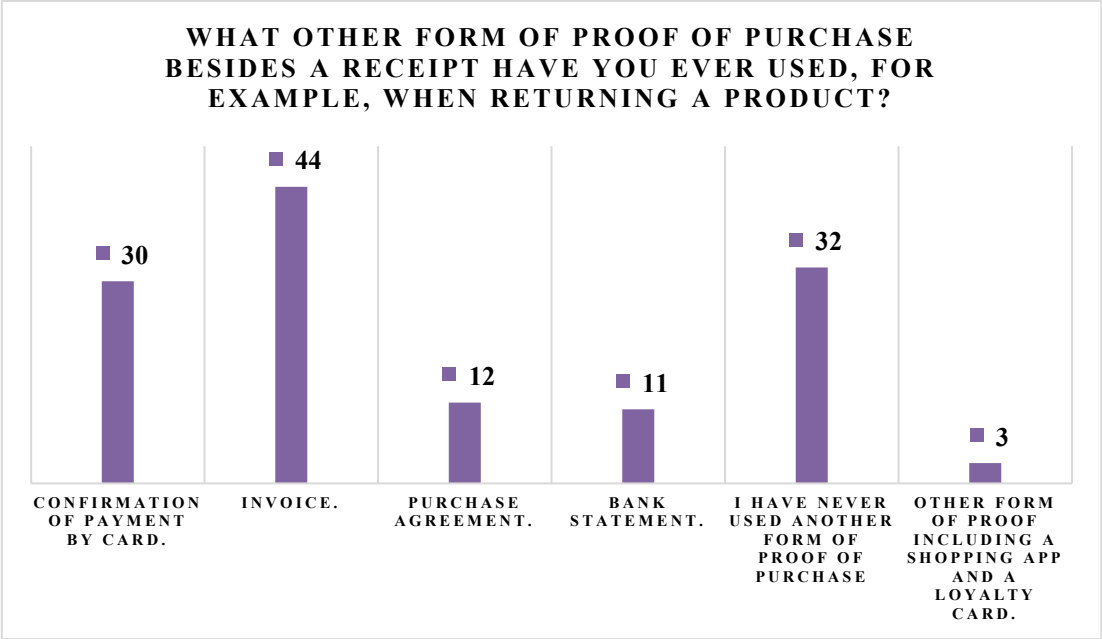
The next question concerned the products about which respondents most often complained. Therefore, among the proposed answers, footwear was chosen most often (35 people), and food was chosen least often (7 people). In turn, 12 people marked the answer “I have never filed a complaint”. Moreover, 2 people decided to add another category “furniture and dental services”. These results are illustrated by Figure 8.



Source: Own

Fig. 8: Products about which respondents most often file complaints

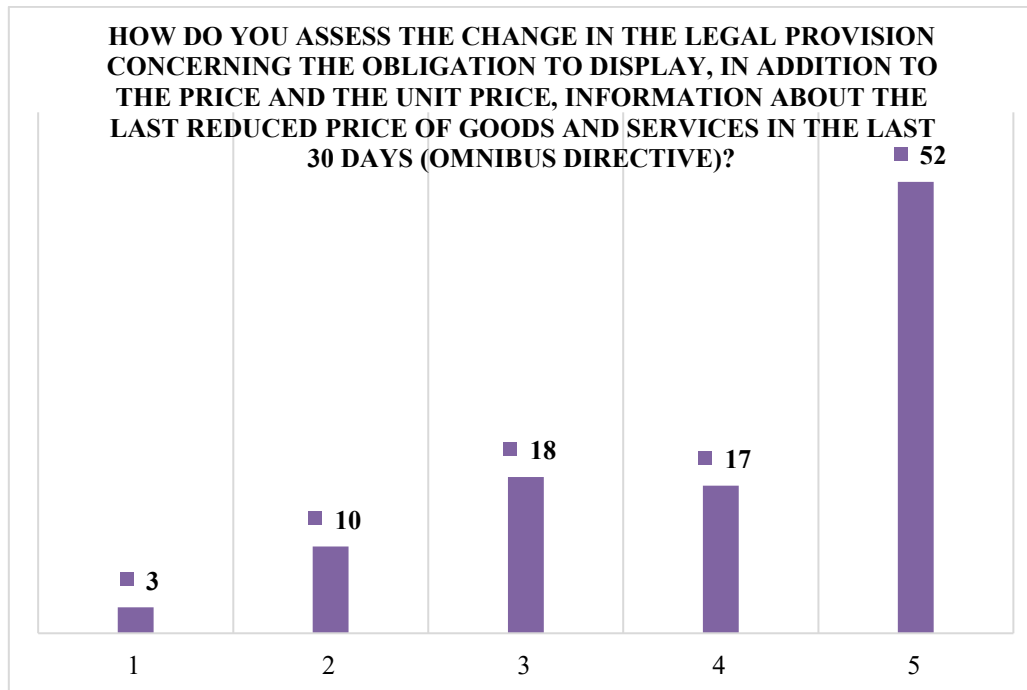
Respondents were also asked what form of proof of purchase they had used other than the receipt. Most people used an invoice (44 people) or card payment confirmation (30 people). However, as many as 32 people stated that they had never used any form of proof of purchase other than a receipt. Moreover, 3 people indicated the application as another answer they proposed. These results are illustrated by Figure 9.



Source: Own

Fig. 9: Other forms of proof of purchase (apart from the receipt) used by respondents

The next question concerned the assessment of the change in the legal provision (Omnibus Directive) among the respondents. The scale of the response was from 1 to 5, meaning 1- respondent think that the change in the law was definitely negative; 5- respondent think the change in the law was very good. Most people rated this change as very good (53 people). Only 3 people rated it as definitely negative, and 18 people maintained a neutral position, marking 3. These results are illustrated by Figure 10.



Source: Own

**Fig. 10:** Evaluation of the Omnibus Directive among respondents

The next section of the survey concerned the purchase of a defective product by respondents and its possible complaint. Thereby, purchasing a defective product happened to 89 respondents, and only 11 people had never experienced it. 87 people who purchased the defective product complained about it. People who did not submit such a complaint mainly believed that the benefit resulting from a recognized complaint would be relatively low compared, for example, to the commitment necessary to submit it. In turn, people who filed complaints about a defective product stated that the complaints were mostly resolved in their favor. Only in the case of 16 people, most of the complaints were not accepted.

Respondents were also asked whether they had ever contacted the Consumer Rights Adviser of Region. Only 13 people declared that they had used such assistance. These people were, therefore, asked to write the reason for such a need in the form of an open question. They replied that it was a matter of:

- complaints about a tourist trip,
- rejected complaint (mentioned by 4 people),
- failure to receive the purchased shoes (the store claimed otherwise),
- complaints about telecommunications services,
- poorly performed carpentry service,
- delivery of defective TVs and its long complaint process,
- damaged glasses after glass insertion service,
- complaints about football/sports shoes (2 people),
- product purchase.

The last question for respondents concerned their proposals to introduce new legal regulations regarding the protection of consumer rights. This question was voluntary and took the form of an open question. The respondents replied that the changes introduced would concern:

- price lists for multiple pieces, as they may feel they are misleading because they are often illegible and at first, one may think that the price is for a set, but it turns out that the price is for one piece when purchasing several pieces (2 people pointed out this problem),
- categorization of return conditions depending on the reason,
- immediate replacement with a new product in the event of another complaint about the product due to the same failure,
- giving money back when making a return, without the possibility of refunding the funds for a voucher to be used in the store, unless the consumer agrees to it (this problem was mentioned by 3 people),
- greater responsibility of the manufacturer for the sold goods,
- high penalties for goods prices marked incorrectly,
- the obligation to inform the consumer about his rights when submitting e.g. complaints, including the need to be aware of the difference between a regular warranty and a statutory warranty,
- extension of the basic warranty to 5 years for electronics and household appliances and solving the problem of equipment breaking down literally after its expiry (2 people mentioned this problem).

## **5.2 Violations of Consumer Rights in the Karkonosze Region**

As part of the first question aimed at assessing the violation of consumer rights in the Karkonosze district, the Consumer Rights Adviser of the Region was asked to assess the level of awareness of their rights among consumers. The Adviser said it was very diverse. Some people contact the Adviser only when they cannot cope on their own with the situation and they have already made some attempts. These are mostly new issues that they haven't encountered before. For example, they have not had trouble returning an online purchase before. These individuals were unprepared for this and became more interested in their rights and regulations in general when they had to deal with these issues. In the case of assessing the level of knowledge of consumer rights among entrepreneurs, the Adviser pointed out that it depends on the size of the enterprise. People running smaller companies, e.g. as sole proprietors, know these rights at a lower level and often base their views on acts that are no longer in force. It is quite the opposite for larger enterprises. This might be because such companies have greater financial resources, allowing them to seek legal advice.

The next question touched on the scope of problems with which consumers most often approach the Consumer Rights Adviser of the Region. The data collected by the Adviser in cooperation with the Office of Competition and Consumer Protection was used to answer this question. These documents concerned the nature of legal advice and information provided in the field of consumer protection and interests (provided in person, by telephone, and in writing) in the years 2021-2023. It can be concluded that most consumers contacted the Adviser in matters related to household appliances, electronic devices, and computer equipment (114 contacts in this category). The second largest category was furniture, interior design, and home maintenance products (82 contacts from this category). Consumers were definitely the least likely to contact the Adviser regarding cosmetics, cleaning and preservatives (2 contacts from this category) and food products (4 contacts from this

category). Consumers contacting the Adviser in 2021 in the sales category mainly paid attention to the problem related to defects in goods.

According to data on in-person and telephone advice on consumer protection and interests for sales in 2022, consumers continued to turn to the Adviser most frequently on matters relating to household appliances, electronic devices and computer equipment (109 contacts from this category) and furniture, interior design and home maintenance articles (56 contacts from this category). In 2022, no one reported a related matter with cosmetics, cleaning and preservatives. The overall number of contacts with the Adviser decreased (from 390 to 313 advice provided in person and by telephone). The most common sales problem remained the issue of defects in goods.

However, the last analyzed year showed a minimal increase in these contacts (from 313 to 347). The category of the most common subject of telephone and in-person advice has not changed either. However, the second place has changed to clothing and footwear (72 contacts in this category). The number of advice on furniture, home furnishings, and home maintenance decreased by only 5 contacts. It is also worth noting that defects in goods were still the main problem of those reporting to the Adviser.

Advice provided by the Adviser may concern not only sales but also services. Data on services in 2021 showed that most of the Adviser's contacts with consumers concerned the energy and water sectors (35 contacts from this category), and the problem with services in this area was mainly related to their improper performance. In second place were telecommunications services (32 contacts from this category), which also mainly performed poorly. In the case of cleaning and repair of clothes and shoes, no one reported to the Adviser, and the fewest people reported in the following categories: ongoing maintenance, home maintenance, minor repairs and care, and maintenance and repair of vehicles and other means of transport (one contact from these categories).

In 2022, there was a decrease in the number of consumer contacts (concerning services) with the Adviser (from 154 contacts to 117). However, the topics of the most frequently given advice have not changed; only their number has changed. However, the number of advice regarding the real estate market increased (by 5 contacts).

In the last period under review, the number of consumers seeking advice on services related to the energy and water sectors increased dramatically (56 contacts in this category, an increase of 30). The increase also concerned the telecommunications category (by 11 contacts from this category), tourism and recreation (by 13 contacts from this category), and the other category (by 10 contacts from this category).

In addition to telephone and personal contact, consumers can also contact the Adviser in writing. However, such contacts occur much less frequently. There were 9 of them in 2021, and they mainly concerned sales (4 contacts in the other category). In 2022, there were only 2 of them (one contact concerned the sale of household appliances, electronic devices, and computer equipment, and the other concerned a financial service). However, in 2023, 4 such contacts took place, and they concerned only services, including as many as 3 belonging to the category of insurance services, and 1 included a telecommunications service.

Additionally, the Consumer Rights Adviser of the Region has the ability to represent consumers in court, which never happened to Mr. Michał Słomski. The Adviser tries to solve consumer problems in such a way as to avoid the need to take consumers' cases to court.

The next question the Adviser was asked during the interview concerned consumers abusing their rights and submitting unjustified complaints. According to the Adviser, most people who come to him with unjustified complaints contact him by phone or e-mail. People are aware



that they are not right, and it often happens that they break off contact after the Adviser's answer. In a situation where such contact does not cease, the Adviser always tries to find a solution that satisfies consumers, supporting it with appropriate provisions. The Adviser also pointed out that both consumers and entrepreneurs violate and abuse their rights. He also pointed out that sometimes the reluctance to solve a consumer's problem amicably may result from the entrepreneur not having good relations with his consumers or having had bad experiences with similar situations in the past.

The next question concerned consumers' awareness of their obligations. In most cases, the Adviser stated that the issue concerned the return of goods as part of the withdrawal from the contract or the complaint process. People are not aware of their obligation, e.g. to return the goods. The seller has the right to see the goods, e.g. if the consumer reports withdrawal from the contract due to defects. The consumer is also obliged to submit such a withdrawal in writing; simply sending the product back is not sufficient, although sometimes the seller may accept such a solution.

The Adviser was also asked about which rights consumers are most often unaware of. He pointed out that the problem is mainly with stationary returns. It should be recalled that not every stationary store is obliged to accept returns without giving a reason. The situation is different when we want to return the goods and provide a reason for the return, e.g. significant defects of the product.

The last question asked concerned legal regulations regarding consumer rights that should be introduced in Poland. According to the Adviser, the rules for returns in stationary stores should be unified - returns should be allowed in all stores. However, this could be quite risky, considering that consumers can buy goods, use them for their own purposes, and then return them. The Adviser also drew attention to a market area in which, in his opinion, consumers are too poorly protected. Such an area are telecommunications services and related to them contractual penalties for terminating contracts, that consumers are unaware of. It may happen that a person changes their place of residence, and the contract was initially made for specific premises. Transferring to another location is possible, but it could have different conditions.

### **5.3 Unethical Customer Behavior in the Karkonosze Region**

The first question asked five sellers as part of the analysis of unethical consumer behavior concerned their personal assessment of their knowledge of the law as a seller. All of them indicated that they believed they had the necessary knowledge about consumer rights from the perspective of both the seller and the consumer. They consider the internal regulations in force in the companies where they work to be the most important. They regulate deadlines for the exchange/return of products that are important for consumers or indicate products that are not subject to such procedures (e.g., in the case of clothing stores, it is usually underwear). The provisions of law generally applicable in Poland concern, among other things, the right to make complaints or guarantees and warranties, which, according to the surveyed sellers, requires skillful differentiation to work in their positions.

When asked about possible abuse of their rights by consumers, sellers indicated that this is quite a common phenomenon. Consumers sometimes buy goods, use them, and then return them, believing that the goods are unused. The only conditions for returns in stationary stores are payment confirmation and undamaged packaging or the original tag. Sellers in clothing stores often encounter returns of worn clothes whose labels are questionably attached to the clothes. However, it sometimes happens that the goods do not have a tag when purchased. In such a case, sellers indicate the need to note its possible absence on the receipt when the consumer makes a purchase, so that he or she can return the goods. Additionally, sellers

mainly pointed to the submission of unjustified complaints by consumers as an example of consumers violating their rights. This situation mainly occurs when the good is naturally worn out or it was treated improperly by the consumer, e.g., contrary to the instructions, which led to its destruction. According to one of the surveyed sellers, consumers, in addition to bending their rights, also violate general laws by committing actions bordering on theft. They believe that the goods they have purchased are incomplete, and they complete them themselves by adding additional parts, e.g., electronic equipment, to the original packaging. In the case of this seller, she is therefore obliged to check the completeness of each package when checking out to avoid such practices among customers. Another example of breaking the law indicated by the seller may involve consumers sticking price tags on goods and arguing about the price so that the seller is forced to change it to the consumer's advantage.

The third question asked to sellers was related to possible "bending" of the regulations on their part, for example, to satisfy a problematic customer. Sellers pointed out that sometimes, in stores, for example, complaints or returns are not the responsibility of the sellers but their superiors. This is important because these are the procedures during which, according to them, the law is most often "bent". Sellers or their superiors sometimes return/exchange goods after the deadline is regulated by internal regulations. However, one of the sellers pointed out that such a procedure is difficult due to the electronic program, which automatically does not allow the return/exchange procedure if the deadline is exceeded. In the case of complaints, "bending" the regulations is related to their positive consideration despite, for example, consumer abuse of the product. Only one of the surveyed sellers mentioned that he always prioritizes resolving the above situations for the benefit of the company he works for. Additionally, it indicates that a pleasant conversation and truthfulness are the best ways to resolve a possible dispute with a client.

Sellers were also asked to indicate new legal regulations governing consumer-seller relations that should be introduced in Poland. They mainly pointed to the unification of the deadline for returning goods in stationery stores that accept such a procedure in their internal regulations. Most late returns/exchanges are due to consumers' ignorance of store regulations. It is usually 30 days, but there are stores where it is 14 days or only 7. Thus, sellers also pointed out the need to introduce an obligation requiring stores to display the regulations (if they decide to have some kind of statute) in places where they can be read. Additionally, one salesperson also pointed out the common rudeness towards salespeople among customers as an aspect that each of us should work on personally. It happens that consumers display pathological behavior, e.g. they become aggressive as a result of a complaint being rejected. In such situations, it should be remembered that the seller is only obliged to follow the procedures and that she/he may, for example, be liable to her/his employer for her/his decisions.

## **Conclusion**

Consumer behavior is constantly changing. This is due to the creation of newer needs and the development of marketing and consumerism.

The aim of the article was to assess the awareness of consumer rights on the example of residents of the Karkonosze region. This knowledge is necessary because the processes related to globalization have undoubtedly influenced the formation of constantly changing consumer behavior. Consumer rights must also be constantly modified, and as a result, the level of awareness among consumers and the level of skillful use of them change.

Thus, the study in the form of a survey allowed for the analysis of the level of consumer awareness in the Karkonosze region. The research revealed that most respondents hold a neutral attitude towards legal regulations. Some regulations, such as the timeframe in which

a consumer can withdraw from a distance contract without providing a reason, are well known, while others, like the period within which consumers can withdraw from a contract made in a physical store without providing a reason, are less familiar. Nevertheless, the majority of the respondents are knowledgeable about exercising their rights correctly and are capable of suggesting needed changes. The information collected during the interview with the Consumer Rights Adviser of the Region allowed conclusions to be drawn regarding the level of knowledge of consumer rights among consumers and entrepreneurs, which turned out to be very diverse. Another important aspect of this conversation was the abuse of their rights by consumers, which the Adviser described as frequent, but pointed out that it was a problem also occurring on the part of entrepreneurs.

The interview also allowed for obtaining data regarding advice and legal information provided over the years 2021-2023 (in person, by phone, and in writing). From the data obtained, it can be concluded that consumers most often turned to the Adviser on matters related to household appliances, electronic devices, and computer equipment (sales advice) and the energy and water sector (service advice), and written advice was very sporadic and over the years analyzed, they concerned different categories.

Other research in the presented article included interviews with sellers. They allowed for the identification of unethical behavior on the part of consumers, which mainly concerned their abuse of their rights, especially related to the complaint and returns process. Sellers also proposed the introduction of new legal regulations, primarily regarding the unification of the return process in stores that allow it.

The researched topic suggests that consumer awareness has the potential to increase in the era of consumerism. Market regulations are constantly changing, but consumers are becoming more aware of them. However, at times, their potential is not fully utilized, and as a society, we need to work on this.

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## POSOUZENÍ INFORMOVANOSTI O PRÁVECH SPOTŘEBITELŮ NA PŘÍKLADU KRKONOŠSKÉHO OKRESU

Cílem článku bylo zhodnotit informovanost o právech spotřebitelů na příkladu obyvatel Krkonošského okresu. Hlavní cíl byl rozčleněn na dílčí cíle, a to: posouzení znalosti spotřebitelů o právech a jejich vhodném používání, posouzení znalosti prodejců o právních předpisech, zjištění četnosti a charakteru problémů, se kterými se spotřebitelé obracejí na Okresní úřad pro ochranu spotřebitele.

Hlavní výzkumná hypotéza byla následující: v Krkonošském okrese je povědomí o právech spotřebitelů na subjektivně průměrné úrovni.

Analýza výzkumu ve formě dotazníkového šetření mezi obyvateli Krkonošského okresu, rozhovorů s prodejci a Okresním úřadem pro ochranu spotřebitele, a analýza sekundárního výzkumu tuto tezi potvrdila. Z výzkumu také vyplynulo, že většina respondentů má neutrální postoj k právním předpisům, ale ví, jak je správně využít a dokáže navrhnout potřebné změny.

## BEWERTUNG DES BEWUSSTSEINS ÜBER VERBRAUCHERRECHTE AM BEISPIEL DES KREISES KARKONOSZE

Ziel des Artikels ist es, das Bewusstsein für Verbraucherrechte am Beispiel der Bewohner des Riesengebirges zu bewerten. Das Hauptziel wird in spezifische Ziele zerlegt: Bewertung der Rechtskenntnisse der Verbraucher und ihrer geschickten Anwendung, Bewertung der Rechtskenntnisse der Verkäufer, Bestimmung der Häufigkeit und Spezifität von Problemen, mit denen Verbraucher sich an den Kundenrechtsberater der Region wenden.

Die Haupthypothese der Forschung war folgende: Im Riesengebirge ist das Bewusstsein für Verbraucherrechte subjektiv durchschnittlich.

Die Analyse der Forschung, welche in Form einer Umfrage unter den Bewohnern des Riesengebirges, eines Interviews mit Verkäufern und dem Kundenrechtsberater der Region sowie einer Analyse der Sekundärforschung durchgeführt wurde, bestätigte die These. Die Untersuchung ergab auch, dass die Mehrheit der Befragten eine neutrale Haltung gegenüber gesetzlichen Regelungen einnimmt, diese jedoch richtig anzuwenden weiß und in der Lage ist, notwendige Änderungen vorzuschlagen.

## OCENA ŚWIADOMOŚCI PRAW KONSUMENCKICH NA PRZYKŁADZIE POWIATU KARKONOSKIEGO

Celem artykułu była ocena świadomości praw konsumenckich na przykładzie mieszkańców powiatu karkonoskiego. Cel główny został rozbity na cele szczegółowe, którymi są: ocena wiedzy konsumentów na temat prawa i jego umiejętnego stosowania, ocena znajomości prawa przez sprzedawców, określenie częstotliwości i specyfiki problemów, z jakimi konsumenci zwracają się do Powiatowego Rzecznika Konsumentów.

Główna hipoteza badawcza była następująca: w powiecie karkonoskim świadomość praw konsumenckich kształtuje się na subiektywnie przeciętnym poziomie.

Analiza badań w postaci: ankiety wśród mieszkańców powiatu karkonoskiego, wywiadów ze sprzedawcami i Powiatowym Rzecznikiem Konsumentów oraz analiza badań wtórnych potwierdziła tę tezę. Badanie wykazało także, że większość respondentów zachowuje neutralny stosunek do regulacji prawnych, jednak wie, jak prawidłowo z nich korzystać i potrafi zaproponować niezbędne zmiany.

## WORKERS' ATTITUDES TOWARDS DIGITAL TRANSFORMATION AND PERCEIVED WELL-BEING AT WORK: A CASE STUDY

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### Abstract

This study examines workers' attitudes toward digital transformation and job well-being in the semiconductor industry, focusing on a major German manufacturer, to identify ergonomic and managerial potentials for improvement. Through a standardized paper survey of 46 skilled workers in 2021, it explores the impact of automation and digitalization on well-being and the influence of job characteristics and attitudes on workers' behavior. For confirmatory hypothesis testing, Pearson's correlation coefficient was calculated between the variables. The results show no direct link between company digitalization efforts and worker well-being. However, worker identification with their job and interest in new technologies positively correlate with willingness to embrace digital challenges and participate in further education. These findings suggest fostering job identification and tech interest can enhance engagement in digital initiatives, offering organizational insights for navigating digital transformation.

### Keywords

Semiconductor industry; Automation; Job characteristics; Technology commitment; Human factors; Mental and physical well-being.

### Introduction

For more than a decade, automation and digitalization have been the driving factors behind the so-called Industry 4.0 (Kagermann et al., 2013). Although most of the companies in Germany and other European countries have not yet adopted I4.0 concepts as much as expected (Handelsblatt Research Institute, 2022), the implications for companies are manifold. For example, the introduction of I4.0 technologies and approaches can also have negative side effects, especially for workers on the shop floor. Along with increased automation and digitalization efforts, such as the use of robots and artificial intelligence (AI) in manufacturing, many of them may experience a lack of workplace skills or fear of job loss (Keil et al., 2020).

So far, the research on and adoption of I4.0 technologies like augmented reality (AR) has focused heavily on technological aspects (Mühlán et al., 2021). However, social considerations are expected to be at least as important in such change management processes (Richter et al., 2018). The recent concept of Industry 5.0 (I5.0) points to the need to further

explore the social, ergonomic, and individual aspects of workers in cyber-physical production systems to design human-centered workplaces that optimally combine both human and machine capabilities (Maddikunta et al., 2022).

Semiconductors form the basis of almost every modern technology, making semiconductor manufacturing itself one of the most innovative and complex industries. It is characterized by capital- and cost-intensive investment in plant and equipment, while the production of a computer chip can involve up to 1,000 process steps and take up to three months to ship (Keil, 2012). To remain competitive, manufacturers must constantly adapt to new technologies, optimize their operations, and reduce costs through automation and digitalization. The semiconductor industry is therefore a promising area to explore how workers in this industry feel affected by increased automation and digitalization.

The rest of this article is structured as follows: First, an overview of the current research background on automation and digital transformation in the semiconductor industry (Section 1.1) and on human factors related to technology acceptance and well-being (Section 1.2) is presented. On this basis, research hypotheses are derived (Section 2), and the applied survey method and analyses are described in Section 3. The results of the confirmatory hypothesis tests are then presented (Section 4) and their implications for answering the RQs are discussed (Section 5). This includes comparing the findings with the current literature, highlighting the limitations of our study (Section 5.1), and suggesting future avenues for research in this area (Section 5.2), before concluding on the relevance of the findings.

## **1 Theoretical Background**

In the following, we briefly review the current literature and research gaps on automation and digital transformation in the semiconductor industry, as well as the role of employee well-being and technology acceptance as the rationale for our research.

### **1.1 Automation and Digital Transformation in the Semiconductor Industry**

With the invention of the steam engine, the conveyor belt, electronics, sensors, and actuators, manual labor was first mechanized and then automated, enabling mass production at affordable prices. At the same time, these industrial revolutions have had profound impact on the way we work and live (Britannica, 2024).

With the advent of computers, modern information and communication technology (ICT), and now artificial intelligence (AI), information has been further digitized, jobs have been digitalized, and business have digitally transformed (Brynjolfsson & McAfee, 2014). While digitization refers to the one-to-one process of transforming analogue to digital processes (Gartner, Inc., 2024), digitalization further encompasses changes in the characteristics of the processes, tasks, or jobs as well (Muro et al., 2017), and digital transformation includes the application of new business models on top (MIT Center for Digital Business & Capgemini Consulting, 2011).

In our work, we use the term digital transformation when referring to the general economic, organizational, and operational efforts of the company to transform and adapt its business to the digital age, as it is also the case for Infineon Dresden, our case company. However, when relating to the employees of Infineon, we have used the term digitalization, as this is what directly affects their jobs and workplaces and what they directly experience.

The semiconductor industry is one of today's key global industries. Its chips and components are required for almost every modern technology. At the same time, semiconductor-manufacturing processes are complex, resource, time, and cost-intensive (Bureau et al., 2006).



Some semiconductor manufacturers follow Moore's Law, which aims to double the number of integrated circuits per chip each year (Mack, 2011). Others follow a strategy called "more than Moore", focusing on different technologies and a broader product portfolio. However, both approaches require constant changes in processes and equipment, supported by automation of process steps and digitalization of workplaces. For example, in modern semiconductor factories, factory workers are less likely to be required to lift or move heavy objects such as lots of chip wafers. Instead, their activities are shifting towards monitoring and control tasks (Keil et al., 2020). This affects not only workers on the shop floor, but also business and administrative processes (Schneider et al., 2021).

However, the role of the human worker as part of a highly automated and digitalized environment has not yet been analyzed in depth and requires further study (Schneider et al., 2022; von der Weth et al., 2022). This semiconductor manufacturing environment, where constant change through automation and digitalization has become commonplace, therefore seems well suited to investigate the effects of digitalization in the workplace on workers' attitudes.

## **1.2 Human Factors Concerning Technology Acceptance and Well-being**

Human factors and ergonomics refer to the psychological, emotional, and social factors that influence socio-technical work systems and the human-machine interaction. Through the thorough design of work tasks, workplaces, and assistance systems, human factors engineering can prevent errors and accidents (Hinsch & Olthoff, 2019), benefiting both the organization and the individual worker. Furthermore, the proper design of physical and mental work can keep employees healthy, motivated, and committed to the organization (Büssing et al., 2004).

More recently, the notion of Industry 5.0 (I5.0) promotes, among other things, the worker-centered design of production systems and the targeted use of assistive technologies (de Nul et al., 2021). For example, Romero et al. (2016) distinguish several types of operators that can be individually supported by different technologies like exoskeletons, AR, virtual reality (VR), wearables, or collaborative robots. Therefore, in I5.0, it should be possible for technology not to be implemented for its own sake, but to be targeted and individually adapted to the personal needs and preferences of workers.

There are several approaches to assessing individuals' attitudes towards technology and their behavioral antecedents. The Technology Acceptance Model (TAM), for example, measures the behavioral intention of employees to use a specific information technology (IT) system at work, considering the perceived usability and usefulness of the system (Venkatesh & Bala, 2008). However, as in our case, we are not focusing on a single technology but on digitalization in the workplace in general, we are applying theoretical concepts from traditional work design for our purpose.

For example, in their Self-Determination Theory (SDT), Deci and Ryan (2014) state that autonomy, competence, and relatedness form the three basic needs that individuals strive for in their self-motivated behavior. Hackman and Oldham (1975) relate motivation, autonomy, and self-efficacy, among others, specifically to the work context. They operationalize them in their Job Diagnostic Survey (JDS) to assess psychological job characteristics and identify improvement potential for designing healthy workplaces. Based on these constructs, we derive hypotheses in the following section to be investigated in the case of automation and digitalization in the semiconductor industry.

## 2 Research Objectives and Hypotheses

As to the best of our knowledge the effects of digitalization and automation have not been specifically addressed in semiconductor workplaces, we want to contribute to the investigation of their sociological effects by analyzing secondary survey data from employees at a large German semiconductor manufacturer, Infineon Technologies Dresden GmbH & Co. KG (NACE class 26.11: Manufacture of electronic components; NACE Rev. 2.1, 2023). Infineon Dresden is characterized by a high level of automation and digitalization (Keil et al., 2020; Keil et al., 2019), particularly in the facility where 300 mm diameter silicon wafers are processed and where our research took place. Automation and digitalization are helping Infineon Dresden to standardize processes and minimize human error, avoiding potentially large economic losses. But how do workers react to such automation and digitalization efforts in their workplace?

To find answers to this question, our goal is to identify factors that correlate with employees' willingness to face the challenges of digitalization and automation. Such insights are essential for considering and deriving (counter-)measures from a managerial perspective to enhance workforce well-being. Therefore, our research questions (RQs) are:

- RQ1: *How do automation and digitalization in the workplace affect the well-being of factory workers?*
- RQ2: *How do individual job characteristics and personal attitudes influence employees' behavior towards automation and digitalization?*

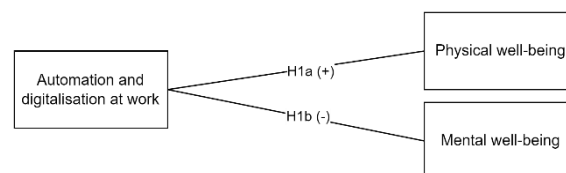
Based on the previous literature and research described in Section 1, we are primarily interested in the links and relationships between the company's automation and digitalization efforts and workers' well-being (Hackman & Oldham, 1975). Starting from the assumption that automation in a factory, e.g., through robots or automated guided vehicles (AGVs), reduces the physical strain of workers, we hypothesize that

- H1a: *The company's automation and digitalization efforts are positively correlated with workers' physical well-being.*

Conversely, given employees' latent fear of being replaced by robots or AI, we expect a negative relationship between automation and digitalization and employees' psychological well-being.

- H1b: *The company's automation and digitalization efforts are negatively correlated with employees' psychological well-being.*

The relationship between the two above-mentioned Hypotheses 1a and 1b, automation and digitalization, and well-being is shown in Figure 1.



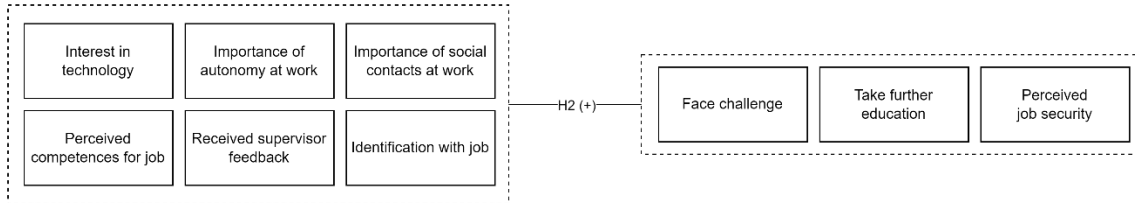
Source: Own

**Fig. 1:** *Conceptual model of Hypotheses 1a and 1b*

Second, we are interested in the relationships between workers' job characteristics and attitudes towards their work (Deci & Ryan, 2014; Hackman & Oldham, 1975; Neyer et al., 2012) and their prospective behavior in the face of further digital transformation. This forms our Hypothesis 2:

- H2: *Workers' autonomy, competence, feedback interested, social embeddedness, and identification, and interest in new technologies are positively correlated with their willingness to face upcoming challenges, participation in training, and perceived job security.*

Correlation of Hypothesis 2 is shown in Figure 2.



Source: Own

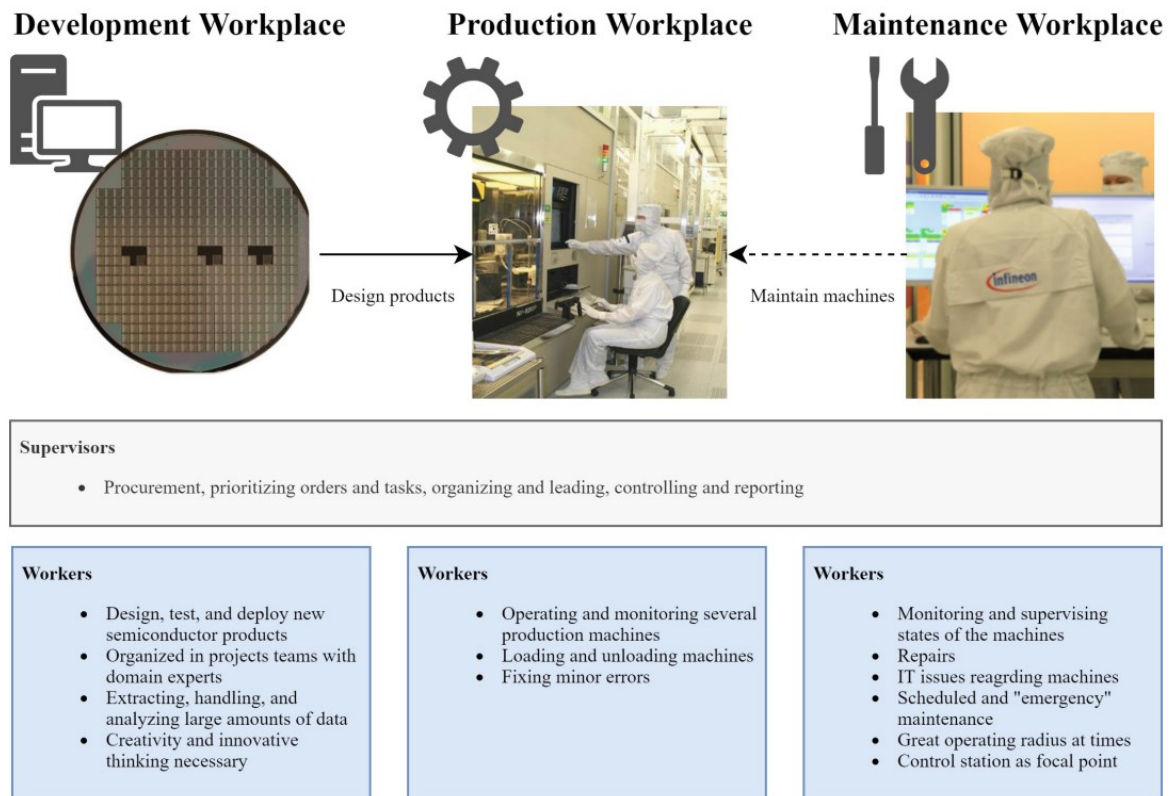
**Fig. 2:** *Conceptual model of Hypothesis 2*

### 3 Methods

For confirmatory hypothesis testing, we conducted a correlational study based on secondary data from a survey described in detail below. Using a convenience sample from the European research and development project Integrated Development 4.0 (iDev40) in the semiconductor industry, a standardized paper questionnaire was administered to skilled workers from two departments of Infineon Technologies Dresden GmbH & Co. KG in 2021: machine tool operators (Department 1) and maintenance workers responsible for the wafer transport system (Department 2). All shift supervisors in the two departments were approached and asked to distribute the questionnaire to their colleagues on a voluntary basis, while maintaining their anonymity. In the end, two shift supervisors forwarded the questionnaire to their colleagues (one each from Department 1 and 2), resulting in a response rate of almost 100%. From these shifts, only workers on holiday or sick leave could not be reached.

Both jobs at Infineon Dresden are already characterized by a high level of automation and digitalization (Schneider et al., 2022) and therefore highly suitable for our research to assess their impact on the workers. The operators at Infineon Dresden are rarely needed to load and unload equipment and almost never to transport wafer batches, as is shown in Figure 3. These processes have been automated through wafer handling robots and AGVs under the ceiling. They are responsible for operating and monitoring the equipment in terms of tool processes and recipes from their computer station, relying on sensor data and using the Manufacturing Execution System (MES), and initiating minor countermeasures if necessary.

The maintenance staff of the wafer transport system monitor the status of the transport system from a control room with several displays and carry out scheduled and unscheduled maintenance (Keil et al., 2020). For these tasks, they use sophisticated, digital transport system monitoring software and mobile applications to track issues and coordinate their tasks and actions throughout the plant in real time. Just the mechanical task itself remains manual (Schneider et al., 2022).



Source: Infineon Dresden (Keil et al., 2020)

**Fig. 3:** Generic production and production-support workplaces at highly automated and digitalized semiconductor manufacturers

### 3.1 Measures

The questionnaire items used for the measures and their codes are reported in Table 1.

The *level of Automation and Digitalization* in the workplace was measured by two questions, one on the current level of automation and digitalization and the other on the company's future efforts in this area. The answers to each question were coded as "0" ("neither"), "1" ("either automation or digitalization"), "2" ("both"). The mean of both items was then used as a measure of the perceived overall level of automation and digitalization in the company.

Both *Physical and Mental Well-being* was also measured with two items asking how often workers currently feel physically or mentally tired and how they expect this to change with increased automation and digitalization, respectively, on response scales of "1" to "4" ("negatively" to "positively"). The responses were then inversely recoded to fit the concept of "well-being" instead of "exhaustion," and the mean of each was used for the analysis.

*Autonomy, Social Contacts, Job Competence, Feedback and Job Identification* were measured in an analogous way with two items and the same response scales, but without recoding.

The same scales were used for *Interest in New Technologies, Willingness to Face New Challenges, Participation in Training, and Perceived Job Security*, but with only one item each.

### 3.2 Analysis

For the analysis, we used version 2.3 of The jamovi Project (2022) and version 4.1 of R from R Core Team (2021). As we calculated the averages of the respective variable items in question shown in Table 1, we used the Pearson correlation coefficient for metric values to

test the bivariate relationships in H1 and H2. We used an alpha level of 0.05 as the threshold for rejecting each null hypothesis. Where appropriate, we also adjusted the respective alpha level by using the Holm-Bonferroni method (Holm, 1979) to account for the respective family-wise error rates (FWER) of multiple hypothesis testing in H1a and H1b and H2.

**Tab. 1:** Survey items (translated from German)

Variable	Item	Code	Meaning
Automation / digitalization	Have your work processes been already automated (e.g. use of robots, automated guided vehicles, ...) or digitalized (e.g. use of tablets, VR glasses, ...)?	0	neither
		1	either automation or digitalization
		2	both
	Your work processes are not automated or digitalized but they are already planned to be changed in such a way.	0	neither
		1	either automation or digitalization
		2	both
Physical well-being	Do you often feel physically exhausted and tired because of your current work? <i>Requires inverse recoding.</i>	1	very rarely
		2	rarely
		3	frequently
		4	very frequently
	In your opinion, how would a planned automation and/or digitalization of work processes impact your physical condition mentioned in the previous question?	1	very negatively
		2	negatively
		3	positively
		4	very positively
Mental well-being	Do you often feel mentally exhausted and tired because of your current work? <i>Requires inverse recoding.</i>	1	very rarely
		2	rarely
		3	frequently
		4	very frequently
	In your opinion, how would a planned automation and/or digitalization of work processes impact your mental condition mentioned in the previous question?	1	very negatively
		2	negatively
		3	positively
		4	very positively
Autonomy	How important is it for you to be able to work independently?	1	very unimportant
		2	unimportant
		3	important
		4	very important
	How do you think your level of independence has changed or will change because of automation and/or digitalization?	1	very negatively
		2	negatively
		3	positively
		4	very positively
Social contacts	How important is personal contact with other colleagues for the fulfilment of your work tasks?	1	very unimportant
		2	unimportant
		3	important
		4	very important
	How do you think the importance of personal contact has changed or will change because of automation and/or digitalization?	1	very negatively
		2	negatively
		3	positively
		4	very positively

Variable	Item	Code	Meaning
Job competence	Do you think you have all the necessary competencies (skills and knowledge) to work successfully in an automated and/or digitalized workplace?	1	no
		2	rather no
		3	rather yes
		4	yes
Feedback	Do you receive enough feedback from your supervisor (frequency/content) on your work?	1	not sufficient
		2	rather not sufficient
		3	rather sufficient
		4	sufficient
	How do you think the level of feedback from supervisors has changed or will change because of automation and/or digitalization?	1	very negatively
		2	negatively
		3	positively
		4	very positively
Job identification	How much do you identify with your job?	1	very weakly
		2	weakly
		3	strongly
		4	very strongly
	How do you think the identification with your job has changed or would change because of automation and/or digitalization?	1	very negatively
		2	negatively
		3	positively
		4	very positively
Interest in new technologies	I am always interested in using the latest technical equipment.	1	not true at all
		2	rather not true
		3	rather true
		4	completely true
Willingness to face new challenges	Imagine that your company plans to implement automated and digitalised systems and processes. How likely is it that you would be up to the new challenge from a professional perspective?	1	very unlikely
		2	rather unlikely
		3	rather likely
		4	very likely
Participation in training	How likely would you be to take advantage of training opportunities offered by the company to this regard?	1	very unlikely
		2	rather unlikely
		3	rather likely
		4	very likely
Perceived job security	How secure do you think your job is regarding increasing automation and/or digitalization?	1	very insecure
		2	rather insecure
		3	rather secure
		4	very secure

Source: Own

## 4 Results

### 4.1 Descriptive Statistics

46 participants completed the questionnaire, 42 from Department 1, and 4 from Department 2. 30 of the participants identified themselves as male, 16 as female. 11% were 34 years old or younger, 46% were 35–49 years old, and 44% were 50 years old or older. Overall, the respondents perceived their workplaces to be slightly above average in terms of automation and/or digitalization.

The sample statistics in Table 2 shows that, except for *Physical* and *Mental well-being*, all individual variables were reported to be above average. The highest average scores were given to employees' *Willingness to face new challenges* due to digitalization and to *Participate in further training*. Perceived *Autonomy*, *Competences*, *Job identification* and *Feedback* also received high mean scores ranging from 3.03 to 3.14. However, *Social contacts*, *Interest in new technologies*, and *Job security* were reported to be the lowest. In particular, the *Interest in new technologies*, *Job security* and *Competences* show the greatest variation in terms of their standard deviation.

**Tab. 2:** Sample statistics

Variable	N	Mean	Standard deviation
New challenges	46	3.46	0.59
Further education	46	3.33	0.52
Autonomy	45	3.14	0.41
Competence	46	3.13	0.69
Identification	38	3.07	0.35
Feedback	38	3.03	0.55
Social contacts	43	2.94	0.48
New technologies	46	2.93	0.74
Job security	46	2.89	0.71
Mental well-being	43	2.35	0.46
Physical well-being	42	2.24	0.51
Automation / digitalization	26	1.19	0.60

All variables have score from 1 to 4 with the exception of *Automation / digitalization* which has score from 0 to 2, see Table 1.

Source: Own

Overall, the variables related to *New challenges* and *Further education* are rated highest, while *Job security*, along with *Physical* and *Mental well-being*, receive lower scores. This suggests a greater perceived importance of career development opportunities than respondents' perceived *Job security* and *Well-being*.

#### 4.2 H1: Automation, Digitalization, and Well-being

The results of the one-tailed Pearson correlation tests between automation and digitalization and both *Physical* (alternative hypothesis is positive,  $r = 0.19$ ,  $p > 0.05$ ,  $N = 26$ ) and *Mental well-being* (alternative hypothesis is negative,  $r = 0.09$ ,  $p > 0.05$ ,  $N = 26$ ) show no statistically significant correlation.

We, therefore, reject both H1a and H1b. We conclude that there is either no or a negative relationship between the level of automation and digitalization and *Physical well-being*. Similarly, there is either no or a positive relationship between automation and digitalization and *Mental well-being*.

These results contradict our previous assumptions. This may indicate that it is not possible to draw a direct link between the perceived automation and digitalization efforts of the company and the perceived well-being of the workers. Rather, it may be that their well-being is related to one or more other human factors and ergonomic aspects, such as those investigated in H2.

### 4.3 H2: Job Characteristics, Attitudes, and Behavior

Given the number of relationships tested ( $n = 18$ ), the adjusted alpha levels using the Holm-Bonferroni correction method (Holm, 1979) allow us to reject the null hypotheses only for the correlations between *Job identification* and *Willingness to face new challenges* (alternative hypothesis is positive,  $r = 0.50$ ,  $p < 0.0028$ ,  $N = 38$ ) and *Interest in new technologies* and *Continuing education* (alternative hypothesis is positive,  $r = 0.46$ ,  $p < 0.0029$ ,  $N = 46$ ). Although several other associations also show statistical significance for themselves, it cannot be ruled out that these associations are not due to chance.

Table 3 presents Pearson's correlation coefficients between the various variables and three main factors: *New challenges*, *Further education*, and *Job security*. The correlations are one-sided, assuming a positive relationship. Significant results, as determined by the Holm-Bonferroni correction for multiple hypothesis testing, are highlighted in **bold**.

**Tab. 3:** Correlation matrix of Hypothesis 2

Variables	N	New challenges	Further education	Job security
Autonomy	45	0.06	0.09	-0.01
Competence	46	0.35 **	0.25 *	0.31 *
Feedback	38	0.21	0.15	0.11
Social contacts	43	0.18	-0.01	0.08
Job identification	38	<b>0.50 ***</b>	0.24	0.40 **
Interest in new technologies	46	0.38 **	<b>0.46 ***</b>	0.03

Note: \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$

Source: Own

*Job identification* ( $N = 38$ ) demonstrates significant medium correlations with *New challenges* ( $r = 0.50$ ,  $p < 0.001$ ) and *Job security* ( $r = 0.40$ ,  $p < 0.01$ ). The correlation with *Further education* is small but non-significant ( $r = 0.24$ ).

*Interest in new technologies* ( $N = 46$ ) shows significant medium correlations with *Further education* ( $r = 0.46$ ,  $p < .001$ ) and *New challenges* ( $r = 0.38$ ,  $p < 0.01$ ). The correlation with *Job security* is weak and non-significant ( $r = 0.03$ ).

*Competence* ( $N = 46$ ) exhibits significant medium correlations with *New challenges* ( $r = 0.35$ ,  $p < 0.01$ ) and *Job security* ( $r = 0.31$ ,  $p < .05$ ). Also, the correlation with *Further education* is significant but weak ( $r = 0.25$ ,  $p < 0.05$ ).

*Feedback* ( $N = 38$ ) has weak, non-significant correlations with *New challenges* ( $r = 0.21$ ), *Further education* ( $r = 0.15$ ), and *Job security* ( $r = 0.11$ ).

*Social contacts* ( $N = 43$ ) shows also weak and non-significant correlations with *New challenges* ( $r = 0.18$ ), *Further education* ( $r = -0.01$ ), and *Job security* ( $r = 0.08$ ).

*Autonomy* ( $N = 45$ ) shows weak and non-significant correlations with all three factors: *New challenges* ( $r = 0.06$ ), *Further education* ( $r = 0.09$ ), and *Job security* ( $r = -0.01$ ).

Overall, the variables *Competence*, *Job identification*, and *Interest in new technologies* show the most significant positive correlations with the factors of *New challenges*, *Further education*, and *Job security*, suggesting that these aspects are strongly interrelated. *Autonomy*, *Feedback*, and *Social contacts*, however, do not show significant correlations with these factors.



## 5 Discussion

The results show that contrary to our initial hypotheses, workers' physical and mental well-being is not directly related to the level of automation and/or digitalization within the company (H1a and H1b). A plausible explanation could be that the semiconductor production environment has been subject to automation and digitalization efforts ever since, and workers may be used to such changes or at least less susceptible to strain.

Furthermore, we only see relationships between employees' identification with their job and their willingness to face new digitalization challenges, as well as between their interest in new technologies and participation in training (H2). This shows that identification with and interest in new technologies may be key personal characteristics of employees that are necessary to drive automation and digitalization efforts in organizations successfully.

It also means, that we could not find support in our sample and with our methods for well-known concepts of work design such as autonomy, competence, and relatedness (Deci & Ryan, 2014; Hackman & Oldham, 1975), which raises the question of other influencing factors for the observed behavior.

Nevertheless, although not statistically significant, there are also indications that the perception of appropriate skills for digitalization may be positively correlated with the willingness of employees to face new challenges and to participate in further training (Tab. 2). Conversely, this would imply that employees who perceive their digital literacy as low are also less likely to participate in relevant training, which seems counterintuitive. Less surprisingly, perceived competence is also likely to be correlated with perceived job security.

The fact that the willingness to take on new professional challenges and to participate in training are rated the highest overall (Tab. 1), and that perceived job security and well-being are rated lowest, suggests that job security and well-being may be closely linked, and that the skilled workers may have understood that continuous personal development and lifelong learning are necessary improve their situation.

### 5.1 Limitations

Although our study provides valuable insights and starting points for further research, it also has several limitations, which we highlight below.

First, although the questionnaire and its items are based on well-known constructs from SDT and JDS introduced in Section 1.2, they have only been used in this study so far, which poses a threat to the internal validity of the measurement method and requires further testing. Furthermore, in order to reach skilled workers in the semiconductor industry at all, we had to rely on the role of gatekeepers in the form of the shift supervisors. This means that the supervisor's decision to forward the questionnaire may have been based on an expectation of good results from their employees, thus biasing our data. Furthermore, as the survey was administered by the supervisors themselves, we cannot completely rule out the possibility that the employees answered the questions in an unbiased manner and did not fall prey to socially desirable answers. Finally, due to the characteristics of the sample (only employees of one company), the external validity and generalizability of the results is also limited and must be used with caution.

### 5.2 Future Research

Based on the findings and the limitations of our study, several areas for further research can be identified. While we have studied a semiconductor company with a high level of automation and digitalization, we call for a comparison of the results with other industries,

jobs, and different companies with different levels of automation and digitalization, especially at lower levels. In doing so, we hope to gain further insights into whether our conclusions apply to workers in other contexts, or how they should be modified.

Such research can be both qualitative and quantitative, through interviews or observations of workers, or through further survey studies or natural experiments comparing different groups of workers with different individual and organizational characteristics.

Furthermore, the questionnaire needs to be optimized and further validated to improve its internal validity. This should be done by further testing in the field and comparison or inclusion and adaptation of other already validated questionnaires such as the TAM or Technology Commitment (Neyer et al., 2012) in order to obtain a standardized measurement method.

## **Conclusion**

We conducted a case study focusing on semiconductor industry employees, using a standardized paper questionnaire to assess 46 employees' personal attitudes towards automation and digitalization and their job characteristics. To gain insights into the relationships between job characteristics, well-being, and digitalization, we adapted constructs from both SDT and JDS explained in Section 1.2.

Contrary to previous assumptions, employees' mental and physical well-being is not related to the level of automation or digitalization in the company. Similarly, autonomy, feedback, and social contacts at work are not correlated with employees' prospective behavior in relation to workplace digitalization, such as personal effort or participation in training.

However, job identification and interest in new technologies are positively correlated with such prospective digital behavior. Most interestingly, however, the lower the perceived digital competence of employees, the lower their willingness to participate in digital training.

Consequently, these findings lead to several implications for managers. First, in their efforts to promote digitalization, companies should focus on job seekers with high levels of job identification, interest in new technologies, commitment to lifelong learning and/or openness to change. However, while the labor market is difficult for companies, they would secondly need to foster these attitudes in their current employees to successfully manage the digital transformation between the organization and its employees with as little friction as possible. However, this effort is no less challenging.

In addition to the managerial implications mentioned above, we have also contributed to the literature on digital work design. As we could not find any correlations between the constructs of SDT or JDS (Section 1.2) in the light of digitalization, except for job identification, we suggest that these constructs should be considered and tested, e.g. as interaction effects, in more complex empirical studies. Such studies could also take the form of natural experiments, comparing the attitudes of employees in highly digitalized companies (as in our study) with those in less digitalized companies.

Further research is needed to capture the multifaceted nature of employee well-being, especially in the digital age.

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## POSTOJE PRACOVNÍKŮ K DIGITÁLNÍ TRANSFORMACI A VNÍMANÁ PRACOVNÍ POHODA: PŘÍPADOVÁ STUDIE

Tato studie zkoumá postoje pracovníků k digitální transformaci a pracovní pohodě v polovodičovém průmyslu se zaměřením na významného německého výrobce s cílem identifikovat ergonomické a manažerské potenciály pro zlepšení. Prostřednictvím standardizovaného papírového průzkumu 46 mezi kvalifikovanými pracovníky v roce 2021 zkoumá dopad automatizace a digitalizace na pracovní pohodu a vliv pracovních charakteristik a postojů na chování pracovníků. Pro potvrzující testování hypotéz byl mezi proměnnými vypočten Pearsonův korelační koeficient. Výsledky neukazují žádnou přímou souvislost mezi digitalizačním úsilím společnosti a pohodou pracovníků. Identifikace pracovníků s jejich prací a zájem o nové technologie však pozitivně koreluje s ochotou přijímat digitální výzvy a účastnit se dalšího vzdělávání. Tato zjištění naznačují, že podpora sebeidentifikace s prací a zájem o technologie může zvýšit zapojení do digitálních iniciativ, což nabízí organizační poznatky pro řízení digitální transformace podniků.

## DIE EINSTELLUNG VON ARBEITNEHMERN ZUR DIGITALEN TRANSFORMATION UND DAS WAHRGENOMMENE WOHLBEFINDEN AM ARBEITSPLATZ: EINE FALLSTUDIE

Diese Studie untersucht die Einstellung von Arbeitnehmern zur digitalen Transformation und das Wohlbefinden am Arbeitsplatz in der Halbleiterindustrie, um arbeits- und managementwissenschaftliche Verbesserungspotentiale zu identifizieren. Anhand einer standardisierten Befragung von 46 Facharbeitern im Jahr 2021 werden die Auswirkungen von Automatisierung und Digitalisierung auf das Wohlbefinden sowie der Einfluss von Arbeitsplatzmerkmalen und persönlichen Einstellungen auf das Verhalten der Arbeitnehmer untersucht. Zur Bestätigung der Hypothesen wurde der Korrelationskoeffizient nach Pearson zwischen den Variablen berechnet. Die Ergebnisse zeigen keinen direkten Zusammenhang zwischen den Digitalisierungsbemühungen des Unternehmens und dem Wohlbefinden der Arbeitnehmer. Allerdings korrelieren die Identifikation der Arbeitnehmer mit ihrem Arbeitsplatz und ihr Interesse an neuen Technologien positiv mit ihrer Bereitschaft, sich digitalen Herausforderungen zu stellen und an Weiterbildungsmaßnahmen teilzunehmen. Diese Ergebnisse deuten darauf hin, dass die Förderung der Identifikation mit dem Arbeitsplatz und des Interesses an neuen Technologien das Engagement für digitale Initiativen erhöhen kann und somit Erkenntnisse für das Management bei der Bewältigung des digitalen Wandels bietet.

## STOSUNEK PRACOWNIKÓW DO TRANSFORMACJI CYFROWEJ A ODCZUWANY KOMFORT PRACY: STUDIUM PRZYPADKU

Przedmiotem niniejszego badania jest analiza nastawienia pracowników do transformacji cyfrowej i komfortu pracy w branży półprzewodników, ze szczególnym uwzględnieniem wiodącego producenta w tym sektorze w Niemczech, w celu zidentyfikowania ergonomicznych i menedżerskich możliwości poprawy. Poprzez standardową ankietę papierową przeprowadzoną wśród 46 wykwalifikowanych pracowników w 2021 r., zbadano wpływ automatyzacji i cyfryzacji na dobre samopoczucie oraz wpływ cech pracy i postaw na zachowanie pracowników. W celu potwierdzenia hipotez obliczono współczynnik korelacji Pearsona między zmiennymi. Otrzymane wyniki nie wykazują bezpośredniego związku między wysiłkami podejmowanymi przez firmę w zakresie cyfryzacji a dobrostanem pracowników. Jednakże poziom identyfikacji pracowników z ich pracą oraz ich zainteresowanie nowymi technologiami są pozytywnie skorelowane z chęcią podejmowania przez nich wyzwań związanych z cyfryzacją i udziału w dalszym kształceniu. Wyniki te sugerują, że promowanie identyfikacji z pracą i zainteresowania technologią może zwiększyć zaangażowanie w inicjatywy związane z cyfryzacją, oferując wgląd organizacyjny w nawigację po procesie transformacji cyfrowej.

## INVESTMENT DECISION FACTORS OF NON-FUNGIBLE TOKENS IN THE CZECH REPUBLIC: SURVEY

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### **Abstract**

Non-fungible Tokens (NFTs), represent a revolution in the digital ownership paradigm. NFTs are a kind of digital asset built on blockchain technology, most commonly the Ethereum blockchain, that validate the uniqueness and ownership of a unique digital item in question. Each NFT carries specific information or attributes that make it original and non-fungible. Unlike cryptocurrencies like Bitcoin or Ethereum, which are identical to each other, non-fungible tokens cannot be exchanged on a like-for-like basis making them non-fungible. NFTs are traded for cryptocurrencies via online trading platforms. Investment in NFTs can present a risky situation due to the large volatility of the assets in a quite short time. This article focuses on identification of key aspects that influence decision making process of potential investors who are considering buying non-fungible tokens as an investment tool in the Czech Republic. From the point of view of investment decision-making, the primary factors appear to be the expected income from the investment, its payback period, and the risk that the investor undertakes. It has been proven that there is a degree of dependence between gender and the mentioned decision-making factors. The research showed that men are more inclined to make decisions based on expected returns, while women are more likely to make decisions based on perceived risk.

### **Keywords**

Non-fungible tokens; Intangible assets; Crypto assets; Investment; Investment decision process.

### **Introduction**

NFTs and cryptocurrencies are both digital assets that operate on a blockchain, but they differ in several ways. The main difference is their fungibility. Non-fungible tokens are a type of cryptocurrency that represent exclusive digital assets or unique artworks. Cryptocurrencies are mutually interchangeable and share a uniform value (Almeida & Gonçalves, 2024). A digital artwork's worth can fluctuate once it is sold, while 1 BTC exchanged for another 1 BTC retains the same value. The cost of a digital artwork can change as the original purchase price changes, unlike Bitcoin, which keeps its value constant when traded for an equivalent sum. Price-determining elements include market demand, trends, the reputation of the artist, and the artwork's perceived value. As a result, the artwork may increase in value and become more costly than when it was first purchased, or it may decrease in value and become less valuable (Ananzeh & Al-Smadi, 2024).

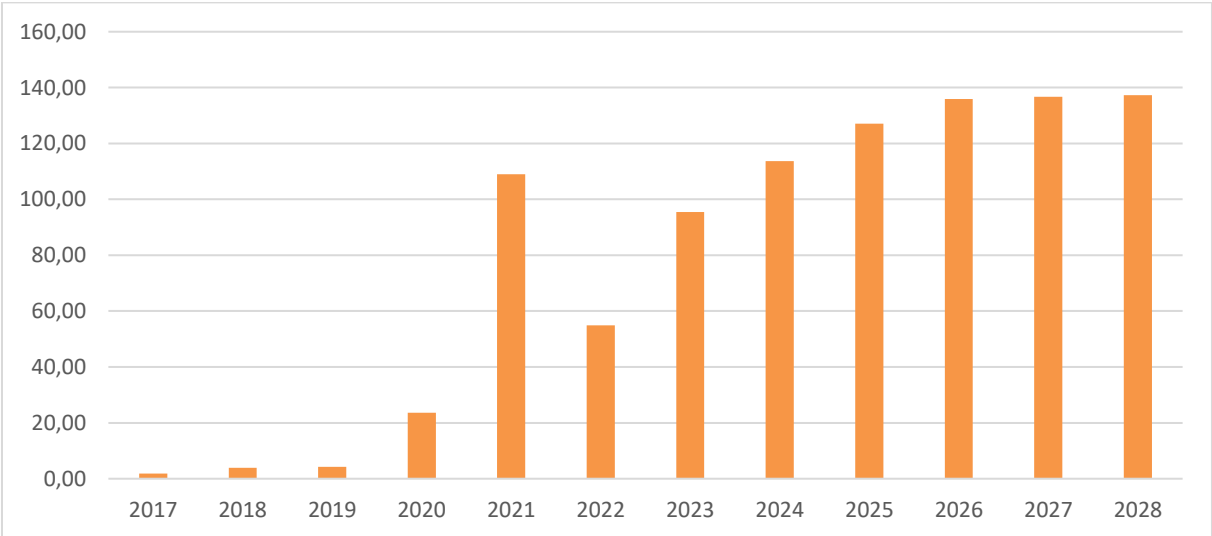
NFTs can also be used to streamline investing. Ernst & Young company developed an NFT solution for one of its fine wine investors by storing wine in a secure environment and using NFTs to protect provenance. NFTs can represent ownership in a business, much like shares in fact, share ownership is already tracked via ledgers that contain information such as the shareholder’s name, date of issuance, certificate number, and the number of shares (Griffin, 2022).

The purpose of this article is to evaluate whether and to what extent decision-making factors defined by scientific literature, such as expected income, payback time, risk factor and asset awareness, influence investment decisions in the field of NFT. Additionally, it aims to explore how this decision-making process is related to investors’ gender and the investment amounts they are willing to commit to NFTs. The research is based on a quantitative survey focused on investment decision factors and awareness of crypto assets.

**1 Literature Review**

Crypto assets are digital expressions of rights and value. Cryptocurrencies are still the most traded crypto assets in the world. There has been a lot of research on the efficiency of the cryptocurrency market (Mokni et al., 2024). The markets for cryptocurrencies are known for having a variety of traits, including high volatility, lax regulations, and relatively low liquidity, all of which can create unusual dynamics and hamper the efficiency of the market. Furthermore, it is challenging to make firm judgments about the efficiency of cryptocurrencies due to their short lifespans compared to traditional financial markets (Ananzeh & Al-Smadi, 2024). To fully comprehend the effectiveness of cryptocurrency markets and their implications for risk management and investment decisions, more investigation and analysis are required.

Cryptocurrencies are decentralized networks based on blockchain technology – a distributed ledger technology that autonomously records peer-to-peer transactions across decentralized computers without a central authority (Ananzeh & Al-Smadi, 2024). These assets are relatively vulnerable to “boom” events, which makes them significantly risky for investors when engaging with them. In a crypto market, investors interpret high volatility as an opportunity to achieve higher profits, unlike in traditional financial markets, where investors perceive volatility negatively (Griffin, 2022).



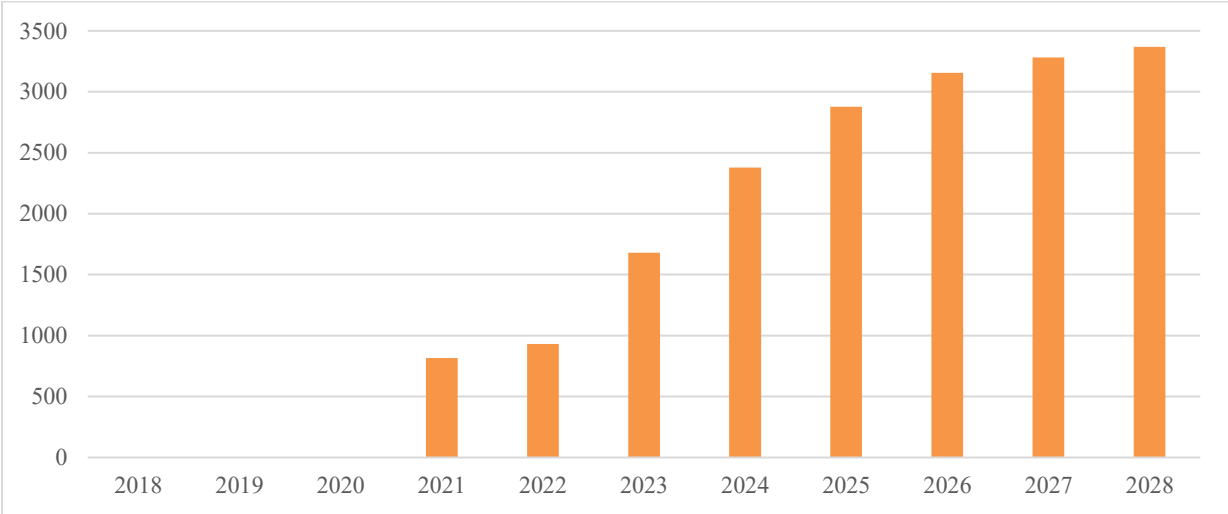
Source: (Cryptocurrencies - Czechia | Statista Market Forecast, 2023)  
**Fig. 1:** Cryptocurrency income development in the Czech Republic



Figure 1 shows the development of cryptocurrency income in the Czech Republic between 2017 and the projected year 2028. Incomes in the cryptocurrency market are projected to reach 137.3 million USD by the year 2028, so the expected compound annual growth rate CAGR between 2024 and 2028 should reach 4.83%, representing the mean annualized growth rate for compounding values over a given time period. Data reflects even the market impacts of the Russia-Ukraine war (Cryptocurrencies - Czechia | Statista Market Forecast, 2023).

Another kind of crypto asset that emerged in the last few years is non-fungible tokens (“NFT”). A non-fungible token is a digital token that is created and recorded on a public blockchain such as Ethereum. The token serves as an option to prove ownership of unique digital items. These are certain parts of computer codes carrying certain information, similar to, for example, cryptocurrencies. NFTs can be freely traded, and unlike cryptocurrencies, NFTs are characterized by their uniqueness, which consists in the fact that they cannot be freely exchanged for any other NFT, which, for example, allows the trading of cryptocurrencies. Currently, NFTs are still viewed as more of a risky investment. While some predict a bright future for NFTs, others urge more sober thinking and call NFTs more of a temporary trend with a not-so-bright future (Mercik et al., 2024). By their nature, NFTs are also close to investments in precious metals, art or collectibles, as digitized works and collectibles are a common object of exchange via trading platforms (Yousaf et al., 2023).

Figure 2 shows NFT income development worldwide between 2018 and the projected year 2028. Data shows the situation not only in the Czech Republic, but worldwide. That is due the lack of statistical information, academic studies and work in the field of non-fungible tokens. These assets are relatively a new trend that is finding its place in the Czech Republic slowly, therefore there are not any significant investment amounts like in the USA, Japan, Germany or Thailand.



Source: (NFT - Worldwide | Statista Market Forecast, 2023)

**Fig. 2:** NFT income development worldwide

Incomes in the NFT market are projected to reach about 2,378 million USD in 2024 and are expected to grow between 2024 and 2028 by CAGR of 9.10% resulting in a projected total amount of 3,369 million USD in 2028 (NFT - Worldwide | Statista Market Forecast, 2023)

So, even though NFTs are just a small part of investment in crypto assets in comparison with classic cryptocurrency, its trend is expected to grow in the next few years. NFTs can be used as a potential investment tool that stores value for a couple of years. Decision-making factors play an important role in investing, according to which a potential investor concludes and reaches an opinion on whether to invest or not to invest in a given asset (Wang et al., 2024).

The main factors to consider in the investment decision-making process are financial, economic, market, behavioral, technological, legal, and social factors. The broader economic environment plays a significant role in shaping investment decisions, mainly macroeconomic indicators such as GDP growth, inflation rates, interest rates, and unemployment impact investment choices (Yousaf & Yarovaya, 2022). The state of financial markets and prevailing conditions influence investment decisions. Behavioral finance has gained prominence in understanding investment decisions, acknowledging the role of psychological factors. Researchers analyze how emotions, overconfidence, and herd behavior influence investment choices and market dynamics (Wang et al., 2024). Its importance also has technological factors that explore the impact of digitalization, algorithmic trading, and artificial intelligence on investment strategies. Literature in this area deals with the growing importance of Environmental, Social, and Governance (ESG) criteria. Examining how ethical, sustainable, and socially responsible investment practices influence decision-making and contribute to long-term value creation (Yousaf & Yarovaya, 2022).

This article deals mainly with financial factors. Financial considerations are fundamental to investment decision-making. Factors such as expected returns, risk assessment, liquidity, and cash flow analysis. In financial management, there is a “magic” triangle of investment decisions that are presented by three pillars – return, risk, and liquidity. It is true that the more return we want, the more risk we have to take. The risk decreases with a longer horizon (Vochozka & kol., 2021). The investment strategy seeks a compromise between maximization of return, maximization of risk, and maximum liquidity. It is impossible to find an investment that would simultaneously achieve all three peaks of the investment triangle (yield, risk, liquidity).

Risk factor measures the probability that the expected return will not be achieved. It consists in the fact that the investment fluctuates over time, is callable and can both rise and fall. The risk can be limited with a long-term investment horizon (time). There is no such thing as a risk-free investment. Bank deposits, for example, are also risky due to inflation. Liquidity is the ability to convert an investment instrument into cash at minimal cost. High liquidity means quick and easy conversion of investments into cash. Low liquidity is when the conversion of the investment into cash is not possible immediately or only at the cost of higher costs (term deposits, closed funds, building savings) (Zhang et al., 2024). Income is the appreciation of assets such as securities. The expected return can change at any time, as the situation in the capital markets changes every second. It can be measured by the rate of return, which is given as a percentage for a certain period and tells how the investment has appreciated over time compared to the initial cost. Such values are subject to discounting, i.e., recalculation of future values to present values using current interest rates offered by commercial banks, rates of long-term bonds, or values of weighted average cost of capital (Vochozka & kol., 2021).

## **2 Methodology and Data**

The analysis of this article is based on data obtained from a quantitative survey about investment intentions in NFT areas. The respondents were residents of the Czech Republic from a total of 14 regions according to CZ NUTS 3 – regions (administrative units). The questionnaire survey was divided into three parts. The first part was to find out whether the respondent was aware of what the acronym NFT means in the field of finance, whether he could explain the meaning of these assets to others, and whether he currently invests in NFT assets or is thinking about it. The second part was to obtain information about whether the respondent is currently investing and to which assets, what amount of money the respondent would be willing to invest in NFT in the current situation, and what factor primarily

influences the respondent in making investment decisions. The last part was obtaining classification data about the respondents.

The quantitative study was created by the author of the article using questionnaire software. The questionnaire was distributed online in electronic form within the Czech Republic. The contact details of the respondents were obtained from the author's previously created and obtained databases. These are members of the public with permanent residence in the territory of the Czech Republic who have given their consent to the sending of questionnaires through online communication channels, this stands for the base set of around 500 respondents. A multi-stage random sampling was used to select respondents in order to ensure that responses were obtained proportionally according to NUTS 3 from each of the 14 regions of the Czech Republic. After dividing the respondents by region, they were further selected on the basis of probability sampling using numerical generation software from the available contact database. The survey was sent by e-mail to a total of 300 potential respondents from the sample set, which was considered by the author of the article to be a sufficiently representative sample. Out of the total number of questionnaires sent out, a total of 103 responses were returned, which was a low response rate than the author of the article originally expected. However, due to the absence of any similar study on the subject of NFT in the Czech Republic, these data were used and subjected to a statistical investigation. On the basis of these data, a general conclusion valid for the Czech Republic cannot be objectively drawn, it is rather a matter of recording a certain trend towards which the public in the field of NFT in the Czech Republic is reaching. And further research in this direction is desirable for the possible generalization of the results found. The article should answer the research questions (RQ) presented in the following subsections.

### **2.1 RQ1: *What is the rate of investment of interviewed respondents for NFTs?***

For the first research question a graphical representation of the response was used to show which specific assets respondents were currently investing in. Thus, the absolute and relative number of responses was determined. The first question examines whether and to what extent the respondents invest in various assets and to what extent specifically in NFTs. Finding out this information can also have an effect on the factors according to which the respondents decide whether or not to invest in the given asset. Whether the level of investment is subsequently related to insufficient confidence in the asset, low awareness or volatility of the asset.

### **2.2 RQ2: *Is there a significant difference in the aspects on the basis of which women and men make investment decisions? What are the decision-making factors?***

For the answer to this research question the number of chi-square tests in the contingency table have been done for meeting the condition for use where the chi-square can be used if at most 20% of the expected frequencies are less than 5 and none are less than 2. The test statistics (1) were used for this calculation.

$$\chi^2 = \sum_{i=1}^r \sum_{j=1}^s \frac{(O_{ij} - E_{ij})^2}{E_{ij}} \quad (1)$$

The estimate calculation for the value in the  $i$ -th column and  $j$ -th row is determined by multiplying the sum of the values in the  $i$ -th column by the sum of the values in the  $j$ -th row and dividing by the number of all elements in the table. The observed frequencies of occurrence are usually denoted by  $O_{ij}$ , where  $i$  is the corresponding row and  $j$  is the corresponding column of the contingency table. Frequencies estimated under the assumption of character independence are usually denoted  $E_{ij}$ .

The test was made at the significance level of 5% and following hypotheses. So when the significance would result in less than 0.05 the null hypothesis would be rejected in the favor of the alternate one.

*H0: There is no significant difference in the analyzed aspects on the basis of which women and men make investment decisions.*

*H1: Non H0*

The decision-making factors in the field of investments were chosen for this article - expected return, payback period, investment risk and knowledge of the given type of asset. The first three factors are basic approaches to evaluating the profitability of investments in the field of financial management. The only thing missing here is the representation of the area of investment liquidity, which was not used for the needs of this work and the appropriate interpretation of the results. The last chosen factor was knowledge of the asset, which was chosen due to the fact that NFTs, especially in the Czech Republic, are still a relatively new type of investment asset. The use of this last factor was thus mainly investigative and could also help to determine the idea for a possible improvement of communication about NFT within the general public, i.e. increasing awareness of these assets, which could lead to higher investments in this area.

### **2.3 RQ3: Is there some degree of dependence between the respondent's status and the amount he is willing to invest?**

To answer the last research question the data was statistically tested. First of all there had to be investigated whether the analyzed data had normal distribution according to normality tests by Kolmogorov-Smirnov and Shapiro-Wilk with the following hypotheses.

*H0: Data have a normal distribution.*

*H1: Non H0*

On the significance level of 5% and the test's significance result of 0.001, the null hypothesis was rejected, and therefore, the data do not have a normal distribution. So for answering RQ3 nonparametric test Kruskal-Wallis 1-way ANOVA was used which operates on test criterion (2).

$$H = \frac{12}{N(N+1)} \sum_{i=1}^C \frac{R_i^2}{n_i} - 3(N + 1), \quad (2)$$

where

$N$  stands for a number of observations in all groups,

$n_i$  is a number of observations in the  $i$ -th group,

$C$  is the number of groups, and

$R_i$  is the sum of ranks in the  $i$ -th group.

The Kruskal-Wallis test is based on the following hypotheses:

*H0: There is no significant degree of dependence between the respondent's status and the amount they are willing to invest.*

*H1: Non H0*

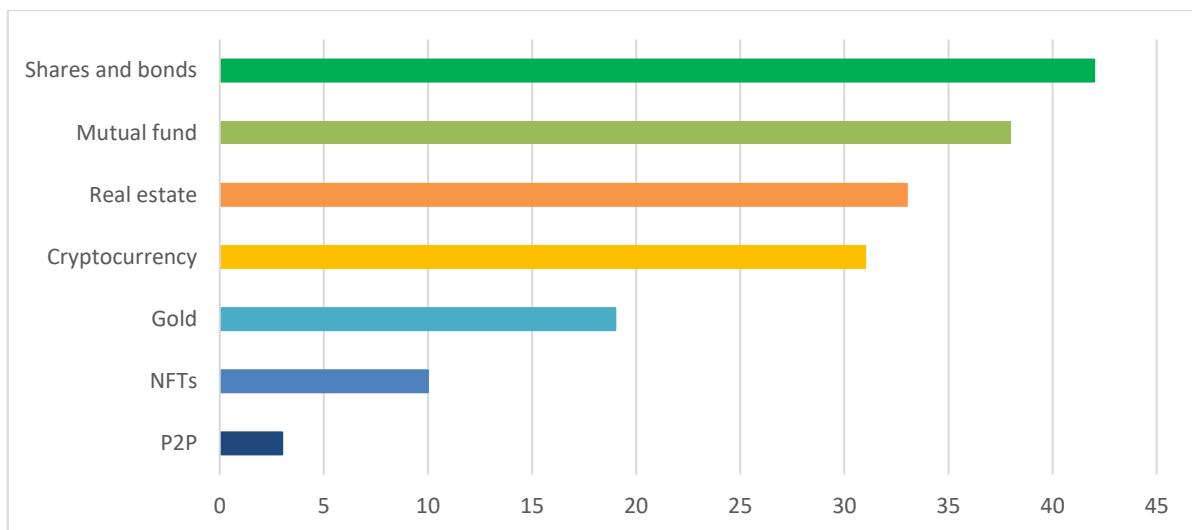
The status was divided into 4 samples according to the status of the respondent – employed, entrepreneur, student and unemployed. The respondents chose in such a way that the choice of status was guided by income, and thus the status with a regular or higher income took precedence over the other answers, i.e. if the respondent was, for example, both a student and

an entrepreneur at the same time, he chose the status of entrepreneur. The aim of the question was to find out whether there can be a correlation between the status variables and the one-time amount that the respondents are willing to invest in NFTs within their status, and therefore whether the status and the expected regular or irregular income with it can influence this decision.

### 3 Results of Research

#### 3.1 RQ1

The first part of the research examined whether respondents invest in any kind of assets and in what assets specifically. More answers could have been chosen. The results are shown in Figure 3.



Source: Own

**Fig. 3:** Respondents investing activity

Figure 3 shows that the assets to which respondents invest the most can be considered shares and bonds (40.78%). Mutual funds (36.89%) and real estate (32.04%) are also widely used assets for investment. Cryptocurrencies turned out to be an equally important investment tool, reaching a share of 30.10%. The least used instruments for investing turned out to be gold (18.45%), NFTs (9.71%), P2P collective loans (2.91%).

Cryptocurrencies are proving to be a full-fledged investment asset in terms of their resistance to more traditional forms of investment (real estate, mutual funds, shares). This fact also corresponds to their development, as was shown in chapter 1 within the framework of the development of cryptocurrencies in the Czech Republic. On the other hand, NFTs are still more in their “development” phase when they do not penetrate much into the investment environment in the Czech Republic. It seems that these digital assets do not have much trust here, also due to their relatively high volatility and the lack of information that would be given to potential investors in the Czech Republic. To answer RQ1, it can be said that the rate of investment in NFTs by interviewed respondents is low, only 9.71%. On the other hand, the investment rate in cryptocurrencies seems to be fairly high. The fact that NFTs are traded for cryptocurrency and, therefore, have a close connection with each other, might result in the growing trend of NFT investments. Of course, the number of investors is not the only measure for the development of the market for a given asset. An important question is the invested volumes, frequency of investments, development of investments in terms of distribution (Gaussian function) and others (Almeida & Gonçalves, 2023). The risks associated with low

confidence in NFT assets are also confirmed by the J&T Banka Art Report 2023 survey, which involved 766 respondents from the field of art collectors, dealers and experts in the art market. The survey showed that only 14% of respondents had purchased NFTs or were considering purchasing them, and that a full 42% of respondents considered NFTs to be only a short-term trend, when it is not an interesting investment asset. Moreover only 7% of dealers in the art market would recommend buying NFTs (Stuchlík et al., 2023).

### 3.2 RQ2

To answer RQ2 the contingency table was constructed. The following factors have been chosen for the analysis:

- *expected income and payback time* – the total income investment would bring during its lifetime and how long does it take when the accumulated income exceeds the original deposit, the aspects which can be measured in finances by NPV (Net Present Value), profitability indexes and ROI (Return on Investment),
- *risk* – all risk factors that could influence the decision-making process in investment, such as volatility of the assets, the current situation of the financial market, fraudulent transactions, stability of the currency, macroeconomic indicators, or, for example, wash trading,
- *asset awareness* – how the respondent is familiar with the assets, recommendations, general opinions and trends, and marketing communication.

Table 1 shows the investment decision factors and the total number of responses for both gender groups.

**Tab. 1:** *Investment decision factors responses [absolute frequency]*

<b>Gender</b>	<b>Expected income, payback time</b>	<b>Risk</b>	<b>Asset awareness</b>	<b>Total</b>
Male	24	15	11	50
Female	11	27	15	53
<b>Total</b>	<b>35</b>	<b>42</b>	<b>26</b>	<b>103</b>

Source: Own

Table 1 demonstrates that, in total, the most significant factor in the investment decision process can be considered risk 42 responses (41%), and the second is expected income and payback time 35 responses (34%). The least significant factor for both groups was the asset awareness 26 responses (25%). It is clear that for men, the most important factor is expected income and payback time, which account for 48% of all men's responses. On the other hand, for women, this factor reached just a level of nearly 21%. The most relevant factor that influences women in the investment decision-making process was the risk 27 responses (51%).

**Tab. 2:** *Pearson chi-square test and correlation coefficients results*

	<b>Value</b>	<b>Significance</b>
Pearson chi-square	8.793	0.012
Phi	0.292	0.012
Contingency coefficient	0.280	0.012

Source: Own

Table 2 shows the result of the chi-square test based on significance levels of Pearson Chi-Square, Phi and Contingency correlation coefficients that examine whether the variables are independent in influencing the test statistic. The chi-square test was made at the significance

level of 5%. The result of the test shows a significance of 0.012, which means a lower significance than at which the test was performed. Therefore, at the significance level of 5%, the null hypothesis can be rejected in favor of the alternate one, i.e., To answer the RQ2 Chi-Square test proved that there is a statistically significant difference in the analyzed aspects on the basis of which women and men make investment decisions. So that men tend to make decisions based more on money aspects (expected returns, payback time), while women tend to think more about the risk associated with the potential investment they might make. Contingency correlation coefficients stands for 0.280, which indicates a moderately strong dependence between gender and investment determinants.

### 3.3 RQ3

The last RQ3 tried to find out whether there is any certain dependence between the respondent's status and the amount he/she would be willing to invest in NFTs. Status was divided into 4 groups – employed, entrepreneur, student, and unemployed. All respondents had to choose from amounts around 5,000 CZK, 10,000 CZK, 50,000 CZK, or 100,000 CZK. This would be a one-time investment amount. The distribution is shown in Table 3.

*Tab. 3: Respondents' status and investment values*

Status	5,000	10,000	50,000	100,000	Total
Employed	30	8	15	8	61
Entrepreneur	7	2	2	4	15
Student	15	3	3	1	22
Unemployed	4	1	0	0	5
<b>Total</b>	<b>56</b>	<b>14</b>	<b>20</b>	<b>13</b>	<b>103</b>

Source: Own

The majority of respondents were employed people, followed by students, entrepreneurs, and the unemployed. The status was then analyzed according to the amount that the respondent would be willing to invest in NFTs. The largest number of respondents would be willing to invest only around 5,000 CZK, which is a really low amount through which nobody could gain any significant amount in terms of crypto assets. The result of the test answering RQ3 is shown in Table 4.

*Tab. 4: Kruskal-Wallis 1-way ANOVA test result*

Test	Value
Significance	0.138
Test statistics	5.505
Degree of freedom	3

Source: Own

With the test significance result of 0.138 tested at the significance level of 5%, the null hypothesis cannot be rejected. Therefore, to answer RQ3, there is no statistically significant dependence between the respondent's status and the amount he/she is willing to invest in NFTs. The main factors that made the difference could be monthly income, investment decision-making factors, or overall assessment of NFTs in the Czech Republic. For the needs of this question, it would be necessary to incorporate the variable of the respondents' monthly income which, however, due to the answers obtained, could not be used due to misleading responses caused by the question's position and due to the uneven distribution of response values.

## Conclusion

NFTs are among the youngest investment instruments, and their position is far from fully developed. The main advantages of investing in NFTs are value preservation, investment tools, low barriers to entry, unique tools for content creators, removal of common restrictions, huge market, and use of tokens as principal. It also serves as a means of preserving value, both monetary and non-monetary, based on how people perceive the object associated with the token. At the same time, NFTs are not subject to exchange rates, and they are not always negatively affected by the unfavorable development of cryptocurrencies (Griffin, 2022). NFTs are still not in higher investment positions in the Czech Republic. They still lag behind proven and safe investment alternatives in the form of securities, real estate, or mutual funds. However, cryptocurrencies have found their place, the popularity and investment volumes of which have increased in recent years. From the point of view of investment decision-making, the primary factors appear to be the expected income from the investment, its payback period, and the risk that the investor undertakes. It has been proven that there is a degree of dependence between gender and the mentioned decision-making factors. The research showed that men are more inclined to make decisions based on expected returns, while women are more likely to make decisions based on perceived risk. Last, but not least, it was a question of whether a person's status in terms of employment or unemployment can have an effect on how much he will be willing to invest, specifically crypto assets. However, the dependence has not been confirmed, so the decision must be based on other factors, such as the size of the monthly income, knowledge of the asset or price volatility. In the Czech Republic, there is still an insufficient base of research and statistics dealing with NFT, although it is a relatively new trend that has found its place in the world. The topic is thus an interesting subject for further investigation.

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## FAKTORY INVESTIČNÍHO ROZHODOVÁNÍ U NEZASTUPITELNÝCH TOKENŮ V ČESKÉ REPUBLICE: PRŮZKUM

Nezastupitelné tokeny (non-fungible tokens, NFT) představují revoluci v paradigmatu digitálního vlastnictví. NFT jsou druhem digitálního aktiva postaveného na technologii blockchain, nejčastěji blockchainu Ethereum, které ověřuje jedinečnost a vlastnictví dotyčného jedinečného digitálního předmětu. Každý NFT nese specifické informace nebo atributy, díky kterým je originální a nezaměnitelný. Na rozdíl od kryptoměn, jako je Bitcoin nebo Ethereum, které jsou navzájem identické, nelze nezaměnitelné tokeny vyměňovat za stejné, což je činí nezaměnitelnými. NFT se obchodují za kryptoměny prostřednictvím online obchodních platform. Investice do NFT může představovat rizikovou situaci kvůli velké volatilitě aktiv v poměrně krátké době. Tento článek se zaměřuje na identifikaci klíčových aspektů, které ovlivňují rozhodovací proces potenciálních investorů, kteří uvažují o nákupu nezastupitelných tokenů jako investičního nástroje v České republice. Z hlediska investičního rozhodování se jako hlavní faktory jeví očekávaný příjem z investice, doba její návratnosti a riziko, které investor podstupuje. Bylo prokázáno, že mezi pohlavím a uvedenými rozhodovacími faktory existuje určitá závislost. Výzkum ukázal, že muži se častěji rozhodují na základě očekávaných výnosů, zatímco ženy se častěji rozhodují na základě vnímaného rizika.

## INVESTITIONSENTSCHEIDUNGSFAKTOREN VON NICHT-FUNGIBLE TOKENS IN DER TSCHECHISCHEN REPUBLIK: UMFRAGE

Nicht-fungible Token (NFTs) stellen eine Revolution im Paradigma des digitalen Eigentums dar. NFTs sind eine Art digitales Asset, das auf der Blockchain-Technologie, am häufigsten der Ethereum-Blockchain, basiert und die Einzigartigkeit und den Besitz eines einzigartigen digitalen Gegenstands bestätigt. Jeder NFT trägt spezifische Informationen oder Attribute, die ihn originell und nicht fungibel machen. Im Gegensatz zu Kryptowährungen wie Bitcoin oder Ethereum, die untereinander identisch sind, können nicht-fungible Token nicht auf gleicher Basis ausgetauscht werden, was sie nicht-fungibel macht. NFTs werden über Online-Handelsplattformen gegen Kryptowährungen gehandelt. Investitionen in NFTs können aufgrund der großen Volatilität der Vermögenswerte in recht kurzer Zeit eine riskante Situation darstellen. Dieser Artikel konzentriert sich auf die Identifizierung von Schlüsselaspekten, die den Entscheidungsprozess potenzieller Investoren beeinflussen, die den Kauf nicht-fungibler Token als Anlageinstrument in der Tschechischen Republik in Betracht ziehen. Die Untersuchung ergab, dass Männer eher dazu neigen, Entscheidungen auf der Grundlage der erwarteten Erträge zu treffen, während Frauen eher Entscheidungen auf der Grundlage des wahrgenommenen Risikos treffen.

## CZYNNIKI DECYZJI INWESTYCYJNYCH W ZAKRESIE TOKENÓW NIEZAMIENNYCH W REPUBLICIE CZESKIEJ: BADANIA

Tokeny niezamienne (non-fungible tokens, NFT) stanowią rewolucję w paradygmacie własności cyfrowej. NFT to rodzaj aktywa cyfrowego opartego na technologii blockchain, najczęściej blockchain Ethereum, które sprawdza unikalność i własność danego unikalnego elementu cyfrowego. Każdy NFT zawiera specyficzne informacje lub atrybuty, które sprawiają, że jest oryginalny i niezamienny. W przeciwieństwie do kryptowalut, takich jak Bitcoin czy Ethereum, które są ze sobą identyczne, tokenów niezamiennych nie można wymieniać na takie same, co czyni je niemożliwymi do zamiany. Transakcje NFT są przedmiotem obrotu na kryptowaluty za pośrednictwem internetowych platform

transakcyjnych. Inwestycja w NFT może stwarzać ryzykowną sytuację ze względu na dużą zmienność aktywów w dość krótkim czasie. W artykule skupiono się na identyfikacji kluczowych aspektów, które wpływają na proces decyzyjny potencjalnych inwestorów, którzy rozważają zakup tokenów niezamiennych jako narzędzia inwestycyjnego w Republice Czeskiej. Z punktu widzenia podejmowania decyzji inwestycyjnych głównymi czynnikami wydają się być oczekiwany dochód z inwestycji, jej okres zwrotu oraz ryzyko, jakie podejmuje inwestor. Udowodniono, że istnieje pewna zależność pomiędzy płcią a wymienionymi czynnikami decyzyjnymi. Badania wykazały, że mężczyźni są bardziej skłonni do podejmowania decyzji w oparciu o oczekiwane zyski, podczas gdy kobiety częściej podejmują decyzje w oparciu o postrzegane ryzyko.

## TRAINING METHODS STRATEGIES ACROSS EUROPEAN COMPANIES

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### Abstract

A company's competitiveness is influenced by a number of factors, including the suitable training strategy. The effectiveness of a company's training strategy is significantly affected by methods of employee development, among other things. Therefore, this article focuses on which employee development methods are chosen by European companies. Based on a literature review and an analysis of secondary data, the structure of employee development methods in European enterprises is examined. The attitude of firms is analyzed in terms of the use of each method over time from 2005 to 2020 and in terms of firm size. The article provides important insights for further scientific research with regard to the necessity to select appropriate employee development methods. Matching the method with the companies' requirements can bring an effective training strategy and increase the competitiveness of European companies.

### Keywords

Corporate training; Training methods; CVTS; Employee development; Employee training.

### Introduction

Employee training is a fundamental component of organizational development, significantly impacting employee performance and organizational outcomes (Ambasz et al., 2023). Corporate training positively influences employee involvement and continuous improvement within organizations (van Assen, 2021). However, the effectiveness of training can be influenced by various factors such as participants, training methods, objectives, materials, and environment (Hidayat & Aziz, 2022). Training not only improves employee skills but also contributes to organizational effectiveness and competitive advantage (Abu Rumman et al., 2020; Alipour et al., 2009). The impact of corporate training on employee performance has been highlighted in various sectors, for example, in the retail industry (Timsal et al., 2016) and the textile industry (Adula et al., 2023). Effective training methods can enhance a company's sustainability (Bilderback, 2023).

The aim of the research is defined in the first section and is closely related to training strategies from the point of view of training methods used in European companies. In the second section of this article, different categories of training methods are mentioned, with a focus on the division between on-the-job and off-the-job methods. This attitude is aligned with the European Continuous Vocational Training Survey (CVTS) (EUROSTAT, 2023a), which is described in the section about methodology in more detail. CVTS covers almost all European countries related to employee training. Last CVTS involved 113,000 European

enterprises with more than nine employees. All findings to the three main research questions mentioned in the methodology are discussed in the section of results.

## **1 Research Subject**

This article aims to investigate the training methods for employees in European companies. It concerns company training strategy from the point of view of training methods. The choice of training methods can influence how effective the employee training will be (Hidayat & Aziz, 2022). This decision can also furthermore influence employee performance (Ambasz et al., 2023) and, therefore, the company's overall performance (Alipour et al., 2009).

## **2 Training Methods**

Enterprises help to adapt their employees to technological change while trying to provide them with a suitable working environment to make the business competitive (OECD, 2021). The pandemic has tested many companies on how they can respond to change (Urbancová & Vrabcová, 2023). There has been a significant reduction in corporate training participation due to the COVID pandemic and many companies have reduced their training activities (OECD, 2021). Corporate training can be approached from different perspectives.

### **2.1 Formal or Informal Training**

Formal training includes activities provided by schools or training organizations that are state-recognized educational institutions. The program has a specific curriculum designated and delivered by teachers (Hager, 2012). Formal education forms basic and general knowledge and skills and is mainly focused on the social development of the individual. All other educational activities are defined as informal education or informal training (Koubek, 2012).

### **2.2 General or Specific Vocational Training**

Becker (1993) distinguishes between general and specific corporate training. Competencies improved by general training could be used in different companies. Specific training is valuable only to the company that provides training. It cannot be used in another enterprise. It does not increase the productivity of the worker in another enterprise (Becker, 1993). At the same time, Becker (1993) admits that there is not a pure form of general or specific training. Specific or vocational training forms specific knowledge and skills associated with a particular job. It includes a combination of different competencies required by the enterprise (Koubek, 2012).

The European Statistical Office (Eurostat) defines continuing vocational training (CVT) in companies as

*“training measures or activities with the primary goal of acquiring new skills or enhancing existing ones. These activities should be at least partially funded by the company for their employees who have a working contract, or who directly contribute to the enterprise, such as unpaid family workers and casual workers. Persons employed holding an apprenticeship or training contract should not be taken into consideration for CVT. The training measures or activities must be planned in advance and must be organized or supported with the special goal of learning. Random learning and initial vocational training (IVT) are explicitly excluded” (EUROSTAT, 2023a).*

## 2.3 Training Strategies According to Methods

Training of employees can be delivered through various methods. Some authors categorize it into two types: on-the-job and off-the-job training (Abu Rumman et al., 2020; Alipour et al., 2009; Timsal et al., 2016). European Statistical Office (Eurostat) divides into five main training methods in European companies (EUROSTAT, 2023a). From this point of view, there are the following training methods delivered in European companies:

1. *CVT courses* – mostly separated from the active workplace with a high degree of organization (time, space, and content). The content is designed for a group of learners and is delivered by a trainer or a training institution. CVT courses are organized by the enterprises themselves, called internal CVT, or by external institutions or trainers (external CVT courses).
2. *Guided-on-the-job training* – planned activity tailored according to the learners' individual needs connected to the active workplace.
3. *Job rotation, exchanges, secondments, or study visits* – meaning a change of job or position within a company, which can be permanent or temporary.
4. *Participation in conferences, workshops, trade fairs, and lectures* is an employee training method characterized by instruction received in a formal form.
5. *Learning or quality circles* – presents meeting with colleagues from different departments characterized by the mutual exchange of knowledge within the company,
6. *Self-directed learning* – is often characterized by a degree of self-organization, such as time, space, or content, by the individual learner or by a group of learners. Include all types of e-learning, another similar form that encourages individuals to take responsibility for their learning needs to improve performance in their current job or to develop their future potential.

## 3 Methodology

This research on employee training methods in companies is based on a literature review of research articles from the Web of Science, Scopus, Research Gate and Scite databases. The original broad topic was narrowed by the following research questions:

- *What training methods are used in the European companies?*
- *Is there any difference in using training methods according to company size?*

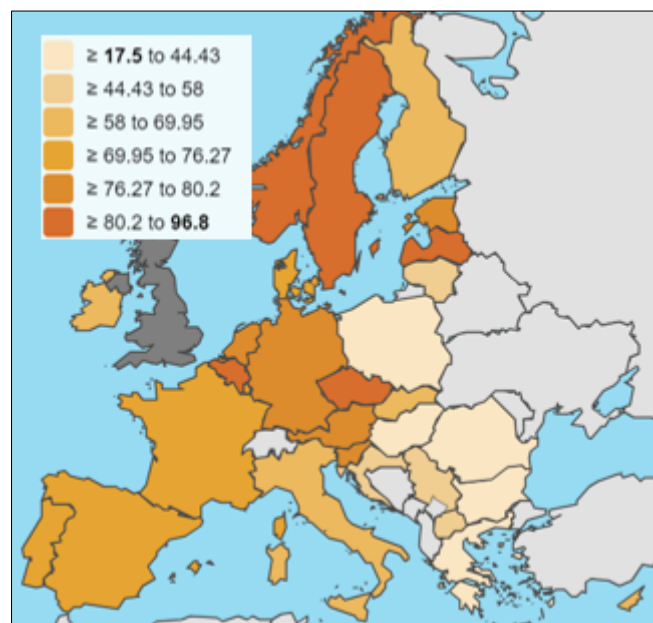
The main outputs of the literature review are mentioned in the Introduction and Chapter 2 of this article. The literature review was conducted in the context of the PRISMA method, which is an appropriate tool for scientific articles (Page et al., 2021). Using keywords, scientific articles written in English text were systematically filtered from three above-mentioned databases. Selected scientific articles were saved and investigated using Zotero software. The basis for the literature review were keywords “Employee”, “Training”, and “Method”. To answer the research questions, the literature review was extended by the secondary data analysis that provides new insight to the topic. Basic information about dataset are mentioned in the following Subchapter 3.1. All findings from literature review and secondary analysis are discussed in Chapter 4 and summed up in Conclusion.

### 3.1 Secondary Data Analysis

The Continuous Vocational Training Survey (CVTS), coordinated by Eurostat in five annual cycles, has been a long-established European survey on the topic of employee training in

European countries (EUROSTAT, 2023a). It covered 113,000 enterprises with more than nine employees from 29 European countries in 2020 in total (EUROSTAT, 2023b). The last aggregated results of the last survey, CVTS6, were published in 2022 and related to the reference year 2020 (EUROSTAT, 2022). Thanks to the long-term data collection, this survey also allows us to reflect on different strategies for employee training in European companies.

Figure 1 shows the situation of how companies in different European countries develop their employees based on CVTS6 (EUROSTAT, 2023b). The larger the number, the more saturated the color in the figure. The number represents the proportion of companies planning at least one training activity for their employees in 2020. Figure 1 shows that Latvia provided the most CVT-planned activities in Europe (96.8%), followed by Norway (93%), Sweden (91.5%), the Czech Republic (85.9), and Belgium (82.2%). The lowest percentage was in Romania (17.5%), followed by Greece (17.8%), then Hungary (37.7%), Poland (40.9%) and Bulgaria (45.1%). The average for the EU in 2020 was 67.4 % of enterprises that planned at least one training activity for their employees.



Source: Own based on (EUROSTAT, 2023b)

**Fig. 1:** Provision of training activities in European companies in 2020 according to the training intensity in enterprises in percentage

## 4 Results

The company is fully responsible for its training strategy. Following the research questions, the first subchapter of results deals with the choice of training methods used by European companies from a time perspective. The second subchapter deals with the training methods used by European companies according to different company sizes based on employed persons.

### 4.1 Training Methods of European Companies over Time

Each company can choose its strategy for training its employees (Abu Rumman et al., 2020; Alipour et al., 2009; Timsal et al., 2016). The latest results of a Europe-wide survey of 113,000 businesses showed that most companies choose the CVT course method for their employee development (EUROSTAT, 2023b).

Figure 2 shows the time evolution of the preference for the selected methods in European companies between 2005 and 2020. CVT courses are the most preferred method for employee

training. Although it has seen steady growth up to 2015, by 2020 there has been a decline from 60.2% in 2015 to 54.9% in 2020. In addition, the methods connected to conferences and workshops showed the same trend, with a decrease of 7.8% between 2015 (37.2%) and 2020 (29.4%). The decrease was significantly influenced by the COVID-19 pandemic (OECD, 2021). The other training methods have an increasing trend in corporate training between 2005 and 2020. The self-directed learning, which includes e-learning, has seen the highest growth of 9.6% in 2020 (29.1%) compared to 2015 (19.5%). However, other methods in European companies, such as job rotation, learning, or quality circles, also grew slightly. In the case of job rotation, 14.7% of companies used this method in 2020, while 13.4% of European companies used learning or quality circles.



Source: Own based on (EUROSTAT, 2023a)

**Fig. 2:** Training methods in European companies in the timeframe 2005 to 2020 in percentage

To sum it up, Figure 2 indicates the increasing diversity in the training methods of employee development in European companies. The selection of methods reflects the trend of more personalized corporate training (Chen et al., 2024). However, the question is whether this trend is the same across companies of different sizes, the answer to this second research question brings the next subchapter.

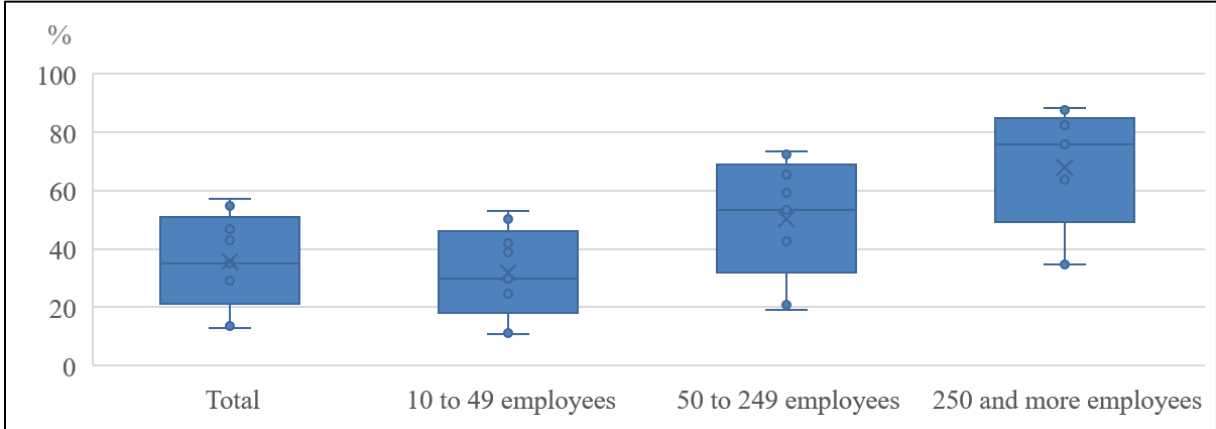
**4.2 Training Methods in Europe According to the Company Size**

The size of the company also influences the attitude of the company towards the training activities of its employees. Especially small firms, which have 10 to 49 employees, train their employees less than medium or large enterprises. In line with the findings of Maršíková et al. (Maršíková et al., 2019), small companies need to develop a strategic approach to employee training. The most frequent reasons for not training their employees are that they often consider the competencies of their employees to be sufficient or that the acquisition of new competencies of employees is solved mainly by recruitment, as shown in previous authors’ research (Trávníčková & Maršíková, 2023a).

The number of small businesses affects the overall outcomes for all businesses, which is in line with previous author research (Trávníčková & Maršíková, 2023b). Figure 3 illustrates it too. The lower quartile of total European companies is 21.25%, which means that about a fifth of 25% of all firms provide employee training. The lower quartile of small enterprises is only 18%. The upper quartile of total companies is 50.85%, and the upper quartile is 46.1% of



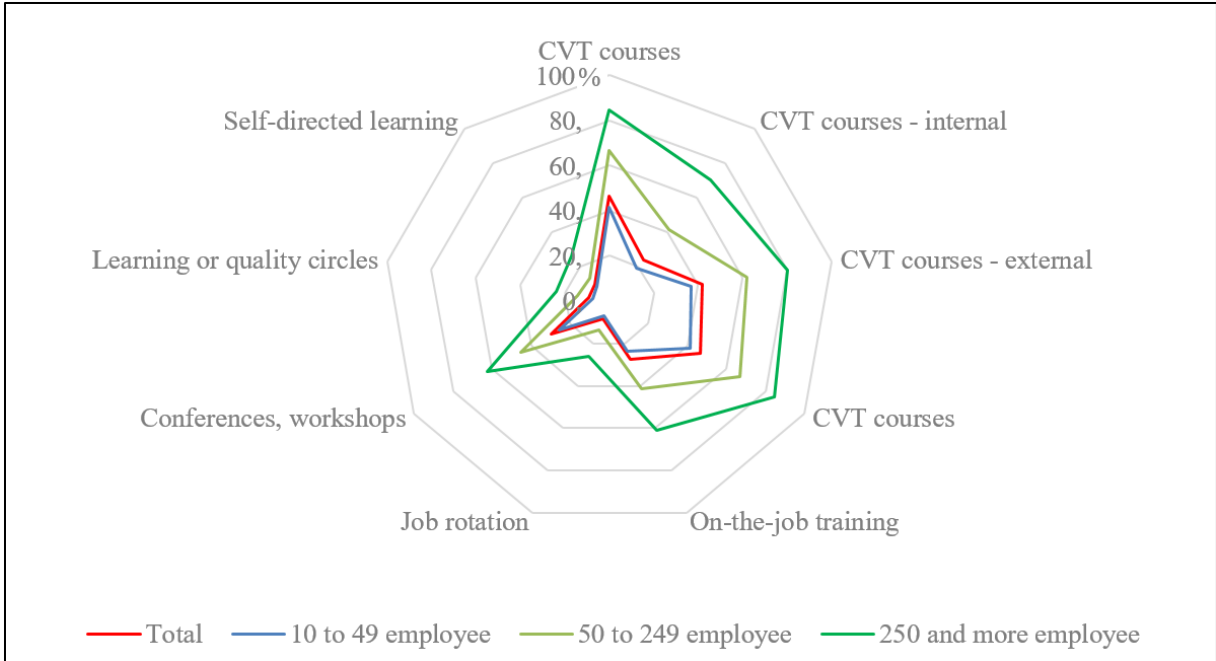
small companies. The median for all European firms is at 35%, whereas the median for small firms is at 29.9%.



Source: Own-based on (EUROSTAT, 2023a)

**Fig. 3:** Providing corporate training in European companies according to size in 2020 in percentage

Figure 3 further shows that large firms develop their employees the most. For large companies, the upper quartile was at 84.95%, and the lower quartile 49.3%. The median for large businesses was 75.8%. The top quartile of medium-sized companies was 68.86%, the bottom quartile 31.8%, and the median at 53.4%. From this perspective, medium-sized European companies provided the highest variety of employee development methods compared to small or large companies.



Source: Own-based on (EUROSTAT, 2023a)

**Fig. 4:** Training methods preference according to size in percentage

Figure 4 illustrates what employee training methods were used in different-sized European companies. The proportion of the use of each method was similar in companies of the size of small and medium-sized enterprises. However, Figure 4 shows that large companies used more internal training for their employees than small and medium-sized companies. In total, 70% of large companies used the method of internal training. This might be an inspiration for

other small and medium-sized companies. Only 41.3% of medium-sized companies and 19% of small European companies use the method of internal courses. To increase the share of this training method, small and medium-sized companies can use, for example, the competencies of new employees who can train already existing employees. As mentioned in Chapter 4.2. recruiting new employees with the required competences is one of the strategies used by small companies instead of training. After the adaptation of a new employee, the firm should extend the new competence to other employees using the internal training method. This will increase the number of firms that train even despite the fact that the firm's resources are limited and they cannot afford to train their employees from external sources.

The methods of job rotation and learning or quality circles require sufficient job vacancies and qualified staff for the training method. Job rotation was used by 26.2% of large enterprises, 13.8% of medium-sized enterprises, and 6.9% of small enterprises, so overall, only 8.5% of European enterprises, on average, used the job rotation method. The average for learning or quality circles was 7.6% for all European enterprises, with 16.2% of large enterprises using this method.

The biggest difference between large and small enterprises was in the case of planned development activities in the form of on-the-job. Large enterprises used this method intentionally in 60.9% of large companies, while only 23.8% of small companies. In total, 27.9% of all European companies used on-the-job methods.

In the case of self-directed learning, only 9.9% of European companies reported this method as a planned training activity in 2020. Again, there was an influence of small companies, where only 8.6% of small companies used this method, while over a quarter of large companies (26%) used self-directed learning. With the progressive digitalization and the availability of online learning, it is expected to increase for all companies as online learning becomes more and more available and used in companies (Armstrong, 2022).

The results presented in Figures 3 and 4 provide important information about the training methods strategies in European companies. The proportion of methods used is similar across firms of different sizes. Large enterprises stand out in the use of CVT courses, in particular in the internal form, which could be stimulating for other enterprises.

## **Conclusion**

The literature review revealed that employee development is essential for the competitiveness and sustainability of a company. The choice of training methods can influence the effectiveness of an enterprise's training strategy. Based on these findings, secondary data analysis was conducted. The source of secondary data was the European Corporate Training Survey, for which Eurostat is responsible. The advantage of this dataset is the possibility to compare the data over time, specifically between the reference years 2005, 2010, 2015, and 2020. In total, 113,000 firms with more than 9 employees participated in the last reference year 2020. The data analysis showed that the most used methods of employee development in European companies were CVT courses, which were delivered by external or internal trainers. Particularly, the small companies should strengthen their planning of internal training. They can use the competencies of new employees who can provide internal training for other employees. Moreover, only one-fifth of small companies reported guided on-the-job training as a planned development activity for their employees. The method of self-directed training, often represented by e-learning, also has great potential, which is demonstrated by the greatest increase over time in training methods in European companies.

Despite the limitations of the research and CVTS dataset, the findings show a need to focus more on the choice of training method in the company. The appropriate selection of employee

development methods will affect the effectiveness of the training strategy as well as the competitiveness of the whole enterprise. Therefore, this article provides valuable suggestions for other scientific research, such as an investigation of which employee development methods are suitable for companies and their employees.

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## METODY ROZVOJE ZAMĚŠTNANCŮ V EVROPSKÝCH PODNICÍCH

Konkurenceschopnost podniku je ovlivněna řadou faktorů, včetně vhodného výběru strategie týkající se firemního vzdělávání a rozvoje zaměstnanců. Efektivita firemní vzdělávací strategie je ovlivněna mimo jiné výběrem metody rozvoje zaměstnanců. Tento článek se tedy zaměřuje na téma, jaké metody rozvoje zaměstnanců si vybírají evropské podniky. Na základě literární rešerše a analýzy sekundárních dat je zkoumána struktura metod rozvoje zaměstnanců v evropských podnicích. Postoj firem je analyzován jak z pohledu použití jednotlivých metod z pohledu času v období 2005 až 2020, ale i z pohledu velikosti firmy. Článek přináší důležité východiska pro další vědecké zkoumání, ale i nutnost vybírat vhodné metody rozvoje zaměstnanců v souladu s potřebami firmy. Sladění těchto potřeb může přinést efektivní vzdělávací strategii, ale také zvýšit konkurenceschopnost evropských podniků.

## METHODEN DER ENTFALTUNG DER ANGESTELLTEN IN EUROPÄISCHEN UNTERNEHMEN

Die Konkurrenzfähigkeit des Unternehmens wird von einer Reihe von Faktoren beeinflusst, zu welchen die Wahl einer geeigneten Strategie gehört, welche sich auf die firmeninterne Weiterbildung und Entwicklung der Angestellten bezieht. Die Effektivität der firmeninternen Bildungsstrategie wird unter anderem von der Wahl einer Methode der Angestelltenentfaltung beeinflusst. Dieser Beitrag befasst sich mit dem Thema, was für Methoden der Entfaltung der Angestellten von Firmen im europäischen Kontext gewählt werden. Auf der Grundlage von Literaturrecherchen sowie der Analyse von Sekundärdaten wird die Struktur der Methoden der Entfaltung der Angestellten in europäischen Unternehmen untersucht. Die Analyse der Haltung der Firmen erfolgt sowohl aus der Sicht der Verwendung einzelner Methoden in Bezug auf den Zeitraum von 2005 bis 2020 als im Hinblick auf die Firmengröße. Dieser Artikel liefert wichtige Ausgangspunkte für weitere wissenschaftliche Untersuchungen, weist aber auch auf die Notwendigkeit der Auswahl einer geeigneten Methode der Angestelltenentfaltung in Übereinstimmung mit den Bedürfnissen der Firma hin. Die Harmonisierung dieser Bedürfnisse kann eine effektive Bildungsstrategie mit sich bringen, aber auch die Konkurrenzfähigkeit europäischer Unternehmen erhöhen.

## METODY ROZWOJU PRACOWNIKÓW W EUROPEJSKICH PRZEDSIĘBIORSTWACH

Na konkurencyjność przedsiębiorstwa wpływa wiele czynników, w tym odpowiedni wybór strategii dotyczącej kształcenia w przedsiębiorstwie i rozwoju pracowników. Na skuteczność strategii szkoleniowej przedsiębiorstwa wpływa między innymi wybór metody rozwoju pracowników. Niniejszy artykuł skupia się zatem na tym, jakie metody rozwoju pracowników są wybierane przez europejskie przedsiębiorstwa. Na podstawie kwerendy literatury i analizy danych wtórnych zbadano strukturę metod rozwoju pracowników w europejskich przedsiębiorstwach. Postawa firm jest analizowana zarówno pod względem wykorzystania poszczególnych metod w czasie w okresie od 2005 do 2020 roku, jak i pod względem wielkości firmy. Artykuł stanowi ważną podstawę dla dalszych badań naukowych, a także wskazuje na konieczność doboru odpowiedniej metody rozwoju pracowników zgodnie z potrzebami przedsiębiorstwa. Dopasowanie tych potrzeb może przynieść skuteczną strategię szkoleniową, ale także zwiększyć konkurencyjność europejskich przedsiębiorstw.

# Systematic Literary Research

## CREATIVE UPCYCLING PROJECTS IN SUPPORT OF THE GREEN DEAL FOR EUROPE

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### Abstract

The circular economy plays an important role in delivering on the commitment set out in the Green Deal for Europe. One of its key priorities is plastics - an important material that is ubiquitous in the economy and everyday life due to its functions. The production, use, and consumption of plastics have a negative impact on the environment, generating greenhouse gas emissions and reducing the supply of non-renewable raw materials. The change towards a circular economy, which is intended to preserve the value of products and materials for as long as possible, is to be supported by a hierarchy of waste management methods. The priority is waste prevention, while reuse and recycling are other appropriate ways. The paper presents how the Liberec Region is managing to meet the commitments of the Green Deal for Europe. Every individual can contribute to the implementation by changing their thinking and creative approach. An example is the upcycling of a plastic bottle, where the bottle is not perceived as waste but as a material for creating a new product with a higher use value.

### Keywords

Circular economy; Education; Plastics; Upcycling; Waste; Workshop.

### Introduction

The transition to a circular economy is one of the prerequisites for achieving the objectives set out in the Green Deal for Europe. The circular economy is intended to reduce the amount of waste produced, avoid wasting scarce raw material resources and thus contribute to reducing greenhouse gas emissions. Contributing to these goals needs to start with the involvement each of individual, which requires education and awareness-raising to promote the spread of sustainable waste management practices. Projects aimed at the general public can be used as an effective tool, not only to disseminate knowledge of the principles of circular waste management, but also to promote a creative view of waste as a resource and opportunity, and to provide practical training in upcycling waste, where waste is turned into a product with new or higher use value. The article presents a project focused on the upcycling of plastic beverage containers, which is implemented at the Faculty of Economics of the Technical University of Liberec, and the benefits that similar projects can provide.

## 1 Circular Economy in Support of the Objectives of the Green Deal for Europe

The Green Deal for Europe represents a political commitment by the European Union to reduce net greenhouse gas emissions to zero by 2050 and become the first climate-neutral

continent. The sub-target is to reduce greenhouse gas emissions by 55% compared to 1990 (European Commission, 2019). The circular economy is a key enabler for achieving these goals. It is a framework of systemic solutions that address global challenges such as climate change, biodiversity loss, waste and pollution (Ellen MacArthur Foundation, 2023). The circular economy is an alternative to the current linear management principle, which is based on disposable consumption, stimulates consumers to consume more and more, requires the constant use of non-renewable resources and creates unnecessary waste that ends up in landfills. The circular economy aims to preserve the value of products, materials and resources for as long as possible and includes measures such as reducing energy and resource consumption, preventing waste, designing products with minimal waste and extending the life of products and materials in closed cycles (Kirchherr et al., 2017). This approach is based on the principle of renewal and regeneration (Geisendorf & Pietrulla, 2018) and mimics natural cycles (Hofstetter et al., 2021). The transition to a circular economy requires the full integration of sustainable and circular thinking in all areas, including policies, products, production processes and business models.

The waste hierarchy concept provides a guide for the order of waste management activities (Price & Joseph, 2000). The general waste hierarchy has five stages, from the most preferred actions in terms of efficiency and environmental impact to the least preferred, and includes prevention, reuse, recycling, recovery and disposal (European Commission, 2018a). Prevention involves the reduction of waste production, while reuse focuses on extending the useful life of products before they enter the waste stream. Recycling involves converting waste materials into new products, while recovery refers to extracting energy or resources from waste. Disposal, such as landfilling, is considered the least desirable option and is usually used for waste that cannot be managed by other methods.

In terms of the waste hierarchy, waste prevention is the first priority, which should result in a reduction in the volume of waste produced and the consumption of non-renewable resources and greenhouse gas emissions.

It is best to avoid the generation of waste, hence the emphasis on waste prevention and product reuse in the waste hierarchy. Recycling and composting are other ways of managing waste. This is followed by incineration to generate energy, and at the very end of the appropriate methods is landfilling, which is considered the least appropriate method of waste management in terms of its impact on the environment and human life, yet it is still one of the cheapest options.

Plastics are an important material for their functions, widely used in the economy and everyday life, but the way they are currently produced, used and disposed of is damaging to the environment. Plastics raise environmental concerns, including littering, the difficulty of reuse and recycling, greenhouse gas emissions and resource use. Therefore, plastics are one of the key priorities of the circular economy (European Commission, 2018b). The aim is to move towards a circular economy that includes recycling, reuse and minimizing waste and resource use. The focus should be on preventing plastic waste and promoting the reuse and recycling of plastics. In Europe, the most common way of managing plastic waste is through energy recovery, but the potential of recycling plastic waste is not being exploited. Only about 30% of plastic waste is recycled, reuse is low and about a quarter of all plastic waste generated is landfilled (European Commission, 2018b). The European Commission has committed to making all plastic packaging recyclable by 2030.

Concrete actions and strategies need to be adopted to promote a circular economy for plastics and contribute to sustainable development and environmental protection (European Commission, 2018b).



## 2 Hierarchy of Municipal Waste Management

Municipal waste is defined as waste from households and other sources such as retail, administration, education, health, accommodation and food services and other services and activities that is similar in nature and composition to household waste (European Commission, 2018a). It represents approximately 7 to 10% of the total waste generated in the European Union. The management of this type of waste is one of the most complex, as it is a waste with a very complex and variable composition. Waste is generated in close proximity to citizens, is visible to the public and has an impact on the environment and human health. An efficient system of collection, sorting, monitoring of waste flows and financing is necessary for the management of municipal waste. The quality of the municipal waste management system is indicative of the quality of the overall waste management system in a country and the achievement of recycling targets (European Parliament, 2018a).

The common EU objectives of the Waste Framework Directive (European Commission, 2018a), the Packaging and Packaging Waste Directive (European Parliament, 2018b) and the Landfill Directive (European Parliament, 2018c) are to accelerate the transition to a circular economy and deliver environmental, economic and social benefits (European Commission, 2018a) are as follows:

1. Recycle 65% of municipal waste by 2035, with sub-targets of 55% by 2025 and 60% by 2030 (European Commission, 2018a).
2. Recycle 70% of packaging waste by 2030, with a sub-target of 65% by 2025 (European Parliament, 2018a).
3. Reduce landfilling to no more than 10% of municipal waste by 2035 (European Parliament, 2018c).

According to the Commission's 2023 report (European Commission, 2023), the Czech Republic is one of the nine Member States that are on track to meet the municipal and packaging waste recycling targets (European Commission, 2023). Increased efforts are needed to address the still-distant target of the proportion of waste going to landfill.

The share of material recovery of municipal waste in 2021 was 38% in the Czech Republic, while in the Liberec Region, it was 43%. As regards recycling of packaging waste, the recycling rate for the Czech Republic in 2021 was 68%, while the Liberec Region recycled only 44% of packaging waste. A significant share of municipal waste is plastic waste, which is difficult to recycle (Cenia, 2021, Liberecký kraj).

The complex design often hinders recycling and contributes to high sorting losses during processing. Moreover, the Commission's assessment (European Commission, 2023) shows that current collection systems often capture only a very limited proportion of plastics from municipal waste. To increase the recycling rate of plastic waste, it will be necessary to promote new designs for recyclable packaging, improve the efficiency of separate collection systems for plastics as well as introduce a payment system to incentivize operators to sort at the source.

One of the sustainable approaches to waste management is also upcycling which involves reusing waste materials, repairing, and reprocessing to avoid disposal (Caldera et al., 2022). It brings environmental benefits and advantages compared to conventional approaches (Igalavithana et al., 2022). Upcycling reduces the volume of waste, saves energy and water, reduces greenhouse gas emissions by extending the life of materials, and avoids the use of other valuable natural resources. Upcycling helps to create a circular economy where materials can be continuously reused instead of turning into waste. It can be applied to

different types of waste, including plastic waste (Wang et al., 2021). According to Eriksen et al. (2019), by exploiting the specific properties of plastic bottles, it is possible to maximize the value of the recycled material.

Upcycling encourages creativity in finding ways to use waste materials for new, unique and useful products, and can help reduce production costs through the use of waste materials and support local businesses. Governments, industries and businesses should work together to promote and implement upcycling technologies in waste management programs. However, further research, investment and supportive policies are needed to fully exploit the potential of upcycling in waste management.

### **3 Raising Public Awareness of Waste Management through Creative Upcycling Projects**

Starting with small upcycling projects is one way to introduce the general public to sustainable ways of waste management and to build their confidence in the principles of circular economy and sustainable development of society. Appropriate communication with citizens (European Commission, 2018a) and environmental education and training significantly impact public awareness of this issue, contributing to behavioral change in waste management (Sokolíková & Andreska, 2021) and thus increasing the efficiency of separate waste collection systems.

#### **3.1 Creative Upcycling of Plastic Beverage Containers**

Creativity, i.e. the ability to discover new opportunities, develop creative ideas and adapt to a changing environment (Cropley, 2020), combined with education and awareness raising on how the circular economy works, promotes a new view of waste as a resource and an opportunity. It encourages individuals to take a proactive approach to sustainable waste management. Workshops on creative upcycling of plastic beverage packaging, where participants learn to create useful products with higher or new use value from plastic waste, support the development of participants' creativity and skills and can also become the basis for their future entrepreneurial activities.

The claim that upcycling plastic bottles is a creative activity that benefits the environment and society can be verified in the literature. Widiati (2021) shows how upcycling plastic bottles can create new useful items such as pencil cases or pencil stands and reduce waste. Sapada & Mawardah (2023) implemented a project focusing on the creative processing of plastic waste in a selected community. The project had both environmental benefits for the local community, as it helped to effectively reduce the amount of plastic waste and change the perception of waste as a resource, and economic benefits, as it contributed to the creation of new jobs and improved the living standards of the residents. According to the results of this project, the introduction of innovative approaches to waste management is important not only for environmental sustainability but also for socio-economic development.

#### **3.2 Potential Benefits of Upcycling Projects for the General Public**

Experience from abroad shows that to promote environmentally friendly activities, recycling and waste prevention in line with the concept of circular economy, it is advisable to actively involve the wider community and entire families.

Involving all family members in upcycling projects is a great way to create a culture of waste reduction and encourage each family member to think creatively about reusing waste materials. This activity can reinforce awareness of the importance of protecting the

environment and encourage cooperation and teamwork within the family and the wider community actions that each individual can take to achieve these goals.

Donating or selling upcycled products is a great way to reduce waste and promote sustainability awareness. Alternatively, these items can be sold online through platforms that allow the sale of handmade and upcycled products. In this way, it is not only possible to reduce waste but also to promote sustainable trade and economy.

### 3.3 Creative Upcycling Project “KUTIL”

At the Faculty of Economics of the Technical University of Liberec a project called “KUTIL” is underway. The designation of the “KUTIL” project is an acronym for the full name “Creativeness for the Sustainable Life of the Planet” in the Czech language. At the same time, the word KUTIL means DIY person and this acronym expresses the essence of the course, i.e. to create something new with your own hands from waste and think about how to value this new product.

The project promotes creative creation, and entrepreneurial thinking and introduces participants to the basics of a systematic approach to circular economy through practical workshops focused on upcycling plastic beverage containers. The intention is to combine the topics of circular economy, and creative management techniques for problem-solving with the creation of their own original product from plastic beverage packaging. The purpose of the project is to offer interested participants a space for their own creation in the context of sustainable development, but also to evaluate the possibilities of applying the created product on the market.

The workshops are intended for the general public and are suitable for high school and university students, seniors and entire families. The timing of the workshop can be adapted to the participants and their time possibilities, the minimum is 4 hours.



Source: Own

**Fig. 1:** Sample product from a plastic bottle

In the first part of the workshop, participants will gain an understanding of the concept of circular economy, the perception of waste as a resource and sustainable waste management with a focus on upcycling plastic beverage containers. Creative management techniques based on free association are used to foster the participants’ creativity, e.g. group elaboration of a

mind map on a current topic related to plastic waste. In the next part of the workshop, participants learn about the tools and components needed to upcycle a plastic bottle and watch a practical demonstration of the material processing process. For inspiration, participants can see specific products that have been created by upcycling a plastic bottle, photos of the products (see Figure 1), or workflows.

In the second part of the workshop, participants will try working with the material themselves and create their own original product. Making a piece of jewelry out of a plastic bottle, a lampshade or a stationery case are simple projects that can be easily completed and further developed. In this part of the workshop, participants will get the basic information needed to prepare a business plan and price the product, which they will then use to prepare the basic framework of their business plan. At the end of the workshop, participants present their business plans.

The benefit of the project is the use of beverage containers to produce products that have artistic and economic value, helping to develop creativity and entrepreneurial spirit. The project raises awareness of sustainable waste management practices, how to prevent waste and how to reduce unused waste. The benefits are mainly in the area of education and awareness raising, but in the long term it can also contribute to improving the quality of life and the quality of the environment.

## Conclusion

Everyone can contribute to the goals of the Green Deal for Europe, which focuses on sustainable development and environmental protection, and the related goals of the circular economy by changing their mindset and being creative. By integrating upcycling into household waste management it is possible to reduce waste, save resources and promote creativity and innovation.

Involving the individual or the wider community in upcycling projects can be seen as the first step towards finding new solutions for waste management. The development and implementation of upcycling technologies, innovative materials and products require further research, investment and collaboration between different stakeholders (Roy et al.,2021). Businesses can integrate upcycling into their industrial processes and production chains (Caldera et al., 2022), closing the circle of the circular economy and achieving better waste management results. There is a need to prepare an environment and regulations that encourage and support upcycling practices (Caldera et al.,2022). Addressing waste-related issues can be seen in a broader context as an opportunity for economic competitiveness, can spur economic growth, job creation and innovation, and help achieve climate neutrality in Europe.

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## PROJEKTY KREATIVNÍ UPCYKLACE NA PODPORU ZELENE DOHODY PRO EVROPU

Významnou roli v plnění závazku uvedeného v Zelené dohodě pro Evropu hraje oběhové hospodářství. Jednou z jeho klíčových priorit jsou plasty – důležitý materiál, který je díky svým funkcím všudypřítomný, jak v ekonomice, tak v běžném životě. Výroba, používání a spotřeba plastů má negativní vliv na životní prostředí, vznikají emise skleníkových plynů, snižují se zásoby neobnovitelných surovin. Změnu směrem k oběhovému hospodářství, které má přinést zachování hodnoty produktů a materiálů po co nejdelší dobu, má podpořit dodržování hierarchie způsobů nakládání s odpady. Na prvním místě je prevence vzniku odpadů, která se projeví ve snížení objemu produkovaného odpadu, další vhodné způsoby jsou znovupoužití a recyklace. V příspěvku bude uvedeno, jak se daří v Libereckém kraji plnit závazky Zelené dohody pro Evropu. K plnění může přispět každý jednotlivec změnou myšlení a kreativním přístupem. Příkladem může být upcyclace plastové lahve, kdy lahev není vnímána jako odpad, ale jako materiál pro tvorbu nového výrobku s vyšší užitnou hodnotou.

## KREATIVE UPCYCLING-PROJEKTE ZUR UNTERSTÜTZUNG DES GREEN DEAL FÜR EUROPA

Die Kreislaufwirtschaft spielt eine wichtige Rolle bei der Erfüllung der im Green Deal für Europa eingegangenen Verpflichtungen. Eine ihrer wichtigsten Prioritäten sind Kunststoffe – ein wichtiges Material, das aufgrund seiner Funktionen in der Wirtschaft und im Alltag allgegenwärtig ist. Die Herstellung, die Verwendung und der Verbrauch von Kunststoffen haben negative Auswirkungen auf die Umwelt, da sie Treibhausgasemissionen verursachen und die Versorgung mit nicht erneuerbaren Rohstoffen verringern. Der Wandel hin zu einer Kreislaufwirtschaft, die darauf abzielt, den Wert von Produkten und Materialien möglichst lange zu erhalten, soll durch eine Hierarchie der Abfallbewirtschaftungsmethoden unterstützt werden. Vorrangig ist die Abfallvermeidung, während Wiederverwendung und Recycling andere geeignete Wege sind. Dieser Beitrag stellt dar, wie die Region Liberec die Verpflichtungen des Green Deal for Europe erfüllt. Jeder Einzelne kann zur Umsetzung beitragen, indem er seine Denkweise und seinen kreativen Ansatz ändert. Ein Beispiel ist das Upcycling einer Plastikflasche, bei dem die Flasche nicht als Abfall, sondern als Material für die Herstellung eines neuen Produkts mit höherem Nutzwert betrachtet wird.

## KRETYWNE PROJEKTY UPCYKLINGOWE WSPIERAJĄCE EUROPEJSKI ZIELONY ŁĄD

Gospodarka o obiegu zamkniętym odgrywa ważną rolę w realizacji zobowiązań określonych w Europejskim Zielonym Łądzi. Jednym z jego kluczowych priorytetów są tworzywa sztuczne - ważny materiał, który jest ze względu na swoje funkcje wszechobecny w gospodarce i życiu codziennym. Produkcja, wykorzystywanie i zużycie tworzyw sztucznych mają negatywny wpływ na środowisko, ponieważ produkują emisje gazów cieplarnianych i zmniejszają zasoby surowców nieodnawialnych. Przejście na gospodarkę o obiegu zamkniętym, której celem jest zachowanie wartości produktów i materiałów przez jak najdłuższy czas, ma być wspierane przez hierarchię metod gospodarowania odpadami. Priorytetem jest zapobieganie powstawaniu odpadów, natomiast kolejnymi wskazanymi sposobami są ponowne użycie i recykling. W artykule przedstawiono, w jaki sposób w regionie libereckim udaje się pełnić zobowiązania Europejskiego Zielonego Łądu. Każda osoba może przyczynić się do ich realizacji poprzez zmianę swojego sposobu myślenia i kreatywne podejście. Przykładem jest upcykling plastikowych butelek, gdzie butelka nie jest postrzegana jako odpad, ale jako materiał do stworzenia nowego produktu o wyższej wartości użytkowej.

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