

**THE IMPACT OF FINANCIAL PERFORMANCE OF COMPANIES
ON THE EXTENT OF DIGITALIZATION IMPLEMENTATION
IN HRM****Stacho Z., Krynke M., Vadkertiová A., Hamar M., Hegedús E.***

Abstract: The study presented in this article expands the knowledge base regarding the implementation of digital innovations and gamification in Central and Eastern European businesses and their potential positive influence on people management efficiency. Furthermore, there are highlights of the relationship between positive economic outcomes and the tendency to invest more in innovative strategies, as their effective implementation and execution might require certain financial and personnel resources. The findings and deductions expounded within this contribution emanate from an examination of a research specimen (n=1112 in 2020 and n=1109 in 2021) encompassing feedback acquired from managers of enterprises operating within the economic domain of Central and Eastern Europe. Based on the evaluation of the survey results, it can be argued that companies with positive economic results achieve higher values both in the indicator of utilizing as well as perceptions of the importance of implementing innovative tools in the near future.

Keywords: human resources management, digital innovations, gamification, virtual reality

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Introduction

In establishing and maintaining collaborative work teams and team cohesion, which represent notable attributes of successful enterprises, HR specialists and managers

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encounter various challenges. These challenges are influenced by multiple factors (Fidalgo-Blanco et al., 2019), including the degree of globalization in the business environment, the increasing significance of Industry 4.0 (Jahanger et al., 2022; Tortora et al., 2019), the impact of global pandemic conditions (Nicola et al., 2020), and the diversity of local cultures, values, and employee attitudes (Rozkwitalska et al., 2017). These aspects gain even greater complexity within the context of intergenerational differences as organizations operate and collaborate with up to four distinct generations—Baby Boomers, Generation X, Generation Y, and Generation Z (Betz, 2019)—each characterized by their unique communication style, approach to work, privacy, expectations, and values.

In the context of Industry 4.0, an agile management approach is being cultivated (Cooper, 2019), wherein enterprises employ modern technologies and digital tools for swifter and more efficient control of their processes and resources. The agile approach entails organizations being capable of flexibly responding to changes and innovating in real-time (Sjödín et al., 2018), a vital asset in a dynamic environment (Tronvoll et al., 2020) where companies must adapt to rapid market changes and competitive pressures. Such an approach also encourages collaboration and interaction among various departments and team members, augmenting effectiveness and enhancing coordination across the enterprise (Noguera et al., 2018). This approach can be a suitable model for preempting issues stemming from uncertainty and swift transformations, as it involves continual team formation centered around addressing defined tasks and necessitates a stronger focus on team cohesion, collaboration, and communication. Additionally, the job market is being infiltrated by Generation Z, individuals born between 1997 and 2012, who grew up in a digital technology and internet-driven environment (Betz, 2019; Dorsey and Vila, 2020). Consequently, this generation tends to possess adeptness in working with technologies and anticipates modern and innovative solutions from their employers.

To maintain or increase competitiveness, it becomes vital for companies to be able to react in the context of technological changes. However, since investments in this type of innovative tools can require considerable resources, the authors of this paper decided to find out whether the digital revolution and its accompanying effects will be implemented in the context of the efficiency of business management in the previous period.

Literature Review

Gamification in people management and the gaming industry are closely intertwined and are becoming increasingly vital within Industry 4.0 (Siala et al., 2020; Stacho et al., 2023). Gamification fundamentally involves incorporating gaming elements and techniques into various aspects of life, including people management. In the business environment, gamification motivates employees to achieve goals, enhances collaboration and teamwork, improves customer experience, and more.

The gaming industry and digital games offer a plethora of ideas and techniques that can be applied to gamification in business (Siala et al., 2020). For instance, a player is motivated to improve, overcome obstacles, and achieve objectives in a game. Similarly, gamification is used in business (Lorincova et al., 2022) to motivate employees to attain set goals and enhance performance. Within the context of Industry 4.0, gamification in people management and the gaming industry is crucial for developing an agile management approach and increasing production efficiency. Gamification can aid in achieving higher engagement (Stacho et al., 2022; Junsawang et al., 2022) and productivity among employees, key components for Industry 4.0 objectives. Digital games also provide innovative solutions that can be applied in enterprises, such as virtual reality, which allows for real-time simulations and training.

Empirical studies exploring psychological aspects of e-sports conducted between 2000 and 2017 (Bányai et al., 2019) suggest that, for peak performance, players must be capable not only of adapting to opponents but also of effectively communicating with teammates, building trust (confidence in abilities), developing individual and team skills, and setting various goals (short-term and long-term) (Himmelstein et al., 2017). These insights showcase the appeal of e-sports for Generation Y, Z, and Alpha and their potential use in motivating and engaging employees, contributing to organizational adaptation.

As another digital element, virtual reality can be harnessed within HR for novel training (Zahabi et al., 2020) and employee development methods. Employees can be placed in virtual environments where they can practice various skills and gain experience in simulated scenarios that might not frequently occur in real life or are too costly to create. This provides them with experience and training in a safe environment without the risks of mistakes.

Furthermore, virtual reality can be utilized in recruitment processes (Zertuche et al., 2020), where potential employees could be immersed in virtual simulations of their future workplaces, giving them insight into the skills they need to master. It can also prove valuable for remote work or teleconferencing (Sasikumar et al., 2021), enabling employees to join a virtual environment and collaborate with colleagues worldwide as if they were physically present in the same room. VR applications can enhance employee productivity, foster skill development, and increase satisfaction, positively impacting overall performance.

Enhanced digital capabilities are increasingly pivotal in achieving results that reflect companies' strategic objectives. The ability to tackle complex supply chain challenges, innovate, facilitate hybrid distributed workforces, and continuously enhance virtual and real customer experiences increasingly relies on digital possibilities (Schräge et al., 2022). Ferrari and Rocca (2010), in their study, attempted to explain the connection between innovation and performance using a statistical model. Data considered were derived from a survey of Unicredit Group companies from 2004 to 2006, covering Italian manufacturing firms. The study revealed a weak but significant relationship between ROA and innovation.

Numerous studies conducted so far analyze the impacts of various innovation types on firms' and entire economies' economic performance (Wang et al., 2021; Capello and Lenzi, 2019). Research has also focused on the value and attitudinal differences among generations in the job market and employee motivation (Hitka et al., 2021; Kupec, 2020; Taha et al., 2020; Matúšová, 2021). Within the realm of industrial revolution and human resources, the changes in job competencies and roles have been explored (Tokarčíková et al., 2020; Olexova and Sudzina, 2019; Blštáková et al., 2019). However, an overview of the current utilization of digital tools in human resource management processes is lacking. The studies presented in this article expand the knowledge base regarding the implementation of digital innovations and gamification in Central and Eastern European businesses and their potential positive influence on people management efficiency. Furthermore, they highlight the relationship between positive economic outcomes and the tendency to invest more in innovative strategies, as their effective implementation and execution might require certain financial and personnel resources.

In light of the above, the authors of the contribution have established the following research questions:

- To what extent do organizations utilize gamification elements, digital interaction platforms, and virtualization in Human Resource Management (HRM) functions?
- Is there a relationship between a company's economic performance and its willingness to invest in innovative digital solutions?
- Is there a growing trend in the extent of utilization of these variables?
- Does a positive experience with utilizing gamification elements, digital interaction platforms, and virtualization in HRM functions motivate higher expectations in the near future?

Derived from the research questions, the authors postulated the subsequent hypotheses:

- Hypothesis 1: Companies achieving positive economic results have a higher rating of the current use of digital interaction platforms and virtualization elements in human resources functions than companies that do not achieve positive economic results.
- Hypothesis 2: Companies utilizing gamification elements in HR features show higher future status ratings than companies that don't.
- Hypothesis 3: Companies utilizing digital interaction platforms in HR functions show a higher assessment of expected future status than companies that do not use digital interaction platforms.
- Hypothesis 4: Companies utilizing virtual reality tools in HR functions show higher ratings of expected future status compared to companies that don't use virtual reality tools.

Research Methodology

The foundational research framework employed for the purpose of this contribution consists of a systematic study of literature and research works, followed by a critical evaluation of the acquired information and its relevance to the research questions. The authors utilized electronic scientific databases such as EBSCO HOST Research Databases, SCOPUS, Web of Knowledge, and Web of Science as primary sources for obtaining theoretical information.

Data necessary for processing this contribution were obtained through a research tool aimed at assessing the current level of implementation of digital tools and gamification elements in human resource management, as well as expectations for implementation in the near future. A comprehensive questionnaire survey was conducted to map trends in human resource management due to the digital transformation of companies.

Table 1. Questions from the questionnaire used to represent research results

To what extent do you apply modern tools and concepts in the human resources management system in the company?					
	1	2	3	4	5
People management functions use gamification (elements of playful principles)	We do not apply	We are not applying yet; we	I cannot judge the true situation	We apply partially	We apply completely
People management functions use virtualization					
Digital interaction platforms, networking					
How do you perceive the importance of modern tools and concepts in the human resources management system for the future of the company?					
	1	2	3	4	5
People management functions use gamification (elements of playful principles)	Immaterial	Rather irrelevant	I cannot evaluate the	Rather important	Important
People management functions use virtualization					
Digital interaction platforms, networking					

The distribution of the questionnaire and data collection took place via the Google Forms platform from January to September 2020 and subsequently from March to December 2021 within the economic environment of Central and Eastern Europe. Respondents/companies evaluated the extent of actual application/presence of the observed attributes in corporate practice and also the perceived importance level for the company's future. This level was rated on a scale from 1 to 5, where 1 represented the lowest achieved level or the lowest level of future relevance of the studied phenomenon, and 5 represented the highest. The survey questions were thematically

focused on modern tools and concepts in the human resource management system within companies related to the advent of Industry 4.0.

The findings and deductions explained in this paper are based on a research sample review incorporating feedback from delegates of enterprises operating in the CEE economic area. The composition of the respondent structure took into account the criterion of the size of the company based on the number of employees to achieve a double-digit number of representatives in different size categories. The authors of this paper are members of an international research consortium of 55 researchers from Europe. As part of the research carried out by this research network, a total of more than 3,000 managers from private sector companies operating in Central and Eastern Europe were interviewed, responsible for the management and development of human resources in the company. The selection of respondents within each country was random. In the context of the study carried out by the authors of this paper, a series of surveys were carried out on a cumulative cohort of more than 1550 managers (both in 2020 and 2021) representing entities in the private sector. Out of a total of 1,552 requested companies, 2020 witnessed the comprehensive completion of 1,112 questionnaires, yielding a participation rate of 72%. Accordingly, in 2021, out of 1,558 requested companies, 1,109 questionnaires were carefully completed, yielding a participation rate of 71%. The specific demographics of respondents, categorized by labour force size, business domain and prevailing ownership structure, are defined in Table 2.

Table 2. Demographic Composition of Participating Respondents in the Study

Number of companies by size (number of employees):	2020	2021
1-9	324	326
10-49	242	244
50-249	243	243
250 and more	303	296
Number of companies by industry sector:	2020	2021
Industry	363	362
Services	493	500
Other	256	247
Country	2020	2021
Slovakia	264	246
Poland	95	89
Czechia	208	194
Hungary	74	90
Latvia	98	85
Lithuania	97	103
Ukraine	74	91
Romania	108	99
Bulgaria	94	112
Total	1112	1109

Source: Own elaboration

To evaluate the established hypotheses, the authors chose the nonparametric one-way analysis ANOVA Kruskal-Wallis to test the dependence between the current and expected state of the investigated instruments and their economic results. In the case of revealing significant relationships, the Holm correction was used to control the level of statistical significance. The parametric Pearson's correlation test (r) was employed to statistically assess individual correlations.

Research Results

Many studies conducted so far have analyzed the impacts of various types of innovations on the economic performance of companies. However, the authors of this study examine the relationship between positive economic results and the tendency to invest more in innovative strategies. For this reason, they focused on determining the relationship between a company's financial performance and its inclination to utilize digital interaction platforms and virtualization in HR functions (Figure 1).

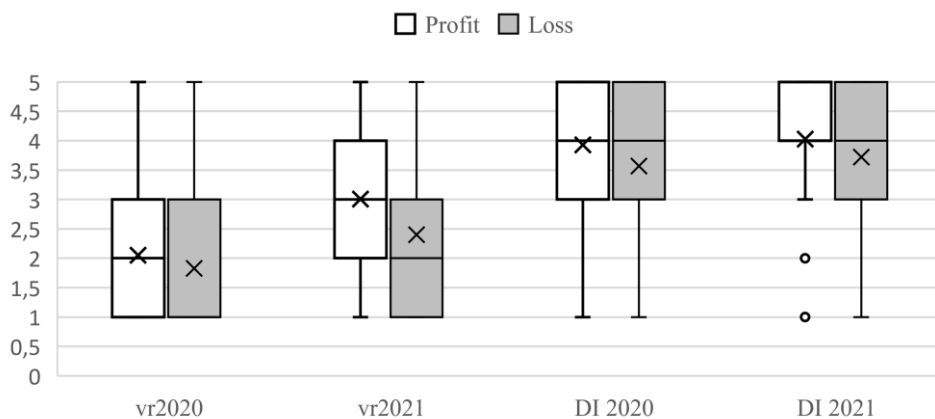


Figure 1: Relationship between Company's Economic Performance and Willingness to Invest in Innovative Digital Solutions in HR

In the questionnaire, the respondents answered the question of the overall economic result, where they chose from the options profit (positive economic result) or loss (negative economic result). The verification of hypothesis 1 was assessed in relation to the respondents' answers to this question. Based on the evaluation of responses to the research question, "Is there a relationship between a company's economic performance and its willingness to invest in innovative digital solutions?" (see Figure 1), it can be concluded that companies with positive economic results in both observed years achieve higher values in both the indicator of virtual reality utilization in human resource management tools (2020: profitable \bar{X} 2.05 / loss-making \bar{X} 1.82; 2021: profitable \bar{X} 3.00 / loss-making \bar{X} 2.39) and in the utilization

of digital interaction tools among employees (2020: profitable Ø 3.92 / loss-making Ø 3.56; 2021: profitable Ø 4.02 / loss-making Ø 3.72).

Hypothesis 1 (H1): In identifying the relationship between the economic result and evaluating the current state of the investigated instruments, the authors found through a nonparametric comparison of Kruskal-Wallis ANOVA that the economic result had a small but significant impact on the evaluation of digital interactions, $H(1) = 21.173$, $p < .001$, $\eta^2_H = .021$. In several comparisons, it was found that companies making profits η^2_H ($p_{Holm} < .001$), showed significantly higher ratings than loss-making companies. There was also a marginal but significant impact of economic results on the use of virtualization, $H(1) = 8.849$, $p = .012$, $\eta^2_H = .009$. While profit-making and loss-making companies (η^2_H $p_{Holm} = .008$) differed significantly, profit-making companies had higher ratings. Thus, based on this result, it is possible to confirm the H1 hypothesis: Companies that achieve positive economic results have a higher rating of the current use of digital interaction platforms and virtualization elements in human resources functions than companies that do not achieve positive economic results.

As part of the survey, the authors also investigated whether organizations utilize gamification elements in HR functions or expect a higher utilisation level shortly.

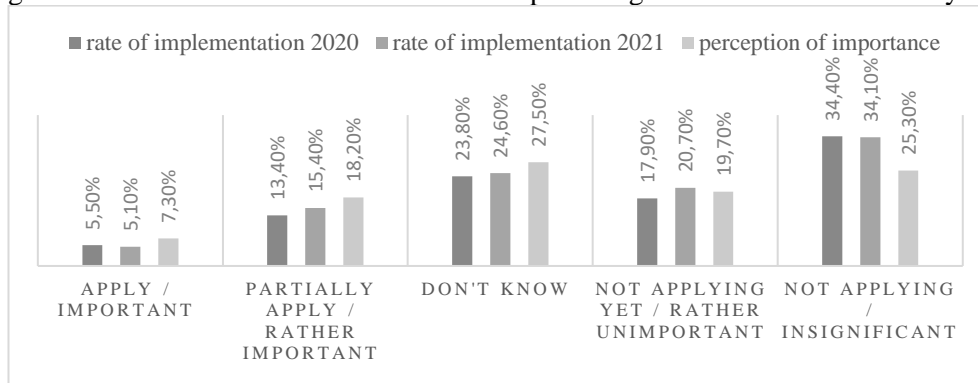


Figure 2: Utilization of Gamification Elements in HR Functions

Findings indicate that companies in Central and Eastern Europe currently utilize gamification elements relatively sparingly within HR activities, as only approximately 5% of respondents declare their complete utilization. However, 7.3% of respondents perceive these elements as important, and 15.2% of respondents consider them somewhat important. When comparing results between the two years, there is a noticeable shift towards a higher level of implementation. Based on these findings, it can be assumed that the utilization of these elements will increase in the future.

Hypothesis 2 (H2): The Pearson correlation test results indicate a statistically significant relationship between companies utilizing gamification elements in HR functions and companies that expect a higher utilisation level in the future, as the

variable correlates at the significance level $\text{sig.} = 0.01$ with a Pearson correlation coefficient value of $r = 0.617$, the desired significance level was achieved. Based on the above, this hypothesis was not rejected, and it is possible to confirm a moderate relationship between the analyzed variables.

In the following question, the researchers aimed to determine the level of implementation of digital interaction platforms within HR and how the importance of these platforms for the competitiveness of companies in the future is perceived.

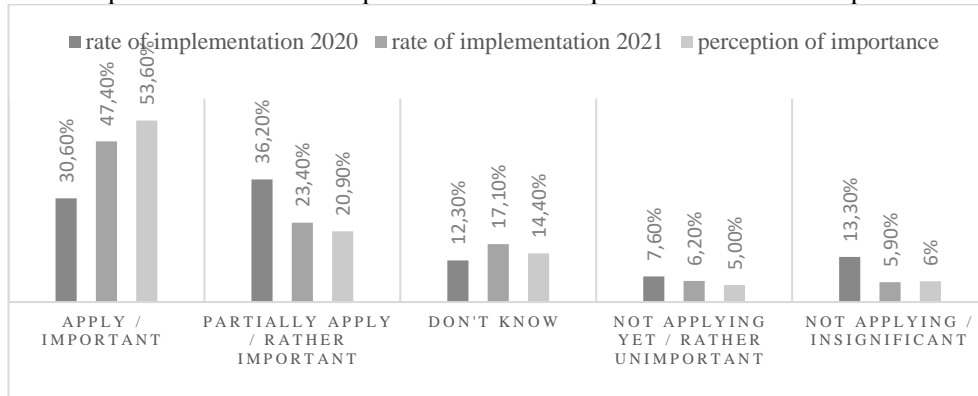


Figure 3: Utilization of Digital Interaction Platforms in HR Functions

Based on the evaluation of responses to this question, it can be argued that the implementation of digital interaction tools during the pandemic has reached a significant level, with nearly 70% of organizations partially or fully applying these tools. The most notable shift occurred in partial and complete implementation. Considering the results in the realm of perceived importance, it is presumed that the implementation rate of these tools will continue to grow in the future.

H3: The Pearson correlation test results indicate a statistically significant relationship between organizations implementing digital interaction tools in HR functions and those expecting a higher utilisation level in the future. Since this variable correlates at a significance level of $\text{sig.} = 0.01$ with a Pearson correlation coefficient value of $r = 0.988$, the desired significance level has been achieved. Based on the aforementioned, this hypothesis was not rejected, confirming a mild relationship between the analyzed variables.

In the concluding section, the authors also investigated whether organizations utilize virtual reality tools in HR functions or anticipate greater utilization in the near future.

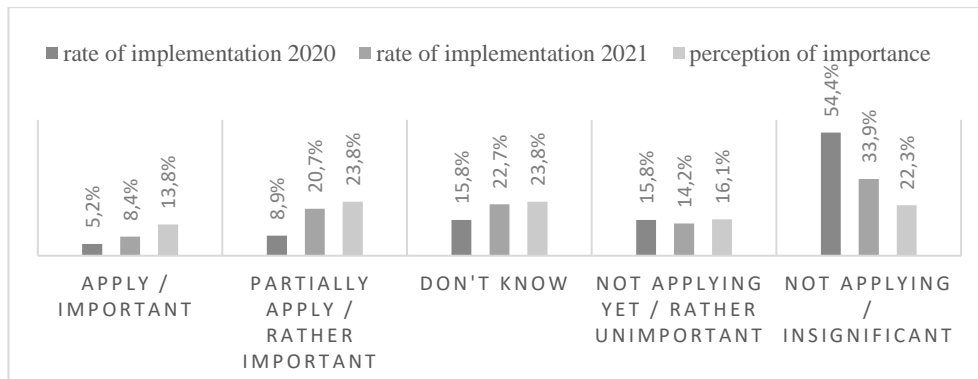


Figure 4: Utilization of Virtual Reality Tools in HR Functions

The findings indicate that businesses in Central and Eastern Europe currently utilize virtualization elements in HR activities to a relatively limited extent, with only approximately 8% of respondents declaring their complete utilization. However, 7.3% of respondents perceive these elements as important, and 15.2% view them as important. When comparing the results across the years, there is a noticeable shift towards a higher degree of implementation. Based on these findings, it can be assumed that the utilization of these elements will increase in the future.

Hypothesis 4: The Pearson correlation test results demonstrate a statistically significant relationship between companies employing virtualization elements in HR functions and companies anticipating a higher utilisation level in the future, as the variable correlates at a significance level of $\text{sig.} = 0.01$ with a Pearson correlation coefficient value of $r = 0.748$, the required significance level was achieved. Consequently, this hypothesis was not rejected based on the aforementioned, confirming a mild relationship between the analyzed variables.

Discussion

The research presented in this paper focuses on the relationship between a company's economic performance and its willingness to invest in innovative digital solutions, specifically digital innovations, gamification elements, and virtual reality within human resource management. Several studies have demonstrated a connection between innovations and the economic performance of companies (Wang et al., 2021; Capello and Lenzi, 2019). Based on the evaluation of the survey results, it can be argued that there is also a reverse relationship, indicating that companies with positive economic results achieve higher values both in the indicator of utilizing virtual reality in HR management tools and the use of digital interaction tools among employees.

Industry 4.0 is accompanied by the emergence of agile management approaches characterized by flexibility, the ability to respond to real-time changes and support for team collaboration (Hitka et al. 2021, Tokarčíková et al. 2022, Ližbetinová 2014, Dziuba and Szczyrba 2023). Such approaches are particularly relevant for

Generation Z members, who have grown up in a digital environment and expect rapid and effective solutions (Cretu et al., 2020; Singh *and* Dangmei, 2016). Agile management becomes a tool for coping with uncertainty and change, emphasizing team cohesion, collaboration, and communication. The transition to implementing agile approaches in management, where companies utilize modern technologies and digital tools for more efficient and faster process and resource management, occurred 20 to 25 times faster than anticipated, according to a survey of 899 company executives by McKinsey (2020). The results of the study presented in this paper confirm these findings. Based on the evaluation of respondents' answers from the conducted research, it can be argued that the implementation of digital interaction tools during the pandemic has achieved a significant degree, with almost 70% of organizations partially or fully applying these tools. The most significant shift occurred in the partial and full application. Given the results in the area of perceived importance, it is anticipated that the implementation rate of these tools will continue to grow in the future.

On the other hand, research findings indicate that businesses in Central and Eastern Europe currently utilize virtualization elements in HR activities to a relatively limited extent, with only approximately 8% of respondents declaring their complete utilization. However, 7.3% of respondents perceive these elements as important, and 15.2% view them as important. When comparing the results across the years, there is a noticeable shift towards a higher degree of implementation. Based on these findings, it can be assumed that the utilization of these elements will increase in the future.

In the context of utilizing the mentioned virtualization elements, an interesting examination area is gamification – the use of game elements and techniques in various areas of life, including human resource management, which becomes an essential tool within Industry 4.0 (Blštáková et al. 2019). Generation Z, growing up in a digital environment, is a natural user of new digital tools. These tools enhance their engagement, productivity, and job satisfaction. Adapting to the preferences and expectations of this generation can positively impact overall organizational performance. Virtual reality offers new possibilities for training and employee development. Employees can gain experience in simulated situations without the risk of errors and can more effectively prepare for real work situations. According to the research presented in this paper, the utilization of gamification elements in organizations involved in the study is at a low level. Only 5% of organizations indicated that these elements are fully implemented, and 18% partially utilize them. Nevertheless, it is found that respondents perceive these elements as more important for the future than their current utilization level (Figure 1). An important finding is that nearly 70% of organizations already use various digital interaction platforms in human resource management.

However, it should be noted that the results of this research have certain limitations, primarily due to the diverse respondent samples and the varying timeframes in which the surveys were conducted, which may partially affect the accuracy of the findings.

Conclusion

At present, human resources specialists and managers are confronted with multiple challenges in the establishment of collaborative work teams and the sustenance of team cohesion (Urbancová, Fajčíková 2020, Hitka et al. 2019). These challenges are intricate due to the influence of global factors, the advent of Industry 4.0 (Lizbetinova et al. 2020, Vetráková et al. 2021, Stareček et al. 2023), the exigencies imposed by the pandemic (Nicola et al. 2020, Jankelová et al. 2021, Černá et al. 2022), and the heterogeneity of the workforce (Lorincová et al. 2019, Vetráková Smerek 2019, Urbancová et al. 2015). Furthermore, intergenerational disparities exacerbate these challenges (Braedon et al. 2021), given that organizations encompass a spectrum of four generations characterized by distinct communication modalities, dispositions, and principles.

With the emergence of Generation Z in the labor milieu, it becomes imperative to apprehend their attributes and comportment as a prerequisite for cultivating an optimal professional milieu. The paradigm of Industry 4.0 introduces an agile managerial approach, wherein contemporary technologies are harnessed to efficiently supervise processes and assets, thereby nurturing inter-team cooperation and interplay.

Digital ludic engagements can influence team cohesiveness, collaborative endeavors, and communicative channels, particularly resonating within Generation Z, a cohort reared in the digital milieu, thus nurturing an expectation of avant-garde solutions from prospective employers. Within the overarching aegis of Industry 4.0 and its concomitant agile management precepts, the indispensability of digital acumen is empirically evidenced as indispensable for realising corporate strategic objectives. Moreover, the ascendancy of digital prowess within the domain of human resources augments in significance, manifesting, for instance, in the assimilation of gamification, connoting the infusion of ludic elements and techniques to motivate the workforce, ameliorate collaborative endeavors, and enhance customer experiences.

The gaming industry and its corollary digital ludic interfaces proffer innovative panaceas that are amenable to transposition within the precincts of the corporate milieu. A corollary digital facet, virtual reality, emerges as an additional instrument that can be harnessed for the training and advancement of personnel, selection protocols, and facilitating remote communication.

Empirical scrutiny, directed towards commercial entities domiciled within the confines of Central and Eastern Europe, has evinced that the escalating integration of digital adjuncts, encompassing gamification, digital interaction modalities, and virtual reality constructs, within the ambit of human resources administration, evinces a positive correlation with heightened anticipations regarding their prospective import. The Pearson correlation test results demonstrate a statistically significant relationship between companies employing virtualization elements in HR functions and companies anticipating a higher level of their utilization in the future (sig. = 0.01; $r = 0.748$). Concurrently, the Pearson correlation test results indicate a

statistically significant relationship between organizations implementing digital interaction tools in HR functions and those expecting a higher utilisation level in the future. Since this variable correlates at a significance level of $\text{sig.} = 0.01$ with a Pearson correlation coefficient value of $r = 0.988$, the desired significance level has been achieved.

The corollary findings of this investigative endeavor proffer invaluable insights germane to organizations endeavoring to acclimate to the emergent currents within the rubric of Industry 4.0, thereby fostering an environment conducive to Generation Z. The pivotal modality resides in the assimilation of nascent technologies and innovations, and their apt integration within the compass of human resources administration, as a conduit for the augmentation of outcomes and the perpetuation of competitive viability.

The study's scope is confined to a distinct concentration solely upon companies active within the Central and Eastern European region. In forthcoming investigations, the authors anticipate broadening the respondent repository to encompass nations in Western Europe, thereby facilitating result juxtaposition and inference derivation. Furthermore, cognizance is granted to the constraint inherent in singular data acquisition, thus prompting the ongoing initiation of a subsequent data collection phase, encompassing participants from diverse European countries.

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WPLYW WYNIKÓW FINANSOWYCH PRZEDSIĘBIORSTW NA ZAKRES WDROŻENIA CYFRYZACJI W HRM

Streszczenie: Badanie przedstawione w niniejszym artykule poszerza bazę wiedzy na temat wdrażania innowacji cyfrowych i grywalizacji w przedsiębiorstwach Europy Środkowej i Wschodniej oraz ich potencjalnego pozytywnego wpływu na efektywność zarządzania ludźmi. Ponadto podkreślono związek między pozytywnymi wynikami ekonomicznymi a tendencją do inwestowania w innowacyjne strategie, ponieważ ich skuteczne wdrażanie i realizacja może wymagać pewnych zasobów finansowych i kadrowych. Ustalenia i wnioski przedstawione w niniejszym artykule wynikają z analizy próby badawczej (n=1112 w 2020 r. i n=1109 w 2021 r.) obejmującej informacje zwrotne uzyskane od menedżerów przedsiębiorstw działających w obszarze gospodarczym Europy Środkowej i Wschodniej. Na podstawie oceny wyników badania można stwierdzić, że firmy o pozytywnych wynikach ekonomicznych osiągają wyższe wartości zarówno we wskaźniku wykorzystania, jak i postrzegania znaczenia wdrażania innowacyjnych narzędzi w najbliższej przyszłości.

Słowa kluczowe: zarządzanie zasobami ludzkimi, innowacje cyfrowe, grywalizacja, wirtualna rzeczywistość