



HR PRACTICES THROUGH THE LENS OF TECHNOLOGY AND DIGITAL TRANSFORMATION

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Abstract: The company's digital transformation requires the optimization and automation of processes through Industry 4.0 technology, leading to a new business model. Along with technology, effective human resource management (HRM) is crucial for this model. HRM and Industry 4.0 technology are interdependent. Technologies require new HR operating models, and HR, through organizational management strategies such as change management, agile organizations, and talent management, influences the provision of a workforce capable of implementing these disruptive technologies. This paper focuses on HR's role in digital transformation and the resulting changes in HRM and HR practices. It presents use cases of Industry 4.0 technology and their benefits. The study presented in this paper examines the impact of HR practices on operational, financial, and employee performance in relation to the use of disruptive technologies. A survey questionnaire was used to examine this impact on 11 large and medium-sized companies in Serbia, using statistical methods of descriptive statistics and correlation analysis through SPSS 23 software to analyze the results. The research showed that the use of artificial intelligence and machine learning (AI/ML) in HR processes has a positive effect on employee performance, as well as operational and financial performance. Other hypotheses were only partially proven. The research also revealed the lack of training for HR employees regarding the use of digital technologies in HR processes and digital skills compared to other sectors in the company. The recommendation is that HR managers begin training on the digitization of HRM as soon as possible.

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1. Introduction

The current business landscape demands a complete overhaul of a company's processes and ways of working due to the advent of new digital technologies. This shift towards digital transformation requires clear strategies, well-defined steps, and experts with appropriate skills to lead the transformation process in an agile manner. One of the companies (Kovalev, 2022) in the lighthouses network of digital transformation proposes that digital transformation be managed by structures that understand digital tools and their usage, possess knowledge of project management, domain knowledge, and change management. To manage digital transformation, a team must be formed that has the sole responsibility of overseeing the process. Companies can either procure experts externally or develop their own talent to manage the transformation process and all the changes. The best option would be a combination of in-house employees (because they are familiar with the existing processes and shortcomings) and new employees with new knowledge, skills, and approaches to work. The team's task is to identify gaps in existing knowledge and skills of employees that are critical for digital transformation processes.

The digital transformation process has a dual role - it changes the HR organization and alters how employees are managed. Overcoming challenges in the reorganization of the HR function requires new operational models. Depending on their business and digital transformation strategies, companies can choose the model that best suits their needs. Changes in HR practices include automation in employment, new recruitment techniques, onboarding, and selection of employees. Additionally, there are new areas, methods, and tools for employee training. It is important to include a multigenerational workforce with specific requirements, knowledge, and skills, and find ways to enable them to work together to effectively utilize knowledge and synergy. For the younger generation, training and career development programs have become important criteria while choosing a company. Engaging, empowering, and caring for employees includes new models and technologies that contribute to it. Finally, a transparent reward system that meets the needs of a multigenerational workforce is essential.

2. Literature review

2.1. The role of HR in the digital transformation of a company

The digital transformation of a company requires far more than the mere use of Industry 4.0 technologies. It requires the commitment of top management

expressed through the provision of resources (technology and knowledge, office for digital transformation) as well as full support (help in solving problems) and control (regular evaluation of results and giving feedback) in the transformation process. Immediately after this is the creation of an organizational culture that will be ready to carry out the transformation process quickly and successfully. The contribution of all this can be reduced if there is no effective human resources management. The main goal is to provide a sufficient talent base for the implementation of technologically and organizationally demanding solutions. Therefore, deploying and managing talent is one of the critical factors of digital transformation (BCG, 2022). Providing digital skills to all employees within the scope of their work tasks, in addition to their individual talents, is crucial for the success of a company in digital transformation. Effective management of changes is also important to create a conducive environment for the implementation of disruptive technologies and to reduce resistance to change. Special employee management practices are crucial for successful digital transformation (World Economic Forum, 2022, p.23):

1. Training for hard, soft, and digital skills and their integration
One of the ways to integrate these skills is gamification (Armstrong & Landers, 2018). By gamification and the learning of digital skills on the road to digital transformation, companies can achieve many benefits. A well-designed game that simultaneously develops hard, soft, and digital skills (through easier and more fun acquisition of knowledge, cooperation, and team spirit if employees are divided into teams during learning) can contribute to agility in learning and greater efficiency of the learning process itself.
2. Agile organizational culture through adequate change management
To foster an agile organizational culture, it is crucial to implement adequate change management. This culture should prioritize experimentation and innovation, and empower employees to participate in decision-making (Petronas, 2020, p.162).
3. Cooperation and cross-functional teams are vital for creating critical organizational knowledge necessary for digital transformation. Establishing research centers for applying digital technologies, and pursuing long-term initiatives to develop various solutions can significantly benefit digital transformation.
4. A transparent system of rewards and recognition, promotions, sharing of results, and celebrating success is essential for evaluating employee performance. Listening to employee needs and responding to them promptly is also crucial.
5. Achieving a balance between work and personal life, employee well-being, and a sense of belonging (Przytuła et al., 2020) can be accomplished through a culture of well-being that encourages healthy relationships among colleagues. The company should implement policies that promote well-being in all processes, programs, and spaces, whether they are physical or virtual workspaces.

The digital transformation of the company is an undertaking where it is necessary to involve all employees through adequate HR practices. In order for HR practices to be effective, it is necessary to anticipate in time all the changes in HR processes that were created by the application of digital technologies and in time to predict all the effects of the changes on employees, organizational culture and company performance.

2.2. Changes in HR - in the conditions of Industry 4.0

Industry 4.0 technologies are bringing changes to HR organizations and practices. Changes to HR organizations include the adoption of new HR models. McKinsey & Company has proposed new models that suggest (Durth et al., 2022):

1. Business partners (HRBP) need to have digital skills to keep services global and operations digital. This will reduce the number of business partners and focus on management advice, business development, and end-to-end responsibility for relevant activities. It also involves the standardization of HR activities.
2. End-to-end responsibility for strategy, policy, and execution.
3. Line managers should be equipped with digital tools and skills to take over authority in management, especially in the area of recruitment,
4. Artificial intelligence should be used for process automation to provide more time for individual HR interactions with employees.
5. HR experts need to be retrained or employed with analytical skills and skills in the use of AI.

All these changes in the organization of HR require new strategies and the involvement of employees in their definition to ensure the necessary competencies for the implementation of digital technologies. In addition to this, there are also changes in HR practices that primarily imply changes caused by new movements in the labor market and changes caused by the application of the basic technologies of Industry 4.0.

Table 1: Changes in HR practices and their effects

<i>Changes in workforce requirements</i>	<i>Changes in HR practices</i>	<i>Effects of changes</i>
Actualization of hybrid work models and greater autonomy in work (Karolus et al., 2014)	This requires an adequate recruitment strategy, adequate training and development plan, special activities in performance and productivity measurement, employee retention activities, and cyber security.	Benefits: Reduction of labor costs, maximization of productivity, stimulation of technology development, greater employee satisfaction (Thulin, 2020) Risks: cyber security, employee isolation and

		general employee well-being (Kaufman, 2020).
The intertwining of several generations of the workforce	In order to fully benefit the company, it is necessary to establish appropriate policies that enable collaboration between the younger, digitally literate generations and the older, more experienced generations who possess specialized skills. Additionally, since different age groups have varying preferences, special programs and offers should be designed and implemented to cater to the needs of each group. This will facilitate the exchange of knowledge and experiences among the diverse workforce, leading to a more productive and successful organization.	Benefits: The wide range of different skills that each of these generations possesses has a positive impact on the company's performance. Thus, reports say that companies with a multigenerational workforce are more successful (LinkedIn Global Talent Trends, 2020, p.66).
Evaluation of employee experience	Development of employer branding, and recruitment of new professions such as employee experience managers. Keeping track of the employee's experience before he starts work, while he is an employee, and when he leaves the company.	Benefits: Higher talent retention, higher productivity, better image on the market, savings in fees and benefits, and employee training. (Hatfield, 2022).
Requirements for reskilling (Siemon & Kedziora, 2023) and upskilling in terms of digital skills	It is important to provide training for HR employees, particularly in the field of data analytics and new technologies. Additionally, it is beneficial to establish practices that identify gaps in the digital skills of employees and develop programs to address those gaps.	Benefits: Developed digital skills, established digital culture, enabled digital transformation, increased company performance and competitive advantage.

Changes caused by technologies and new ways of working	They require a clear change management strategy. That strategy implies practices such as communication where feedback from managers is provided, greater autonomy in work, cross-functional teams, practices and developments that encourage proactivity and vitality, and involvement in decision-making (Tummers, 2015, p.629).	The proactivity and vitality of employees increase. Proactivity is the ability to anticipate future events and undertake activities and vitality as energy and life are necessary for the successful digital transformation of a company.
Specificity in talent requirements	It requires a talent management strategy that includes defined practices for finding and generating potential talent, attracting and recruiting, interviewing and processing, reference checking, and hiring (Hennigan & Bottorff, 2022).	The impact of effective talent management is reflected in increased talent engagement, which, in turn, improves organizational performance and attracts top talent (Hongal & Kinange, 2020).
People analytics	It requires the centralization of analytics, an analytical team, knowledge of possibilities, advantages, and disadvantages as well as solutions for ethical issues of its use Karmańska, Anna, 2020, p.31).	Benefits: Assists in cost budgeting, recruiting and talent acquisition, learning measurement, workforce planning, knowledge and skills analysis, and employee retention.
Gamification – using games in a non-game context	The use of games in HR is noticeable in the processes of recruitment (Vardarlier,P., 2021) and selection (Landers & Sanchez,2022), onboarding (Heimbürger, 2020), training training (Obaid et al., 2020), and employee well-being (Ferguson , 2021).	Benefits: Motivation and productivity of employees (Apostolopoulos,2019), higher possibility to attract, engage, motivate, and retain employees, especially talents, standing out from the competition., strengthening mental health and ensuring long-term engagement. reducing the time required for the evaluation process. Deficiency: High

		implementation costs and expenses for creating your own games. Concerns about data how company store information during the selection process, given that third parties, such as recruitment platforms, may be involved. Candidate's aversion to games can negatively affect candidates interview performance. Since games are also created by people who may have unconscious biases if not noticed in time, they become encoded biases.
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Source: Authors

As it can be concluded from the table 1, changes in the market, whether caused by technologies, workforce requirements, or the company's need to increase the efficiency of the human resource management process, cause significant changes in HR practices. This is the reason why the training of HR employees is crucial for the effectiveness of implementing these changes.

Regarding the changes that new technologies have brought to HRM, two are currently the most visible and relate to artificial intelligence and gamification. The following table shows the use cases of gamification in several companies and the benefits of their application.

Table 2: Use cases of gamification and AI in HR

<i>Company</i>	<i>Use case</i>	<i>Effects</i>
Emirates Group 102000 employees	They incorporate gamification in candidate evaluation and recruitment, utilize AI-supported video interviews, and have a one-step assessment and interview solution for technical talent recruitment (Manal Al Soori, 2022).	The benefits for the organization are shorter recruitment and assessment times, from anywhere, at any time. Improved experience and flexibility for the candidate. In 2022, they employed 17,160 people (Emirates Group, 2022, p.66) in different positions, shortening the recruitment process by 350 days and saving recruitment costs by 400 thousand dollars (Manal Al Soori, 2022).

Vestas 28000 employees (Vestas 2022, p.44)	They use assessments of technical positions based on "automated coding grade assessments", this type of assessment can also be done by non-technical recruiters (Hirevue,2023). The company also uses video interviews based on AI in the assessment for positions in administration and management.	Optimization of the recruitment process, reduction of time and costs, improved candidate experience.
Delta Air Line 90 000 employees (Delta Air Line, 2023)	The company utilizes AI and game-based assessments to efficiently automate talent recruitment (Jennifer Carpenter, 2023)	Consistency and fairness in employment, elimination of bias. Reduction of employment time.
Unilever 127000 employees (Unilever, 2022, p.2)	In its hiring process, the company employs a game-based assessment. After filling out the assessment profile, the candidate logs in to the company's platform to download 12 games that measure emissive, cognitive, and social intelligence. Additionally, the company uses digital video interviews, where the candidate records themselves in advance and sends the video to the company. The video is analyzed using AI to evaluate the candidate (Hirevue, 2023).	Improved candidate experience through a game that is easy, accessible, and stress-free because the candidate is not aware of what it measures. After completion, he receives a reply and can give an evaluation of the whole process.

Source: Author

2.3. Disruptive technologies of Industry 4.0 and their application in HR processes

In Industry 4.0, HR faces crucial challenges such as selecting appropriate technological tools, transforming the existing organizational culture, and managing the expectations of employees belonging to different generations (Sivathanu &

Pillai, 2018, p.2). In terms of technological tools, it is crucial to understand the potential of different technologies and predict their applications accurately.

Therefore, the integration of AI in HRM offers unique benefits to companies. By embracing AI, companies can achieve greater productivity, cost reduction, and improved operational efficiency. In addition, AI can enhance customer engagement and loyalty, while also delivering cost-effectiveness and higher returns on investment. Through the use of AI, companies can strive for cost-effective service excellence (Malik et al., 2022, p. 1077), becoming top performers in their competitive market by achieving high levels of customer satisfaction and productivity (Singh, S, et.al., 2023).

Using virtual reality (VR) technology requires investment in equipment that enables its use. However, the costs of such equipment can be high, particularly if immersive VR is used, which requires a helmet. This makes it relatively inaccessible in terms of size and price. Apart from immersive VR, there are also desktop distributed and remote displays (Xu, & Xiao, 2020), each with its own advantages and disadvantages. Desktop VR is cheap and widely used, but the experience is not as immersive as other forms of VR. Distributed VR provides a better experience and can connect more participants from different locations, but it requires a high-speed private network. The remote system allows for remote control and uses 3D technology to create a simulation of the real world that is as realistic as possible, providing an experience that is comparable to that of the real world.

Table 3: Use case some of emerging technologies and their benefits in HRM

Disruptive technologies	The use of	Benefits
VR/AR	VR technology is used in the process of recruiting employees, especially for roles that are difficult to fill, where short videos made in VR can contribute to rapid recruitment (Lauren Dixon, 2017). In the process of employee selection where the candidate's knowledge and skills need to be assessed, especially if case studies are used, VR is very effective because it can assess the candidate's ability to make decisions in real situations (Heaslip, 2022), which certainly increases the chances of hiring the best candidate because it is possible to see how the candidate faces problems and how he cuts them.	VR increases the efficiency of the company's human resources management, reduces costs, makes employees more satisfied, and all of this has direct positive consequences on the company's competitive position (Xu & Xiao, 2020, p.1).

	<p>Introducing the employee to the organization, to gain experience of what it's like to work in a company (IKEA, 2018). This technology is very effective in industries whose products are more complex in terms of use and production method and require a deep understanding of these aspects of business. Thus, by using VR in onboarding, the Grundfos company provided its employees with an experience of understanding from product design to its practical use, and at the same time, it significantly eliminated the costs of onboarding in terms of travel costs for new employees from different locations to a couple of locations where factories are located (SynergyXR, 2022).</p> <p>In the process of training and development of employees, especially in industries where work is challenging in terms of training safety, such as e.g. training for transport fire situations, for which Deutsche Bahn uses VR technology (Wohlgenannt,2020, p.4).</p>	
AI/ML	<p>In workforce planning, it is crucial to use AI for predictive analysis of employee behavior and to assess their intention to quit.</p> <p>AI in recruitment and selection through internal or external platforms. AI in recruitment plays a critical role in identifying talents either in the company or in the external market through other companies' platforms. An example of an internal platform is Schneider Electric's Open Talent Market, which provides recruitment and development of internal talent through access to specially designed training and retraining offers (Schneider Electric, 2022, p.218).</p> <p>An external AI-powered recruitment platform, Perfect Match by Joberty, connects IT employers and employees (Joberty, 2023).</p>	<p>Improving employee retention rates is essential, and it can be achieved by responding promptly to any signs of employee dissatisfaction, identifying the root cause of the issue, and working collaboratively to resolve it.</p> <p>Efficient recruitment processes that minimize costs and time can be implemented by enhancing the recruitment channels and mechanisms.</p> <p>Reducing the learning time of new employees can be accomplished by</p>

	<p>In onboarding, platforms that replace buddies, introduce the employee to work, processes, and culture, connecting them with mentors and colleagues (Liscio Apps, LLC, 2022).</p> <p>In the training and development of employees, AI is increasingly being used through various systems and platforms for assessing the required skills and offering training for further upskilling or reskilling. (Flex, 2022, p.53). In addition, the application of a robot instructor who, using a visual scanning system, observes the daily learning status and can calculate the average value of employee attention, based on which he prepares different training programs through data analysis and simulation (Kambur & Akar, 2021, p.174).</p> <p>The application of artificial intelligence in the compensation and reward system-enabled neural networks reduces biases in decision-making and in measuring employee performance through the ability to recognize relationships in large data sets that enable a more objective assessment of performance (Tewari,& Pant, 2020,p.2), providing continuous information to employees about their performance evaluation (Kambur & Akar, 2021, p.176).</p> <p>In the engagement and motivation of employees, the use of AI through the daily monitoring of the feelings and level of stress and the prediction of toxic behaviors that lead to such climate (Sari et.al., 2020, p.185).</p>	<p>providing easy access to mentors and colleagues with similar interests, regardless of their location.</p> <p>Increasing employee satisfaction and engagement can be achieved by implementing a fair reward system and objective performance evaluations.</p> <p>Utilizing robot instructors can boost the quality, speed, and coverage of learning, leading to a more productive workforce.</p> <p>Ultimately, these strategies can lead to greater employee satisfaction, lower stress levels, and a reduction in employee turnover, which can positively impact the company's bottom line.</p>
<p>Cloud</p>	<p>It can be used to integrate the human resource management information system and the cloud, where the biggest challenge is to ensure data security. Cloud-based HRIS includes employee self-services, personal information management, benefits, salary information, and leaves (Abdullah, et al., 2020).</p>	<p>Flexible management of human resources, easier decision-making, reduction of costs in the company, reducing costs in HR, increasing company productivity (Vasiljeva, et al., p.445).</p>

IoT	<p>Companies that people analytics are using the internet of things (IoT) to acquire, engage, and retain talent (Gaur, 2019).</p> <p>In the process of recruiting candidates, it is possible to monitor their behavior through wearable devices while the candidate is in a virtual environment that allows him to experience the job in a realistic way. IoT and AI in the selection process eliminate recruiter biases (Nallakaruppan & Senthil (2018).</p> <p>IoT technology can be leveraged to personalize employee training by collecting data through sensors to evaluate the performance of employees. Another use case of IoT is the improvement of employee physical health through wearable devices that collect data for analysis and creation of health programs.</p> <p>IoT can also enhance employee productivity by measuring their behavioral performance. For instance, by using a badge worn by an employee, sensors can identify the employee's location (which is crucial in the logistics industry) and measure stress levels via heart rate or voice pitch. Sociometric badges can provide information about the ergonomics of the workplace, the most efficient forms of work, and team structure, all of which can ensure greater productivity for employees. Deloitte is an example of a company that has used this approach successfully (Bersin, & Monahan, 2016).</p>	<p>The use of IoT has increased employee productivity, engagement, and well-being (Gaur, 2019, p.38).</p> <p>The more efficient the recruitment, the less the new employee leaves and, therefore, the lower the employment costs (Anand, & Anand, 2021, p.799).</p> <p>It provides HR data that significantly improves decision-making.</p>
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Source: Authors

As can be seen from the previous table, the main benefits of using these technologies appear in the form of:

- positive impact on operational performance (improved decision-making, fairer reward system, objective evaluations of employee performance, increased HR efficiency, greater customer satisfaction, better competitive position of the company on the market),

- positive impact on financial performance (cost-effectiveness and higher returns on investment),
- positive impact on employee performance (productivity, engagement, satisfaction, reduction in turnover, and retention).

3. Methodology

The methodology used in this research paper involved the use of a questionnaire, which was sent to the addresses of 25 large and medium-sized companies in the Republic of Serbia. The selection of these companies was based on the assumption that they use at least one of the technologies related to HR. The response rate to the questionnaire was 44%, with 11 companies responding to the questionnaire via Google Forms. This response rate was expected since the use of these technologies in HR is still in the early stages and is primarily used by larger companies. The collected data was analyzed using statistical data processing methods with the help of SPSS 23 software. The main objective of the research was to understand the HR practices and the use of technologies in current business conditions of companies in Industry 4.0. The research aimed to determine the respondents' opinions¹ on the use of these technologies, including their impact on the operational and financial performance of the company, as well as the performance of employees. The study started with the following hypotheses:

H1: AL/ML has a positive impact on employee performance and company performance (operational and financial).

H2: VR/AR has a positive impact on employee performance and company performance (operational and financial).

H3: IoT has a positive impact on employee performance and company performance (operational and financial).

H4: Cloud computing has a positive impact on employee performance and company performance (operational and financial).

¹ Example of a question asked in a survey: Please indicate your level of agreement or disagreement with the following statements on a scale of 1 to 5, where "1" means "Strongly Disagree" and "5" means "Strongly Agree"

Statement 1: "The use of AL/ML in HR on operational performance (improved decision-making, fairer reward system, objective evaluations of employee performance, increased HR efficiency, greater customer satisfaction, and better competitive position in the market) has a positive impact."

Statement 2: "The use of AL/ML in HR on financial performance (profitability and higher return on investment) has a positive impact".

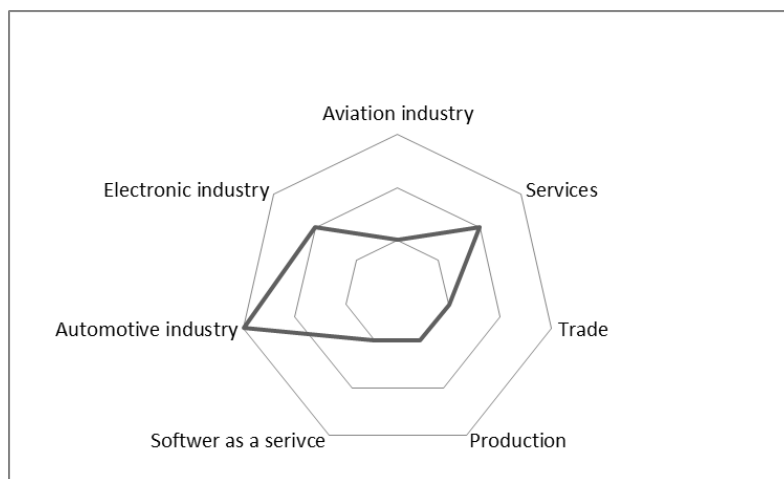
Statement 3: "The use of AL/ML in HR on employee performance (productivity, engagement, satisfaction, turnover reduction, and retention) has a positive impact".

The same question was asked about the impact of other technologies (VR/AR, Cloud, and IoT) on operational, financial, and employee performance.

4. Analysis of results and discussion

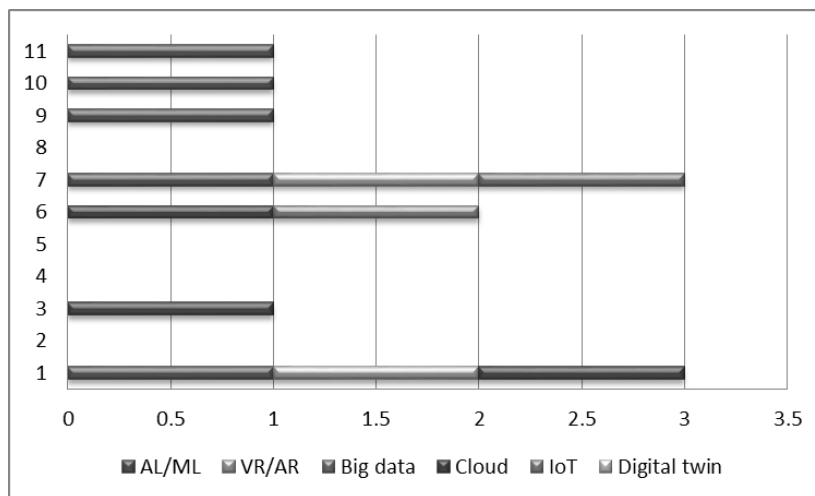
In this survey, 73% of the respondents were large companies, while 27% were medium-sized companies. Additionally, 90% of the participating companies were based overseas and had a well-defined digital transformation strategy. The respondents were primarily from the automotive, electronics, services, trade, and aviation industries.

Graph 1: Companies by industry



Source: Authors

Graph 2: Application of disruptive technologies in HR



Source: Authors

According to this paper, 36% of companies are not utilizing any Industry 4.0 technologies in their HR processes. However, the majority of companies are leveraging artificial intelligence, cloud computing, virtual reality, big data, and the IoT for various HR activities such as recruitment, learning and development, performance management, reward systems, and attrition risk analysis, as well as cloud-based HRIS systems, chatbots for operational activities, workforce planning software, and employee connectivity applications for problem-solving purposes.

The Questionnaire not only covered questions regarding technologies, but also asked about included the changes in the HR function and HR practices, which were defined in the previous chapters. Graph 3. shows that the companies under research have implemented strategies that are crucial for the success of digital transformation.

Graph 3: Application of HRM strategies for success in digital transformation



Source: Authors

Based on Graph 3, the companies mentioned are emphasizing the development of internal talents and the attraction of external talents from the job market through employer branding. The chart suggests that these companies give considerable importance to change management and effectively utilizing a multigenerational workforce. As per the chart, 54% of the companies have an agile organization.

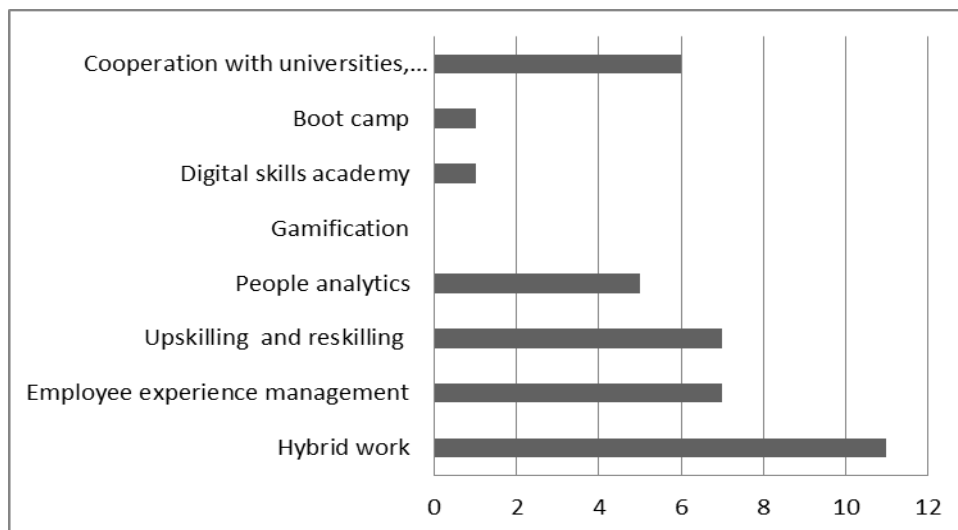
In the theoretical part of this paper, it was pointed out that changes also occur in HR practice. Graph 4 shows those changes.

Based on the study, the leading HR practices in the examined companies are hybrid work, employee experience management, upskilling and reskilling, and

collaboration with various stakeholders to enhance the digital skills of employees. In terms of people analytics, 90% of the companies stated that they use it at a descriptive level.

We compared their responses to this question and the question of technologies which they use in HR, and only one company mentioned that it has implemented analytics and AI. This suggests that in that particular company, analytics can be more than just descriptive and can also be predictive and prescriptive (Margherita, 2020, p.3). Descriptive analytics shows relationships based on current and historical patterns and its focus is on process improvement. Descriptive analytics is based on HRM metrics that measure the effectiveness and efficiency of human resource management. Predictive analytics, including several statistical techniques such as modeling and data mining, uses current and historical data to predict future outcomes. Prescriptive analytics uses simulation and optimization algorithms to predict outcomes and provide decision options, showing alternative impacts.

Graph 4: Application of HR practices for success in digital transformation



Source: Authors

None of the companies use Gamification in any form. They cited the following reasons:

- The complexity of implementation and lack of organizational readiness, competencies, etc. (9%),
- There are no clear effects of the application (36%),
- We don't need it (36%),
- Other reasons (19%).

It is evident from the respondents answers that training HR employees regarding the possibility of using gamification and other Industry 4.0 technologies is very much needed. Also, raising digital skills is an area in which significant progress can be made. Interestingly, none of these companies indicated High implementation costs as a reason for not using gamification. When it comes to digital skills training, the average training times are shown in Table 4.

Table 4: Average upskilling time

	N	Mean	Std. Deviation
Number of training hours per employee per year	11	34.00	23.580
Number of hours of digital skills training per employee per year	11	9.18	8.693
Number of training hours of digital skills per HR employee per year	11	5.09	6.236
Valid N (listwise)	11		

Source: Authors

As can be seen from the data presented, the least training for digital skills in these companies is intended for employees in the HR function. Expectations are, however, that this will change quickly and that the digitization of HR is inevitable, as well as among other processes in the company.

When it comes to the impact of the use of these technologies in HR, on company performance and employee performance, the results show the following:

Table 5: Impact of disruptive technologies in HR on performance

	N	Mean	Std. Deviation
Impact of AI/ML in HR on operational performance	11	3.91	.944
Impact of AI/ML in HR on financial performance	11	4.00	1.095
Impact of AI/ML in HR on employee performance	11	3.91	1.044
Impact of VR/AR in HR on operational performance	11	3.55	1.128
Impact of VR/AR in HR on financial performance	11	3.27	.905

Impact of VR/AR in HR on employee performance	11	3.82	1.168
Impact of IoT in HR on operational performance	11	3.36	.924
Impact of IoT in HR on financial performance	11	3.36	.809
Impact of IoT in HR on employee performance	11	3.64	.924
Impact of cloud in HR on operational performance	11	3.45	.820
Impact of cloud in HR on financial performance	11	3.64	1.027
Impact of cloud in HR on employee performance	11	3.64	.924
Valid N (listwise)	11		

Source: Authors

Based on the research, the implementation of AL/ML (with a mean score of 3.94) has the highest positive impact on performance, followed by Cloud computing (with a mean score of 3.57), and then VR/AR (with a mean score of 3.54). The maximum positive impact of IoT in HR on performance is observed (with a mean score of 3.45).

When categorizing the responses into three groups of influence, namely negative, neutral, and positive, it was found that for the impact to be evaluated as positive, the average score (mean) should be above 3.5 (Van, et.al.,2022, p.6). Based on the obtained results, hypothesis H1 indicating that AL/ML has a positive impact on employee performance, as well as on the operational and financial performance of the company, was confirmed for all three performance components, while for others are only partial confirmations:

H2: VR/AR has a positive impact on employee performance and company operational performance

H3: IoT has a positive impact on employee performance

H4: Cloud computing has a positive impact on employee performance and financial performance of companies.

For the first hypothesis, Spearman's coefficient shows strong correlations at the level of statistical significance for the variables of AL/ML influence on company and employee performance.

Table 6: Correlation between the impact on company performance and employee performance

			Correlations		
			Impact AI/ML in HR on operational performance	Impact AI/ML in HR on financial performance	Impact AI/ML in HR on employee performance
Spearman's rho	Impact AI/ML in HR on operational performance	Correlation Coefficient Sig. (2-tailed) N	1.000 . 11	.841** .001 11	.746** .008 11
	Impact AI/ML in HR on financial performance	Correlation Coefficient Sig. (2-tailed) N	.841** .001 11	1.000 . 11	.748** .008 11
	Impact AI/ML in HR on employee performance	Correlation Coefficient Sig. (2-tailed) N	.746** .008 11	.748** .008 11	1.000 . 11

** . Correlation is significant at the 0.01 level (2-tailed).

Source: Authors

The correlation coefficient was calculated for the variables of the fully proven hypothesis (H1), while for the partially proved ones (H2, H3, H4), the coefficient of correlation was not considered.

The analysis of the research results showed that the application of disruptive technologies of Industry 4.0 in HR processes is at the very beginning. Also, there is still little understanding of how emerging technologies enabled HRM can benefit employees, their professional results, and overall organizational success (Castellacci & Vinas-Bardolet, 2019). For this reason, it is necessary to start as soon as possible with the training of employees in HR to know the possibility of using these technologies.

5. Conclusion

The digital transformation of all processes, including HRM, is inevitable. According to previous research and experience, what is most necessary for companies is to define transformation strategies for each process and include all employees in HR. Knowing the possibilities of using Industry 4.0 technology in

HR goes hand in hand with strategy. The research paper highlights that even in international companies that have successfully implemented disruptive technologies in other processes, there is still a lack of training in understanding and utilizing the full potential of these technologies in the HRM process. Furthermore, the paper emphasizes the positive impact of technologies like AI/ML, VR/AR, Cloud, and IoT in HRM processes in global companies. However, the survey conducted in Serbia suggests a different opinion. According to the HR manager's response, only AI/ML positively impacts employee performance and company operational and financial performance. Other technologies impact positively only some of those performances (VR/AR in HR positively impacts operational and employee performance, IoT employee performance, Cloud financial and employee performance).

The recommendation for HRM would be to create a catalog of use cases for each technology based on previous research of successful companies. All employees from all HR processes should be included in its creation. This would provide a clear purpose for the use of these technologies and make implementation easier. By doing this, companies can tackle problems that are specific to their own operations and leverage these technologies to solve them effectively. When it comes to generating ideas for digitalizing HR, it's important to start with a bottom-up approach. This means identifying use cases and the problems they can solve. Once these proposals are created, they should be sent to top management for review. The management team can then create a strategy for digitalizing HR based on business goals and transformations, using a top-down approach. This strategy should include KPIs to measure success. To manage the implementation of this strategy, it's recommended to entrust the job to the HR director, who can work closely with the digital transformation team or office. By doing this, the organization can achieve successful digitalization of HR while keeping track of progress through the defined KPIs. It is advisable to provide digital skills training and retraining to some of the HR team members. For instance, retraining them as data analysts with a combination of HR domain knowledge and technical expertise in analytics can significantly enhance the overall success of HR.

Further research in this direction should focus on investigating the potential risks and negative impacts associated with these technologies in HR. Additionally, exploring the readiness factors required for these technologies' adoption would be valuable. Finally, promoting collaboration between HR experts and academics to conduct studies related to these topics would be beneficial.

References

- Abdullah, P. Y., Zeebaree, S. R., Shukur, H. M., & Jacksi, K. (2020). HRM system using cloud computing for Small and Medium Enterprises (SMEs). *Technology Reports of Kansai University*, 62(04), 04. p.1977.
- Alessandro Margherita, Human resources analytics: A systematization of research topics and directions for future research, *Human Resource Management Review*, Volume 32, Issue 2, 2022, 100795, ISSN 1053-4822. p.3
- Anand, I. M., & Anand, S. (2021). What Has IoT Got to Do with HR and People: A Case of Deloitte. *Turkish Journal of Computer and Mathematics Education (TURCOMAT)*, 12(5), 797-803. p.799.
- Andrey Kovalev (2022). Danone's Digital Manufacturing Strategy. The Connected Worker Podcast <https://www.youtube.com/watch?v=1hLSIt3GtXc> accessed:21.09.2023.
- Armstrong, M.B. and Landers, R.N. (2018). Gamification of employee training and development. *International Journal of Training and Development*, Vol. 22 No. 2, pp. 162-169.
- Available online: <http://hdl.handle.net/1811/91648> (accessed on 21.09.2023).
- Barbuto, A.; Gilliland, A.; Peebles, R.; Rossi, N.; Shrout, T. Telecommuting: Smarter Workplaces. 2020. Available online: <http://hdl.handle.net/1811/91648> (accessed on 21.09.2023).
- Bersin, J., Mariani, J., & Monahan, K. (2016). Will IoT technology bring us the quantified employee? The Internet of Things in human resources. *Deloitte University Press*.
- Brijesh Sivathanu, Rajasshrie Pillai, (2018). Smart HR 4.0 – how industry 4.0 is disrupting HR, *Human Resource Management International Digest*, <https://doi.org/10.1108/HRMID-04-2018-0059>.
- Budhwar, P., Malik, A., De Silva, M. T., & Thevisuthan, P. (2022). Artificial intelligence—challenges and opportunities for international HRM: a review and research agenda. *The International Journal of Human Resource Management*, 33(6), 1065-1097. p.107.
- Castellacci, F., & Vinas-Bardolet, C. (2019). Internet use and job satisfaction. *Computers in Human Behavior*, 90, 141–152. doi:10.1016/j.chb.2018.09.001.
- De Menezes, L.M.; Kelliher, C. (2011). Flexible working and performance: A systematic review of the evidence for a business case. *Int. J. Manag. Rev.* 2011, 13, 452–474.
- Delta Air Line (2023). <https://news.delta.com/corporate-stats-and-facts>
- Digital transformation. (2022). <https://www.bcg.com/capabilities/digital-technology-data/digital-transformation/overview>.
- Elizabeth Kaufman, Deborah Lovich, Allison Bailey, Reinhard Messenböck, Felix Schuler, and Abhishek Shrof, Remote Work Works—Where Do We Go from Here? (2020). *BCG*.
- Emily Heaslip (2022). 4 Big Impacts of Virtual Reality in Recruitment. <https://vervoe.com/virtual-reality-recruitment/>
- Emirates Group (2022). Annual report <https://c.ekstatic.net/ecl/documents/annual-report/2022-2023.pdf> p.66.
- Ferguson, Craig & Lewis, Robert & Wilks, Chelsey & Picard, Rosalind. (2021). The Guardians: Designing a Game for Long-term Engagement with Mental Health Therapy. 10.1109/CoG52621.2021.9619026.
- Gaur, B., Shukla, V. K., & Verma, A. (2019, April). Strengthening people analytics through wearable IOT device for real-time data collection. In 2019 international conference on

- automation, computational and technology management (ICACTM) (pp. 555-560). *IEEE*. p.38.
- Heimbürger, L., Buchweitz, L., Gouveia, R., & Korn, O. (2020). Gamifying onboarding: How to increase both engagement and integration of new employees. In *Advances in Social and Occupational Ergonomics: Proceedings of the AHFE 2019 International Conference on Social and Occupational Ergonomics*, July 24-28, 2019, Washington DC, USA 10 (pp. 3-14). *Springer International Publishing*.
- Hirevue (2023). <https://www.hirevue.com/platform/assessment-software>
- Hirevue(2023).<https://www.hirevue.com/resources/video/unilevers-recruiting-process>
- Hongal, P., & Kinange, U. (2020). A study on talent management and its impact on organization performance-an empirical review. *International Journal of Engineering and Management Research*, 10. p.64.
- Flex (2020). Sustainability Report: <https://flex.com/downloads/2022-sustainability-report> p.53.
- Joberty (2023). <https://www.joberty.com/sr/my-matches>
- IKEA (2023). [/video/how-delta-disrupts-talent-acquisition-with-ai](https://www.youtube.com/watch?v=ySbTJ3j2aCo) A behind the scenes movie about the virtual reality HR experience (2018). <https://www.youtube.com/watch?v=ySbTJ3j2aCo>
- Jennifer Carpenter (2023). Delta Airline . <https://www.hirevue.com/resources>
- Kailasanathan, Nallakaruppan & Kumaran, Senthil. (2018). Quick fix for obstacles emerging in management recruitment measure using IOT-based candidate selection. *Service Oriented Computing and Applications*. 12. 10.1007/s11761-018-0236-2.
- Kambur, E. and Akar, C. (2022). Human resource developments with the touch of artificial intelligence: a scale development study, *International Journal of Manpower*, Vol. 43 No. 1, pp. 168-205. <https://doi.org/10.1108/IJM-04-2021-0216> p.176.
- Kambur, Emine & Akar, Cüneyt. (2021). Human resource developments with the touch of artificial intelligence: a scale development study. *International Journal of Manpower*. ahead-of-print. 10.1108/IJM-04-2021-0216.p.174.
- Karmanińska, Anna. (2020). The benefits of HR analytics. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*. 64. 30-39. 10.15611/pn.2020.8.03. p.31.
- Kraan, Karolus O., Steven Dhondt, Irene L. D. Houtman, Ronald S. Batenburg, Michiel A. J. Kompier, and Toon W. Taris. 2014. Computers and types of control in relation to work stress and learning. *Behaviour & Information Technology* 33: 1013–26. Available online: <http://hdl.handle.net/1811/91648> (accessed on 21.09.2023).
- Landers, R. N., & Sanchez, D. R. (2022). Game-based, gamified, and gamefully designed assessments for employee selection: Definitions, distinctions, design, and validation. *International Journal of Selection and Assessment*, 30(1), 1-13.
- Laura Hennigan, Cassie Bottorff, 2022, What Is Talent Acquisition? Everything You Need To Know, *Forbes* , <https://www.forbes.com/advisor/business/what-is-talent-acquisition/>;
- Lauren Dixon (2017).This Firm Uses Virtual Reality to Recruit. Should Others Follow? <https://www.clomedia.com/2017/03/13/firm-uses-virtual-reality-recruit-others-follow/>
- LinkedIn Global Talent Trends 2020. <https://business.linkedin.com/content/dam/me/business/en-us/talent-solutions/resources/pdfs/linkedin-2020-global-talent-trends-report.pdf> p.66. (accessed on 21.09.2023).
- Manal Al Soori (2022), Emirates Group. <https://www.hirevue.com/resources/video/emirates-group>

- Obaid, I., Farooq, M. S., & Abid, A. (2020). Gamification for recruitment and job training: model, taxonomy, and challenges. *IEEE Access*, 8, 65164-65178.
- Onboarding Buddy (Liscio Apps, LLC.) <https://onboardingbuddy.com/>
- Petronas Integrated Report (2020). Petroliam Nasional Berhad (PETRONAS) 197401002911 (20076-K).
- Przytuła, S., Strzelec, G., & Krysińska-Kościańska, K. (2020). Re-vision of future trends in human resource management (HRM) after COVID-19. *Journal of Intercultural Management*, 12(4).
- Sandra Durth, Neel Gandhi, Asmus Komm, and Florian Pollner (2022). HR's new operating model. <https://www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/hrs-new-operating-model>
- Sari, R. E., Min, S., Purwoko, H., Furinto, A., & Tamara, D. (2020). Artificial Intelligence for a Better Employee Engagement. *International Research Journal of Business Studies*, 13(2). p.185.
- Schneider Electric (2022). Annual report <https://flipbook.se.com/catalog/ww/en/41123-Schneider-Annual-Report-2022-EN/#page/288> , p.218.
- Siemon, D., & Kedziora, D. (2023). From Accountant to Software Developer–Transforming Employees with Robotic Process Automation (RPA).
- Singh, S., Thakur, P., & Singh, S. (2023). How Does the Use of AI in HRM Contribute to Improved Business Performance?: A Systematic Review. *Managing Technology Integration for Human Resources in Industry* 5.0, 131-139.
- Steve Hatfield Jen Fisher Paul H. Silverglate, 2022. The C-suite's role in well-being, *Deloitte*, <https://www2.deloitte.com/us/en/insights/topics/leadership/employee-wellness-in-the-corporate-workplace.html> (accessed on 21.09.2023).
- SynergyXR (2022). How Grundfos, the world's largest pump manufacturer, uses Virtual Reality to onboard employees. <https://www.youtube.com/watch?v=616AAIKp1LA>
- T. Vasiljeva, S. Shaikhulina, and K. Kreslins (2017). Cloud Computing: Business Perspectives, Benefits and Challenges for Small and Medium Enterprises (Case of Latvia), *Procedia Eng.*, vol. 178, pp. 443–451, Jan. 2017, doi: 10.1016/j.proeng.2017.01.087. p. 445.
- Tewari, I., & Pant, M. (2020, December). Artificial intelligence reshaping human resource management: A review. In *2020 IEEE international conference on advent trends in multidisciplinary research and innovation (ICATMRI)* (pp. 1-4). IEEE. p.2.
- Thulin, E.; Vilhelmson, B.; Johansson, M. New Telework, Time Pressure, and Time Use Control in Everyday Tower 1, *PETRONAS Twin Towers*, Kuala Lumpur City Centre 50088 Kuala Lumpur, Malaysia. p.162.
- Tummers, L., Kruijen, P. M., Vijverberg, D. M., & Voesenek, T. J. (2015). Connecting HRM and change management: The importance of proactivity and vitality. *Journal of Organizational Change Management*, 28(4), 627-640. p.629.
- Unilever (2022). Annual Report and Accounts Highlights. <https://www.unilever.com/investors/annual-report-and-accounts/p.2>
- Vardarlier, P. (2021). Gamification in human resources management: an agenda suggestion for gamification in HRM. *Research Journal of Business and Management (RJBM)*, 8(2), 129-139.
- Vestas Sustainability Report 2022. <https://www.vestas.com/content/dam/vestas-com/global/en/sustainability/reports-and-ratings/sustainability-reports/Sustainability%20Report%202022.pdf.coredownload.inline.pdf> p.44.

- Van, Nguyen & Tucek, David & Pham, Nhat Tan. (2022). Indicators for TQM 4.0 model: Delphi Method and Analytic Hierarchy Process (AHP) analysis. *Total Quality Management & Business Excellence*. 34. 1-15. 10.1080/14783363.2022.2039062. p.6.
- Wohlgenannt, I., Simons, A., & Stieglitz, S. (2020). Virtual Reality. *Business & Information Systems Engineering*. doi:10.1007/s12599-020-00658-9, p. 4.
- World Economic Forum (2022). Global Lighthouse Network: Unlocking Sustainability through Fourth Industrial Revolution Technologies, © 2022 *World Economic Forum*. p.23.
- Xu, D., & Xiao, X. (2020). Influence of the development of VR technology on enterprise human resource management in the era of artificial intelligence. *IEEE Access*. p.3.
- Aris Apostolopoulos, (2019). The 2019 Gamification at Work Survey, *TalentLMS* <https://www.talentlms.com/blog/gamification-survey-results/>.

HR PRAKSE KROZ OBJEKTIV NOVIH TEHNOLOGIJA I DIGITALNE TRANSFORMACIJE

Apstrakt: Digitalna transformacija preduzeća zahteva primenu tehnologije Industrije 4.0 za optimizaciju i automatizaciju procesa u preduzeću, što rezultira u potpuno novom modelu poslovanja preduzeća. Taj model poslovanja osim upotrebe tehnologije zahteva i efikasno upravljanje ljudskim resursima (HRM). Odnos između HRM i primene tehnologije Industrije 4.0 u preduzeću je dvostruk. Tehnologije izazivaju nove HR operativne modele, a HR preko svojih strategija upravljanja organizacijom (upravljanje promenama, agilne organizacije, upravljanje talentima) i adekvatnih HR praksi utiče na obezbeđivanje radne snage spremne da ove distruptivne tehnologije implementiraju uspešno u svim procesima. U ovom radu je razmatrana uloga HR-a u digitalnoj transformaciji, promene koje nastaju kako u funkciji HRM tako i u praksama. Prikazani su slučajevi upotrebe tehnologije Industrije 4.0 i njihovi benefiti. Takođe je razmatran uticaj HR praksi na operativne, finansijske i performanse zaposlenih, sa aspekta upotrebe disruptivnih tehnologija. Za ispitivanje ovog uticaja korišćen je kvantitativni metod istraživanja kroz Anketni upitnik na primeru 11 velikih i srednjih preduzeća u Republici Srbiji, a za analizu rezultata korišćene su statističke metode deskriptivne statistike i korelacione analize kroz SPSS 23 softver. Rezultati istraživanja pokazuju da upotreba veštačke inteligencije / mašinskog učenja (AI/ML) u HR procesima pozitivno utiče na sva tri nivoa performansi, kako na performanse zaposlenih, tako i na operativne i finansijske performanse. Ostale hipoteze su dokazane samo delimično. Istraživanje je pokazalo i nedostatak obuke zaposlenih u HR u vezi sa mogućnostima upotrebe digitalnih tehnologija u HR procesima kao i nedostatak obuka za digitalne veštine ako se poredi HR sa drugim sektorima u preduzeću. Preporuka je da se što pre krene sa obukama HR menadžera u pogledu digitalizacije HRM.

Ključne reči: HR, digitalna transformacija, VR/AR, AI/ML, cloud computing, IoT, analitika ljudi, gamifikacija.

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