

The concept of HR 4.0: A literature review

Magdalena M. Stuss

ABSTRACT

Objective: The article aims to identify the degree of interest and consider HR 4.0 issues in scientific research. This approach enables the analysis of the existing body of work to prepare for future empirical research by gathering relevant resources of knowledge available on this subject, as well as by varying research directions.

Research Design & Methods: The study adopted formal approaches and systematic methods to locate, select, evaluate, summarise, and report the references collected in a literature review. Articles were analysed using the VOSviewer software (version 1.6.19), which is a tool used to construct and visualise bibliometric networks.

Findings: The concept of HR 4.0 forms a separate cluster directly related to the concept of Industry 4.0, and only through this path is it shaped by other semantic determinants. This indicates a lack of detailed analysis of the concept and thus probably of the entire concept itself. In the future, from the perspective of the HR 4.0 concept, the HR function will implement specific tools, such as cybernetic influences, digitalisation of human resource management (HRM), remote HRM, human – machine interface skills, human – strategic organisational links, and human – technology interface competences.

Implications & Recommendations: To date, researchers have focused on technological tools supporting human resource management processes, hence, most references have been identified with the concept of e-HRM. On the other hand, if we take the concept of Industry 4.0 as a starting point, then based on its consequences, it will also be possible in the future to analyse the relationship between the HR function and Industry 5.0.

Contribution & Value Added: There is a wide cognitive gap in the research on the concept of HR 4.0, and the information obtained from research places humans at the centre of Industry 4.0 alongside technology and organisation.

Article type: research article

Keywords: HRM; HR 4.0; Industry 4.0; evolution of the HR; HR function

JEL codes: O15, O32, M 12, M15

Received: 12 May 2023

Revised: 12 July 2023

Accepted: 21 July 2023

Suggested citation:

Stuss, M.M. (2023). The concept of HR 4.0: A literature review. *International Entrepreneurship Review*, 9(3), 109-121. <https://doi.org/10.15678/IER.2023.0903.07>

INTRODUCTION

Initially, it was believed that it was not clear as to what effects determined the individual tools used in the HR function or whether success is determined by the overall construction of the human resource management (HRM) process in a particular company (Wright *et al.*, 2003). Because of difficulties in formally assessing HR practices, some researchers even questioned whether they contribute to organizational outcomes or whether organizational success leads to increased investment in strengthening HR activities (Gerhart, 2005).

Contemporary research confirms that practices related to human resource management processes impact organizational outcomes (Armstrong, 2002; Becker & Huselid, 2006; Guthrie, 2001; Huselid, 1995; Oleksyn, 2017; Pocztowski, 2007) and that obtaining and maintaining a competitive advantage depends not only on the quality of human resources but also on having an appropriate human resource management strategy. The proper alignment of the HR strategy with the company's strategy is a critical condition for achieving organizational goals, creating a specific pattern according to which HR decisions

are made, *i.e.* a long-term concept for human resources (Armstrong, 2002; Listwan, 2002; Mahoney-Phillips & Adams, 2009; Muralidhar, 2016; Tabatabaee *et al.*, 2014).

Thus far, researchers have been mainly interested in the subject of e-HRM as part of the issue of implementing IT tools for personnel functions (Obeidat, 2016; Wirtky *et al.*, 2016). Moreover, in the analyses of Industry 4.0 (Arruda *et al.*, 2023), few authors wrote about HR (Makięta *et al.*, 2021; Verma & Venkatesan, 2022). This indicates a significant research gap in the field of HR 4.0.

The main goal of this research process was to identify the degree of interest and take up HR 4.0 issues in scientific research. A systematic review of references to the HR 4.0 concept was used as a research tool. It will make it possible to analyse the existing body of work to then prepare for future empirical research by gathering relevant resources of knowledge available on this subject and by varying research directions. The composition of the article includes a systematic literature review conducted in accordance with the research methodology described, the research results obtained and their limitations. At the end, conclusions and prospects for future research are presented.

LITERATURE REVIEW

Human resource management functions are carried out during the formulation and implementation of the company's overall strategy. This situation requires treating human resources from a long-term perspective, with careful selection of the right staff and emphasis on their development, so that they can support the implementation of the organization's strategy.

The evolution of human resource management begins with the human resources department through the HR business partner and ends with talent management and organizational business strategy (Figure 1), to evolve towards HR 4.0.

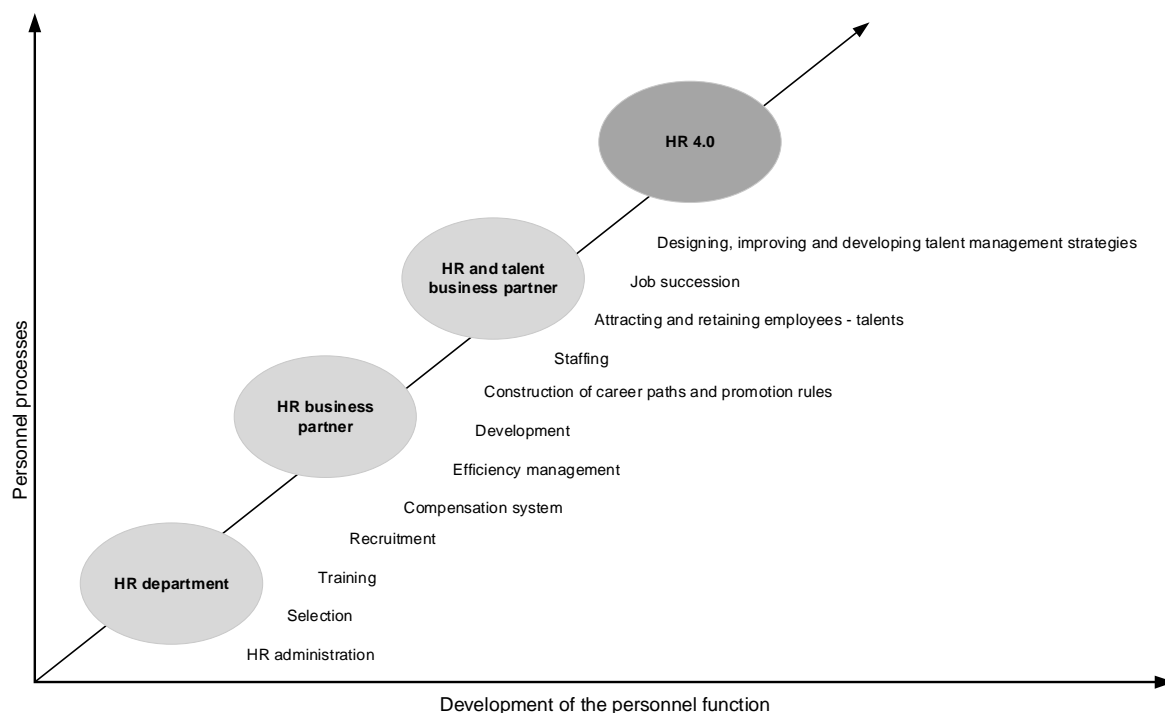


Figure 1. The evolution of the HR function

Source: own elaboration based on (Ganer *et al.*, 2022; Nugroho, 2017; Stuss, 2021).

In the 1970s and 1980s, the business function responsible for people was called the 'personnel department.' Their role was to hire people, pay them, and ensure they had the necessary benefits. In this role, the HR department was a well-understood operational function. The primary responsibility of HR departments was payroll and personnel administration, which is now accomplished by outsourcing routine work and implementing technological solutions (Ulrich *et al.*, 2012). In the 1980s and 1990s,

organizations realized that the HR function was more important and the concept of ‘HR business partner’ emerged. During this time, organizations recognized that the vice president of human resources had a much greater role: recruiting the right people, training them, *helping* with business design and organizational structures (organizational design), developing ‘total compensation packages’ that included benefits, stock options, and bonuses, serving as a focal point of communication for employee health and wellbeing. The ‘personnel manager’ became the ‘VP of HR’ and had a much more significant role in executing the business strategy (Stuss, 2021). The HR strategies focused on linking individual and integrated HR practices to business success through strategic HR. Practices were expanded to include employee assessment and development to integrate them into the organizational culture and leadership in implementing the adopted business strategy (Ulrich *et al.*, 2012).

After the year 2000, the next evolutionary changes in the HR function included the full opening of HR departments to the outside world, combined with the concept of talent management (Stuss, 2021):

- Deliberate use of HR practices to obtain external business conditions and respond to them;
- Extending career aspirations beyond strategy to adapt the HR department’s work to business contexts and stakeholders;
- HR becomes a strategic positioner who understands business and can shape and position success-orientated activities;
- HR becomes a credible activist who gains personal credibility and takes a proactive stance on business outcomes;
- HR becomes a capability builder who can find the right combination of personal and organizational development activities;
- efforts are needed to emphasise talent as human capital;
- HR becomes an innovator and integrator of HR activities;
- HR becomes a champion of human resource change that connects the past to the future, which anticipates and manages individual, initiative, and institutional change;
- HR uses technology to seamlessly process administrative work while also generating information for more strategic work.

All the foundations necessary to enable the concept of management through efficient and effective HR functions have four key pillars (Cheese, 2008):

- Harmonized processes and policies – consolidation of processes and policies into consistent formats and approaches, leading to more consistent people management;
- Integrated HR systems and information – a consolidated database containing the ‘one truth’ for HR information and integrated systems supporting integrated processes;
- Shared services – consolidation of administrative and transactional activities into a common or shared service structure with an integral service management measurement structure. This allows other HR areas, particularly business partners, to focus on their roles and maximize value-added;
- Focus and improved management capabilities – organizing activities in specific areas of the capability to provide focus, improve management, and ensure adequate oversight and proper management of all parts of HR across the organization.

Contemporary research highlights that organizations are slowly becoming cyber-physical systems (Trotta & Garengo, 2019) (Nteboheng *et al.*, 2021; Trotta & Garengo, 2019) and human resource management practices in the context of HR 4.0 are expected to be cyber-based to ensure organizational competitiveness. It is also expected that intelligent systems in HR processes will be used more extensively in the future (Shamim *et al.*, 2016).

RESEARCH METHODOLOGY

In management and quality sciences, a literature review is the first stage of research and is particularly important when considering new research initiatives. This is because it uses formal approaches and systematic methods to locate, select, evaluate, summarize, and report the references collected

(Denyer & Tranfield, 2009). Exploring research gaps using a systematic literature review provides important support in presenting efforts to identify challenges facing future research (Amui *et al.*, 2017; Mariano *et al.*, 2015). A systematic review of references on the concept of HR 4.0 (adopted as the main goal of this research process) will make it possible to analyse the existing body of work to then prepare for future empirical research by gathering relevant resources of knowledge available on this subject, as well as by varying research directions (Denyer & Tranfield, 2006; Kitchenham, 2004). Such a theoretical synthesis of the division of the topic studied into key and ancillary terms increases methodological discipline and helps to create a credible knowledge base by collecting information from a range of studies on HR processes.

To minimize potential errors and biases in this study, data extraction methods were used for the systematic review, which required documentation of all diagnostic stages. Data extraction included general information such as the title, author or authors, and publication details (Jabbour, 2013).

The searched terms were checked in the Scopus database due to its significance as a subscription-based online service for indexing scientific citations. Only scientific articles, monographs, chapters from monographs, and review articles were retained. The following keywords were used: HR 4.0, HRM 4.0, Digital HR, and e-HRM (Table 1). The adopted research process allowed for the identification and analysis of the references obtained based on the coding system, leading to the identification of research gaps in the literature, as well as opportunities and challenges for future studies. In the study based on a systematic review of the literature, a data extraction process was used that included individual analyses of the collected references according to the adopted coding system. All research results from this search were then narrowed down by applying refinement mechanisms by field to business, management and accounting, economics, econometrics and finance, and social sciences. Furthermore, the search was narrowed down to texts in English, as it was the dominant language in all the literature items.

Table 1. Results of the search process and articles remaining after analysis

According to the SCOPUS database	HR 4.0	HRM 4.0	Digital HR	e-HRM
All documents	416	161	133	1365
Subject area, including: Business, Management and Accounting Economics, Econometrics and Finance Social Sciences.	116	117	79	1,162
In English	114	117	75	1151
Content-verified based on abstracts	91	92	63	322

Source: own elaboration.

After collecting the relevant articles, an analysis was conducted to verify whether they all addressed the topic of the HR function from the perspective of implementing tools specific to the HR 4.0 concept, such as:

- cybernetic influences (Trotta & Garengo, 2018),
- digitalization of HRM (Doshi *et al.*, 2021; LUMI, 2020),
- remote HRM (Dlamini & Ndzinisa, 2020),
- human – machine interface skills (Trotta & Garengo, 2019),
- human – strategic organizational links (Gan & Yusof, 2019),
- human – technology interface competencies (Shamim *et al.*, 2016).

RESULTS AND DISCUSSION

Systematic reviews utilize a set of explicit selection criteria to assess the significance of each identified study (Tranfield *et al.*, 2003). Before meticulous codification, articles were analysed using the VOSviewer software (version 1.6.19), a tool for constructing and visualizing bibliometric networks. These networks, made possible through text mining functionality, were used to construct and visualize the co-occurrence of important terms appearing in the literature, representing a way to identify main research topics and

future research opportunities. The terms from the abstracts that appeared most frequently in the networks were initially used to develop analysis categories, as presented in the figures below. Classification frameworks were developed using numerical and alphabetical codes to classify the articles.

As can be seen in Figure 2, the concept of HR 4.0 forms a separate cluster directly related to the concept of Industry 4.0, and only through this path is it shaped by other semantic determinants. This indicates a lack of detailed analysis of the concept, and thus probably of the entire concept itself.

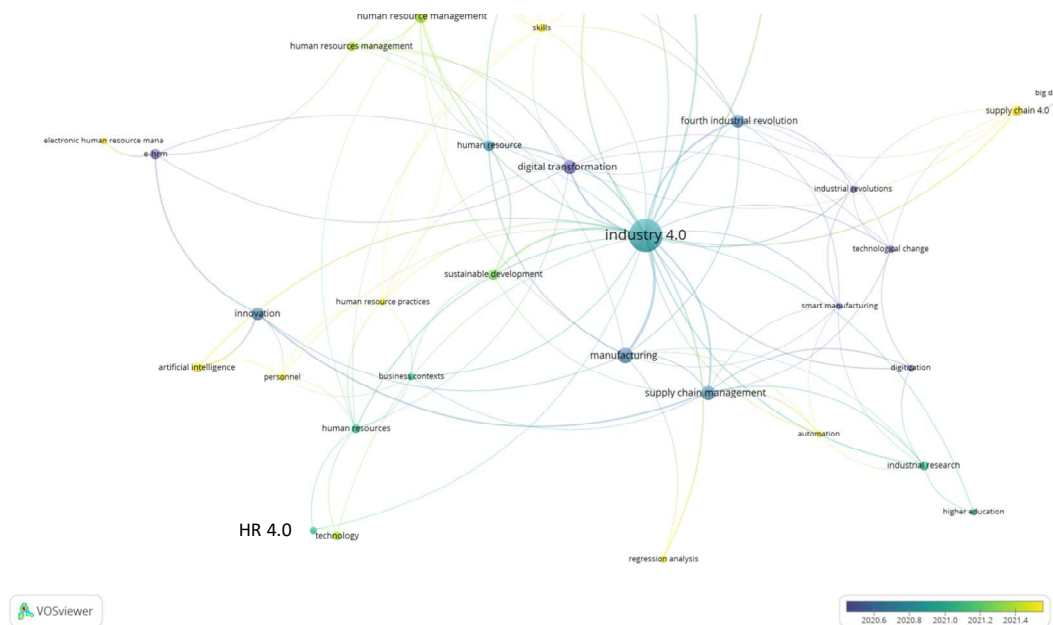


Figure 2. Keyword mapping for the concept of HR 4.0: Network for category development
 Source: own elaboration based on systematic literature review.

Although the number of references found is almost identical to that of HR 4.0, in the case of the concept of HRM 4.0, more turning points were identified from the keywords. As shown in Figure 3, among the clusters, there emerged a general concept of human resources, as well as Industry 4.0 and technology. However, similar to the previous case, these are only symptoms of interest in the issue of HRM 4.0.

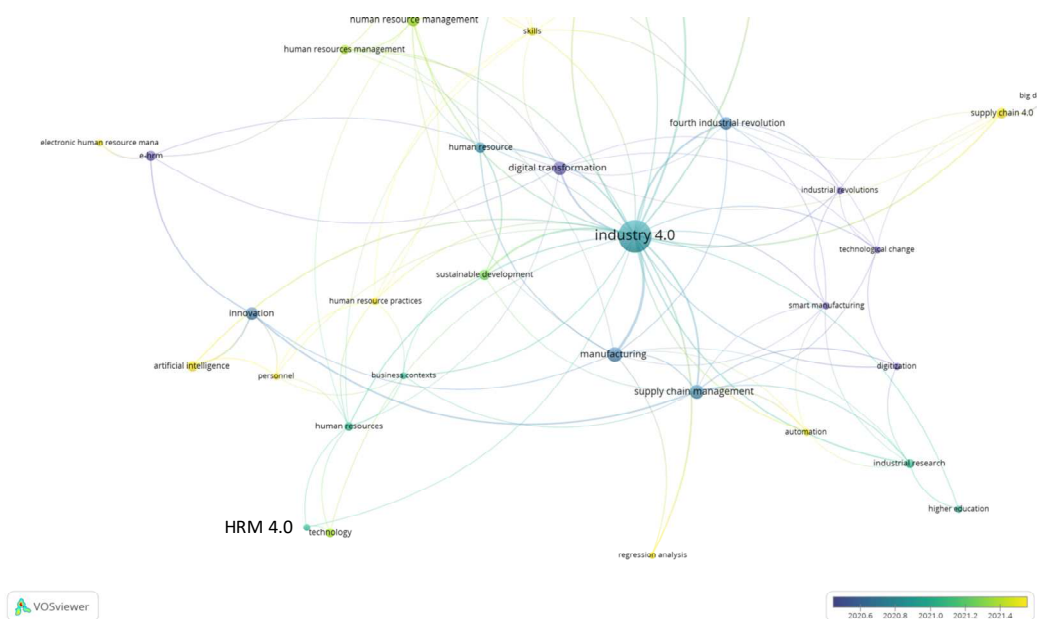


Figure 3. Keyword mapping for the concept of HRM 4.0: Network for category development
 Source: own elaboration based on systematic literature review.

However, the analysis conducted for the concept of digital HR (as shown in Figure 4) highlighted more keywords related to the studied term: employees, technology sensibility development, HRM, digitalisation, mergers, and technology transfer.

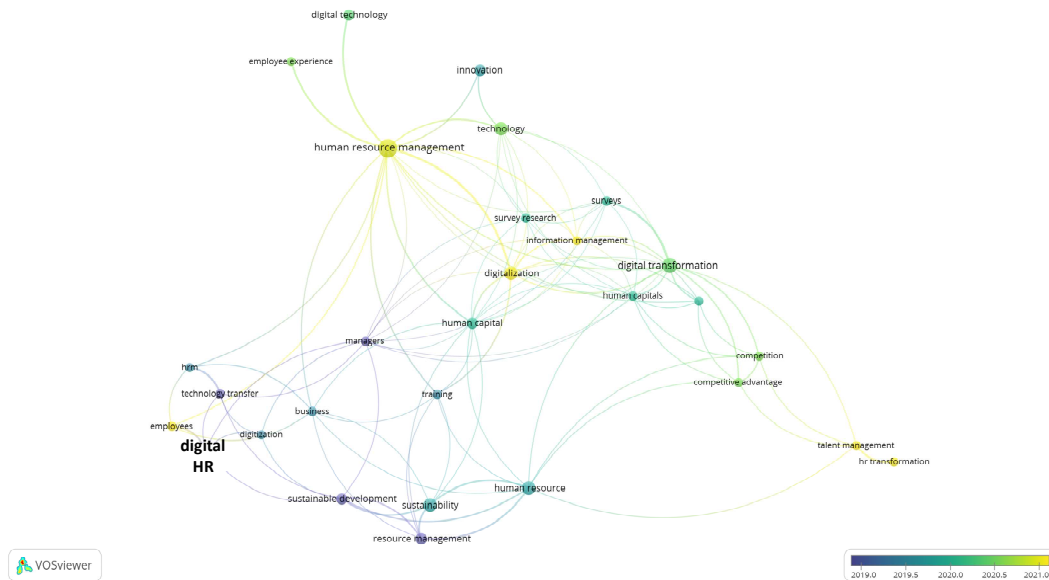


Figure 4. Keyword mapping for the term digital HR: Network for category development

Source: own elaboration based on systematic literature review.

However, there is a lack of direct connection with Industry 4.0, which was emphasized in previous analyses. Therefore, the question should be asked whether this term should be further analysed in the context of the HR 4.0 concept. Therefore, digital HR is not analysed in the context of Industry 4.0.

In the case of the last concept, e-HRM (Figure 5), it is clear that research has been conducted extensively in this area. Numerous connections have been identified, but as before, there is no connection with Industry 4.0. The E-HRM cluster is central alongside human resource management.

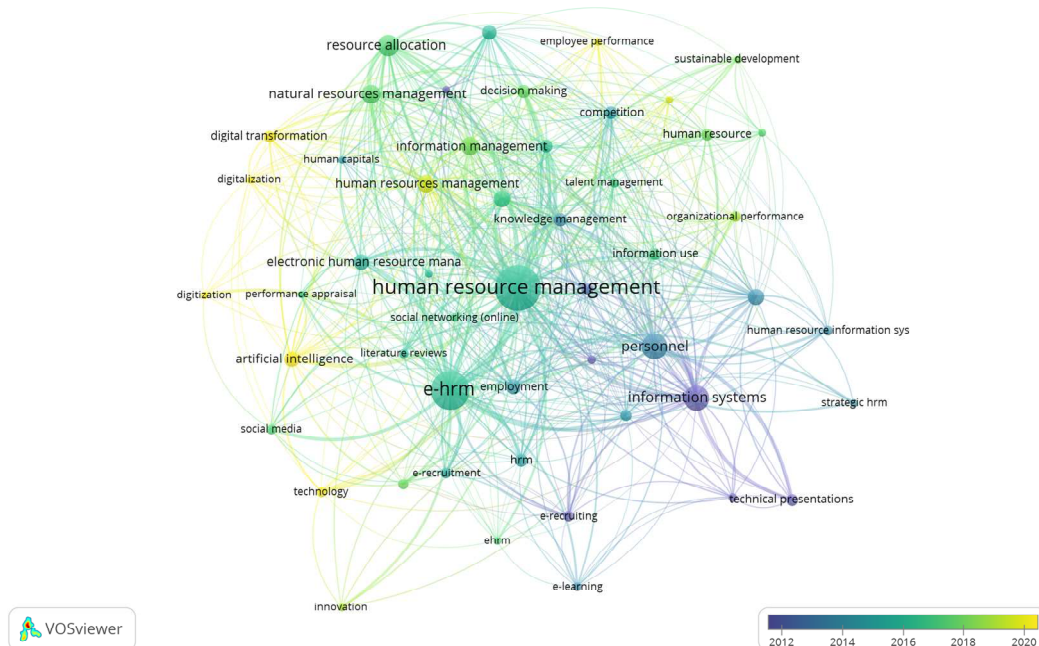


Figure 5. Keyword mapping for the concept of e-HRM: Network for category development

Source: own elaboration based on systematic literature review.

The following graphs present analyses conducted from the point of view of publication date, author affiliations, and funding of publications and/or research from research projects.

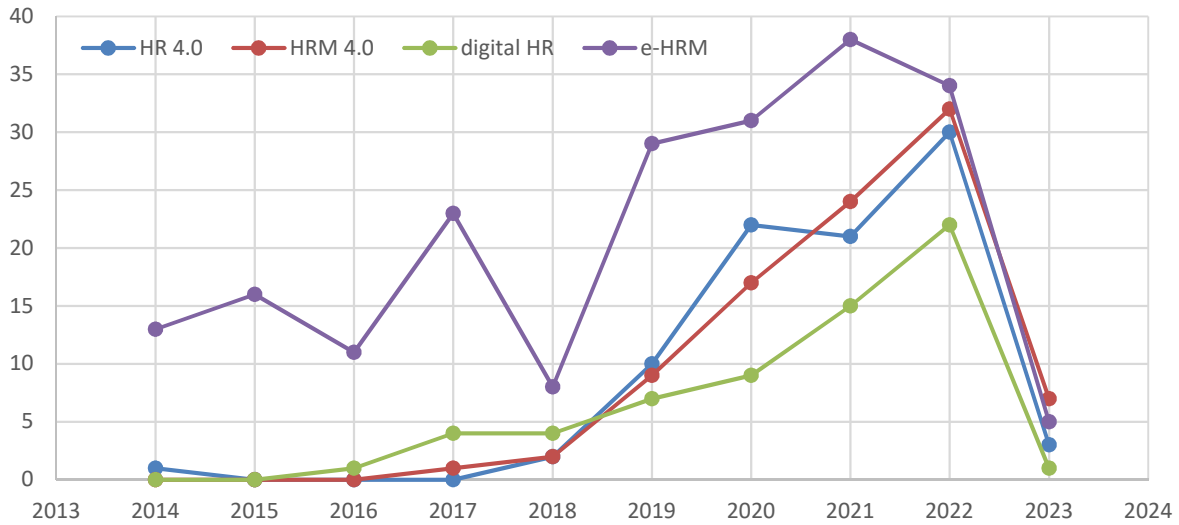


Figure 6. Number of published articles selected per year
Source: own elaboration based on systematic literature review.

Figure 6 shows the distribution of research articles from 2013 to 2023(Q1) and indicates that the number of studies on the analysed issues has been steadily increasing, with a sharp rise after 2019. In conclusion, human resource issues (indexed by the four analysed keywords) are becoming increasingly important and research has been accelerated due to the change in the entire business context after 2019 and the outbreak of the Covid-19 pandemic, often requiring the adoption of digital technology in human resource management. As a result, more and more researchers are focusing on this field and conducting both theoretical and empirical projects.

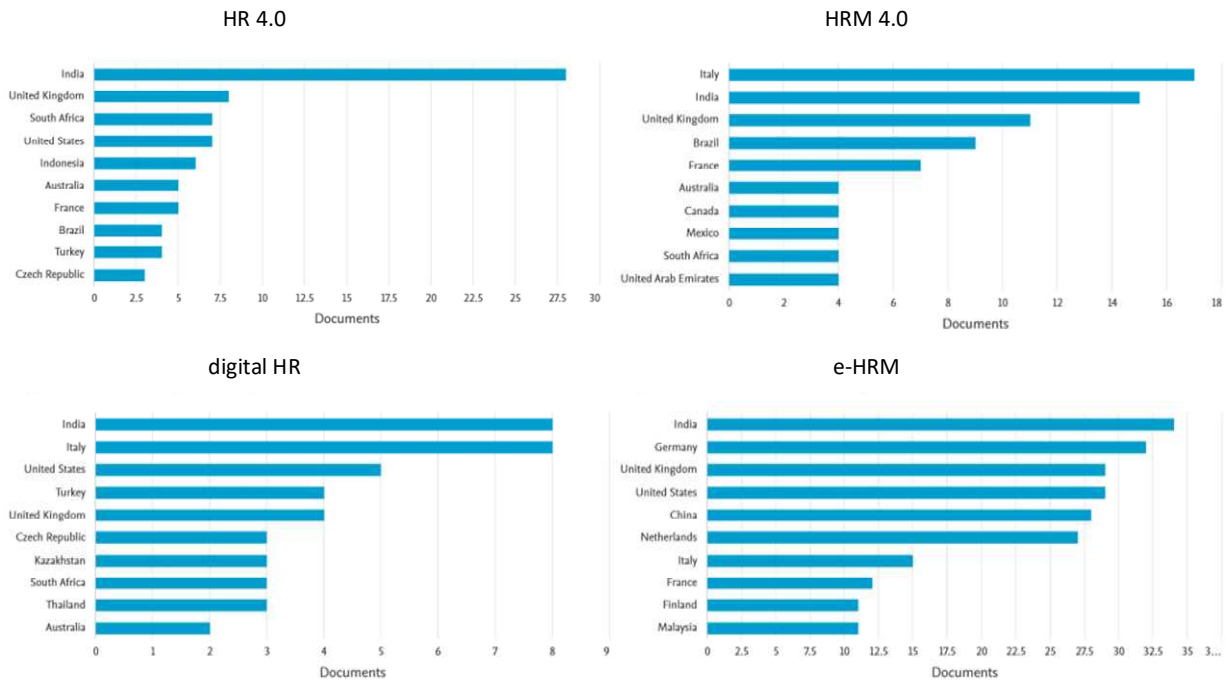


Figure 7. Number of published articles selected by countries
Source: own elaboration based on systematic literature review.

On the other hand, the number of publications based on information on the affiliation of each article showed (Figure 7) that the dominant group of researchers in the case of all analysed concepts comes from India. However, scholars from all over the world are paying attention to this topic, as most articles were written by international research teams.

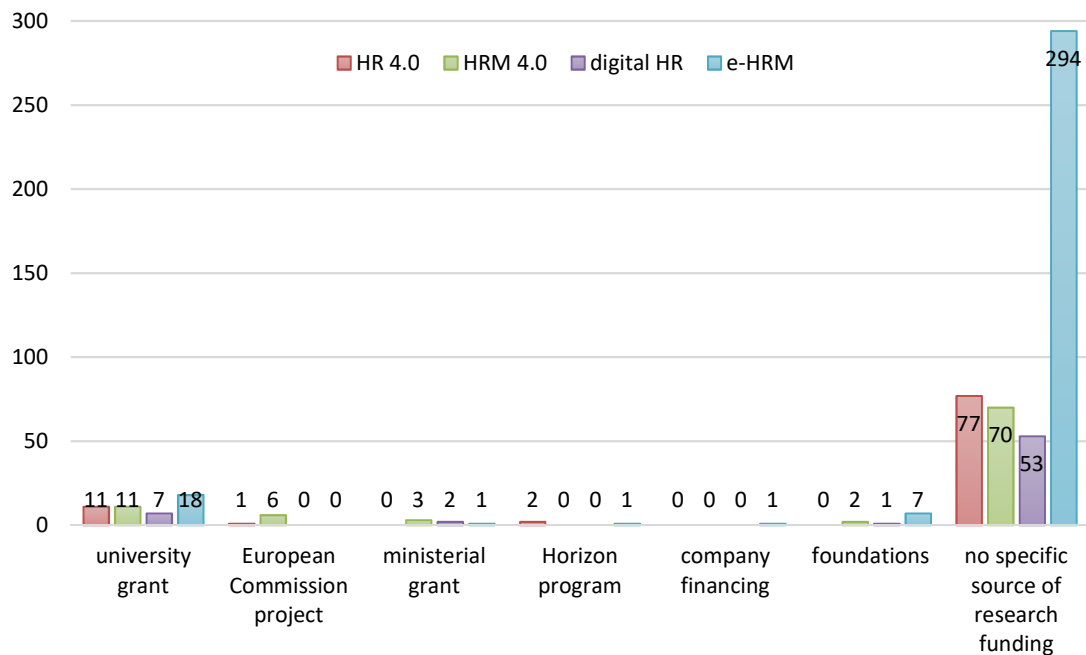


Figure 8. Number of published articles selected, by source of funding

Source: own elaboration based on systematic literature review.

In Figure 8, it is clear that the issues described in the collected references were funded from unknown sources or were not conducted as part of the funded research projects. In the case of the stated sources of funding, university grants were predominant.

In the second stage of the research, a content analysis was conducted based on the distinctive tools that are characteristic of the HR 4.0 concept. All articles were analysed to better understand whether they addressed the identified topics. However, those that were not available for download were removed from the study. The next step after collecting the relevant articles was the analysis of the implementation of tools specific to the HR 4.0 concept, which were adopted in the research methodology. The analysis indicated:

Cybernetic Influences

Challenges facing the HR function in Industry 4.0 include: handling vast amounts of data, adapting to the rapid pace of change, embracing new business models, and leveraging intelligent services enabled by digital tools (Schultz, 2021a). Achieving these objectives requires addressing several challenges. To adopt a particular technology and improve software processes, ethical considerations need to be identified and carefully considered (Rahanu *et al.*, 2021).

Digitalization of HRM

In the literature reviewed, it was emphasized that the digitalization of HRM will continue to play a crucial role in building competitiveness. Human resources management processes such as staffing, compensation, employee relations, and development, driven by information and communication technologies, will rely heavily on data analytics and metrics. Devices and technological infrastructure such as the internet, data analytics, robotics, and artificial intelligence are expected to facilitate digitalization (Nteboheng *et al.*, 2021).

Remote HRM

The demand for workspace is driven by employment trends. The nature of work is becoming increasingly flexible and virtual (Chernyak-Hai & Rabenu, 2018), which may have an impact on future relationships between HR and employees. Digitization and smart communication technology are factors enabling the execution of HR tasks remotely (Kämpf-Dern & Konkol, 2017; Schultz, 2021b). It is essential to provide the proper balance between office, home office, and third space, along with the appropriate information technology (IT) tools and behavioural aspects, to make remote work effective (De Bruyne & Gerritse, 2018).

Human-Machine Interface Skills

The changes brought about by Industry 4.0 are happening quickly and human-machine interface solutions are not always obvious, reaching into organizationally, socially, and culturally ambiguous paths. Qualifications, skills, and appropriate learning frameworks are important issues that support organization's future agenda. The impact of HRM is based on the natural and inseparable relationships between human issues and the adoption of IT practices and trends (Liboni *et al.*, 2019).

Human: Strategic Organizational Links

Despite automation, digitalization, and the electronic nature of future HRM, it has been observed that human resources will continue to be of crucial importance in building organizational strategy. In the future, human resource management practices will have to focus on stronger talent management. The importance of talent management processes is growing, as evidenced by both the many concerns of researchers and the talent management programs implemented in business practice (Stuss, 2021). In the Industry 4.0 era, it is necessary to adapt the education system to the new developmental requirements of society. In these new conditions, only the acquired knowledge will contribute to the development of Industry 4.0. Depending on the industrial sector, specific skills and tasks of humans may differ from others due to the diversity of processes. Therefore, human capital will have a significant role in work and will alter the course of jobs and education (Sima *et al.*, 2020).

Human: Technology Interface Competences

There is an increased need for technology proficiency among HRM operations due to increased virtuality. In particular, the increased use of technology means that everyone is proficient in information technology (IT) to ensure that the required fluidity of network services, connectivity infrastructure, and other technological accessories is maintained. Technology is also an important element that is expected to impact both the processes and outcomes of the entire HRM system (Nteboheng *et al.*, 2021).

The conducted systematic literature review was based solely on one Scopus publication database. It is necessary to conduct a broader analysis of the degree of interest in HR 4.0 based on other databases, such as ProQuest, Emerald, or Web of Science. It is also necessary to analyse sources among Polish-language publications, which are mostly not included in the above-mentioned scientific databases. Irrespective of the indicated organizations, the conducted research confirmed a research gap, namely the growing interest in the issues of HR 4.0 only since 2018. Therefore, modern building of the personnel function is a challenge and necessity today not only for scientists but also for management practitioners.

CONCLUSIONS

The information obtained from research places humans at the centre of Industry 4.0 alongside technology and organization. If the significant variable is human beings, it is clear that investing in human capital and measuring it on an ongoing basis are essential to have insight into the value of human capital and its potential. There is a wide cognitive gap for research on the concept of HR 4.0, or perhaps HRM 4.0 would be more appropriate.

Regardless of which keyword is used, it embodies the industry strategy of bridging gaps around dynamic opportunities to adapt and survive in the 4.0 market by combining real and virtual global information and IT management expertise (Amui *et al.*, 2017; Liboni *et al.*, 2019). All of these terms

are used to describe the management and market revolution brought by the reality of Industry 4.0 and their analysis has the potential to help familiarize researchers and practitioners with the upcoming changes that Industry 4.0 brings and that are currently being discussed in various fields of knowledge.

With the increasing pace of automation, the required number of employees performing redundant, process-based tasks decreases, both in production and office environments (Dhanpat *et al.*, 2020; Baldassari & Roux, 2017). Industry 4.0 is supported by technology and production development, but HR remains a significant factor in changing all of this (El-Khoury, 2017; Liboni *et al.*, 2019), and the HR area includes how people relate to each other, how they relate to technology and inventions developing in the industry, and how they relate to the new concept of Industry 4.0 (DiRomualdo *et al.*, 2018). It is imperative that organizations adapt their HR practices and plans to Industry 4.0 in areas such as skills development and workforce employment (Sivathanu & Pillai, 2018). The digital transformation process that companies must face to be competitive and play a leading role in the markets is not only a technological issue but also a matter of competencies and skills.

To date, researchers have focused on technological tools supporting human resource management processes, and thus, most references have been identified with the concept of e-HRM. On the other hand, if we take the concept of Industry 4.0 as a starting point, then based on its consequences, it will also be possible in the future to analyse the relationship between the HR function and Industry 5.0.

REFERENCES

- Amui, L.B.L., Jabbour, C.J.C., de Sousa Jabbour, A.B.L., & Kannan, D. (2017). Sustainability as a dynamic organizational capability: a systematic review and a future agenda toward a sustainable transition. *Journal of Cleaner Production*, 142, 308-322. <https://doi.org/10.1016/j.jclepro.2016.07.103>
- Armstrong, M. (2002). *Zarządzanie zasobami ludzkimi*. Oficyna Ekonomiczna.
- Arruda, H.M., Bavaresco, R.S., Kunst, R., Bugs, E.F., Pesenti, G.C., & Barbosa, J.L.V. (2023). Data Science Methods and Tools for Industry 4.0: A Systematic Literature Review and Taxonomy. *Sensors*, 23(11), 5010. <https://doi.org/10.3390/s23115010>
- Baldassari, P., & Roux, J.D. (2017). Industry 4.0: preparing for the future of work. *People & Strategy*, 40(3), 20-24.
- Becker, B.E., & Huselid, M.A. (2006). Strategic Human Resources Management: Where Do We Go From Here?. *Journal of Management*, 32(6), 898-925. <https://doi.org/10.1177/0149206306293668>
- Cheese, P. (2008). Driving high performance in the talent-powered organization. *Strategic HR Review*, 7(4), 25-31. <https://doi.org/10.1108/14754390810880507>
- Chernyak-Hai, L., & Rabenu, E. (2018). The New Era Workplace Relationships: Is Social Exchange Theory Still Relevant?. *Industrial and Organizational Psychology*, 11(3), 456-481. <https://doi.org/10.1017/iop.2018.5>
- De Bruyne, E., & Gerritse, D. (2018). Exploring the future workplace: results of the futures forum study. *Journal of Corporate Real Estate*, 20(3), 196-213. <https://doi.org/10.1108/JCRE-09-2017-0030>
- Denyer, D., & Tranfield, D. (2009). Producing a systematic review. In D. Buchanan & A. Bryman (Eds.), *The Sage Handbook of Organizational Research Methods* (pp. 671-687). Sage Publications Ltd.
- Denyer, D., & Tranfield, D. (2006). Using qualitative research synthesis to build an actionable knowledge base. *Management Decision*, 44(2), 213-227. <https://doi.org/10.1108/00251740610650201>
- Dhanpat, N., Buthelezi, Z.P., Joe, M.R., Maphela, T.V., & Shongwe, N. (2020). Industry 4.0: The role of human resource professionals. *SA Journal of Human Resource Management*, 18. <https://doi.org/10.4102/sajhrm.v18i0.1302>
- DiRomualdo, A., El-Khoury, D., & Girimonte, F. (2018). HR in the digital age: how digital technology will change HR's organization structure, processes and roles. *Strategic HR Review*, 17(5), 234-242. <https://doi.org/10.1108/SHR-08-2018-0074>
- Dlamini, R., & Ndzinisa, N. (2020). Universities trailing behind: Unquestioned epistemological foundations constraining the transition to online instructional delivery and learning. *South African Journal of Higher Education*, 34. <https://doi.org/10.20853/34-6-4073>
- Doshi, M., Shukla, A., & Patel, P. (2021). A study on digitalisation in human resources with help of some examples. *SSRN Electronic Journal*, 8, a425-a438.


- El-Khoury, D. (2017). Digital transformation and the world-class HR difference. *Strategic HR Review*, 16(2), 86-88. <https://doi.org/10.1108/SHR-01-2017-0001>
- Gan, J.L., & Yusof, H.M. (2019). Industrial revolution 4.0: The human resource practices. *International Journal of Recent Technology and Engineering*, 8(3), 620-624.
- Ganer, S.D., Kediya, S.O., Suchak, A.K., Dey, S.K., & Band, G. (2022). Analytical study of HRM practices in industry 5.0. *IOP Conference Series: Materials Science and Engineering*, 1259(1), 012041. <https://doi.org/10.1088/1757-899X/1259/1/012041>
- Gerhart, B. (2005). Human resources and business performance: Findings, unanswered questions, and an alternative approach. *Management Revue*, 174-185.
- Guthrie, J.P. (2001). High-involvement work practices, turnover and productivity: Evidence from New Zealand. *Academy of Management Journal*, 44(1), 180-190. <https://doi.org/10.2307/3069345>
- Huselid, M.A. (1995). The impact of human resource management practices on turnover, productivity and corporate financial performance. *Academic Management Journal*, 38(3), 635-672.
- Jabbour, C.J.C. (2013). Environmental training in organisations: From a literature review to a framework for future research. *Resources, Conservation and Recycling*, 74, 144-155. <https://doi.org/10.1016/j.resconrec.2012.12.017>
- Kämpf-Dern, A., & Konkol, J. (2017). Performance-oriented office environments – framework for effective workspace design and the accompanying change processes. *Journal of Corporate Real Estate*, 19(4), 208-238. <https://doi.org/10.1108/JCRE-03-2017-0009>
- Kitchenham, B. (2004). Procedures for Performing Systematic Reviews. *Keele, UK, Keele Univ.*, 33.
- Liboni, L.B., Cezarino, L.O., Jabbour, C.J.C., Oliveira, B.G., & Stefanelli, N.O. (2019). Smart industry and the pathways to HRM 4.0: implications for SCM. *Supply Chain Management: An International Journal*, 24(1), 124-146. <https://doi.org/10.1108/SCM-03-2018-0150>
- Listwan, T. (Ed.). (2002). *Zarządzanie kadrami*. Warszawa: Wydawnictwo C.H. Beck.
- Lumi, A. (2020). The Impact of Digitalisation on Human Resources Development. *Prizren Social Science Journal*, 4, 39-46. <https://doi.org/10.32936/pssj.v4i3.178>
- Mahoney-Phillips, J., & Adams, A. (2009). Getting the measure of HR. *Strategic HR Review*, 9(1), 5-9. <https://doi.org/10.1108/14754391011007061>
- Makieła, Z., Stuss, M.M., & Borowiecki, R. (2021). *Sustainability, Technology and Innovation 4.0*. Routledge. <https://doi.org/10.4324/9781003184065>
- Mariano, E.B., Sobreiro, V.A., & Rebelatto, D.A.N. (2015). Human development and data envelopment analysis: A structured literature review. *Omega*, 54, 33-49. <https://doi.org/10.1016/j.omega.2015.01.002>
- Muralidhar, S. (2016). Impact of HR Practices on Job Satisfaction and Talent Management in the Manufacturing Sector. *PES Business Review*, 11(2), 20. <https://doi.org/10.21842/pes/2016/v11/i2/140731>
- Nteboheng, P., Mefi, W., Sisulu, U., Samson, N., Asoba, W., Mefi, N., & Asoba, S.N. (2021). Sustainable human resource practices for organizational competitiveness post the Covid-19 pandemic. *Academy of Entrepreneurship Journal*, 27, 1-7. Retrieved from <https://www.proquest.com/openview/44b5b0c6f65a7698177438b8cf8d8011/1?pq-origsite=gscholar&cbl=29726> on April 2, 2023.
- Nugroho, R.E. (2017). Analysis of Talent Management, Employee Engagement and Leadership. *International Journal of Economic Perspective*, 11(4), 590-601.
- Obeidat, S.M. (2016). The link between e-HRM use and HRM effectiveness: an empirical study. *Personnel Review*, 45(6), 1281-1301. <https://doi.org/10.1108/PR-04-2015-0111>
- Oleksyn, T. (2017). *Zarządzanie zasobami ludzkimi w organizacji*. Warszawa: Wolters Kluwer.
- Pocztowski, A. (2007). *Zarządzanie zasobami ludzkimi: strategie, procesy, metody*. Polskie Wydawnictwo Ekonomiczne.
- Rahanu, H., Georgiadou, E., Siakas, K., Ross, M., & Berki, E. (2021). *Ethical Issues Invoked by Industry 4.0* (pp. 589-606). https://doi.org/10.1007/978-3-030-85521-5_39
- Schultz, C.M. (2021a). The relationship between self-leadership, the future of human resource management, and work engagement. *SA Journal of Human Resource Management*, 19. <https://doi.org/10.4102/sajhrm.v19i0.1701>
- Schultz, C.M. (2021b). The future and the role of human resource management in South Africa during the Fourth Industrial Revolution. *SA Journal of Human Resource Management*, 19. <https://doi.org/10.4102/sajhrm.v19i0.1624>

- Shamim, S., Cang, S., Yu, H., & Li, Y. (2016). Management approaches for Industry 4.0: A human resource management perspective. *2016 IEEE Congress on Evolutionary Computation (CEC)*, 5309-5316. <https://doi.org/10.1109/CEC.2016.7748365>
- Sima, V., Gheorghe, I.G., Subić, J., & Nancu, D. (2020). Influences of the Industry 4.0 Revolution on the Human Capital Development and Consumer Behavior: A Systematic Review. *Sustainability*, 12(10), 4035. <https://doi.org/10.3390/su12104035>
- Sivathanu, B., & Pillai, R. (2018). Smart HR 4.0 – how industry 4.0 is disrupting HR. *Human Resource Management International Digest*, 26(4), 7-11. <https://doi.org/10.1108/HRMID-04-2018-0059>
- Stuss, M.M. (2021). *Zarządzanie talentami. Koncepcje, modele i praktyki*. Wydawnictwo Uniwersytetu Jagiellońskiego.
- Tabatabaee, S.A.N., Lakeh, A.A., & Tadi, A.A. (2014). A Study of Succession Planning Challenges in Governmental Organizations. *Kuwait Chapter of Arabian Journal of Business and Management Review*, 3(11.a), 231-238. <https://doi.org/10.12816/0018795>
- Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *British Journal of Management*, 14(3), 207-222. <https://doi.org/10.1111/1467-8551.00375>
- Trotta, D., & Garengo, P. (2019). *Assessing Industry 4.0 Maturity: An Essential Scale for SMEs*. 69-74. <https://doi.org/10.1109/ICITM.2019.8710716>
- Trotta, D., & Garengo, P. (2018). Industry 4.0 key research topics: A bibliometric review. *2018 7th International Conference on Industrial Technology and Management (ICITM)*, 113-117. <https://doi.org/10.1109/ICITM.2018.8333930>
- Ulrich, D., Younger, J., Brockbank, W., & Ulrich, M. (2012). HR talent and the new HR competencies. *Strategic HR Review*, 11(4), 217-222. <https://doi.org/10.1108/14754391211234940>
- Verma, A., & Venkatesan, M. (2022). HR factors for the successful implementation of Industry 4.0: A systematic literature review. *Journal of General Management*, 47(2), 73-85. <https://doi.org/10.1177/03063070211019141>
- Wirtky, T., Laumer, S., Eckhardt, A., & Weitzel, T. (2016). On the Untapped Value of e-HRM – a Literature Review. *Communications of the Association for Information Systems*, 38, 20-83. <https://doi.org/10.17705/1CAIS.03802>
- Wright, P.M., Gardner, T.M., & Moynihan, L.M. (2003). The impact of HR practices on the performance of business units. *Human Resource Management Journal*, 13(3), 21-36. <https://doi.org/10.1111/j.1748-8583.2003.tb00096.x>

Author**Magdalena M. Stuss**

Associate Professor at the Jagiellonian University (Poland). Her scientific interests include human resource management in public organizations and enterprises, employer branding, organization of work in managerial positions, and the search for the relationship between human resource management and finance – human capital management in the practice of enterprises and contemporary management concepts.

Correspondence to: Prof. UJ, dr hab. Magdalena M. Stuss, Jagiellonian University, Institute of Economics, Finance and Management, Gołębia 24, 31-007 Krakow, Poland, e-mail: magdalena.stuss@uj.edu.pl

ORCID  <http://orcid.org/0000-0001-9911-649X>

Acknowledgements and Financial Disclosure

The article came into being within the research project conducted at the Department of Management Theory and Human Capital, Institute of Economics, Finance and Management. The author would like to thank the anonymous referees for their useful comments, which allowed to increase the value of this article.

Conflict of Interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Copyright and License

This article is published under the terms of the Creative Commons Attribution (CC BY 4.0) License <http://creativecommons.org/licenses/by/4.0/>

Published by Krakow University of Economics – Krakow, Poland



Ministry of Education and Science
Republic of Poland

The journal is co-financed in the years 2022-2024 by the Ministry of Education and Science of the Republic of Poland in the framework of the ministerial programme "Development of Scientific Journals" (RCN) on the basis of contract no. RCN/SP/0251/2021/1 concluded on 13 October 2022 and being in force until 13 October 2024.

