SILESIAN UNIVERSITY OF TECHNOLOGY PUBLISHING HOUSE

SCIENTIFIC PAPERS OF SILESIAN UNIVERSITY OF TECHNOLOGY 2025
ORGANIZATION AND MANAGEMENT SERIES NO. 227

# THE EVOLUTION OF THE HR FUNCTION – FROM TRADITION TO MODERNITY

Magdalena M. STUSS[1*], Patrycja ZWIECH[2], Eva M. SÁNCHEZ TEBA[3]

[1] Jagiellonian University, Kraków, Poland; magdalena.stuss@uj.edu.pl, ORCID: 0000-0001-9911-649X
[2] University of Szczecin, Szczecin, Poland; patrycja.zwiech@usz.edu.pl, ORCID: 0000-0002-4053-8177
[3] Universidad de Málaga, Malaga, Spain; emsanchezteba@uma.es, ORCID: 0000-0002-2654-292X
* Correspondence author

**Purpose:** The aim of this article was to present the results of a study of the degree of interest in the latest concepts in the HR function in research: the evolutionary change from the HR 4.0 concept to the HR 5.0 concept.
**Design/methodology/approach**: The study used methods of a systematic literature review conducted using VOSviewer software and content analysis using MAXQDA 2024 software in accordance with the described research methodology.
**Findings:** In the conducted literature research, one can observe an analysis of the relationship between the HR function and Industry 5.0, hence the considerable interest in the HR 5.0 concept. Many of the texts describe the evolution from the HR 4.0 concept to HR 5.0. Undoubtedly, the most important issue, to which a significant part of the examined references was devoted, is the possibility of using artificial intelligence in HR processes.
**Research limitations/implications**: The limitation of the presented results is the exclusive use of the Scopus database and its algorithms to collect references, which were then diagnosed according to the methodology of a systematic literature review.
**Originality/value:** The conducted research involved an innovative assessment of the literature on HR 4.0 and HR 5.0 concepts using an IT program for qualitative data analysis.
**Keywords:** human resource management, HR function, HR 4.0, HR 5.0.
**Category of the paper:** Research paper**.**

## 1. Introduction

The first stage of research when considering new research initiatives in the discipline of management science and quality is usually a review of the literature. This is because formal approaches and systematic methods are used to locate, select, evaluate, summarise and report the collected references (Snyder, 2019). Exploring research gaps using a systematic review of the literature provides important support in presenting efforts to identify challenges for future empirical research (Kraus et al., 2022).

The main objective of the research process described in this article was to identify the degree of interest in the latest concepts in the personnel function in research. The general changes that are taking place in management processes indicate the need to answer the question of whether HR processes have evolved from HR 4.0 to HR 5.0. It is also important to identify the criteria, manifestations, tools, etc. used in HR processes.

The research tools used allowed an analysis of the existing body of research on the indicated HR topic in order to prepare future empirical research.

## 2. Methods

The research methodology employed a systematic literature review on the topic of HR 4.0 and HR 5.0 concepts, the main objective of this research process. This made it possible to gather the relevant body of knowledge available on the topic and also to verify and extend the research directions (Denyer, Tranfield, 2006; Kitchenham, 2004).

This theoretical synthesis of dividing the topic under study into key and supporting terms increases methodological rigor and helps to create a reliable knowledge base by gathering information from a range of scholarly sources describing personal functions. To minimize possible bias and error in the study, data extraction methods were used for the systematic review, which required all diagnostic steps to be documented. Data extraction included general information such as title, author(s), year of publication, and publication details included in the abstract (Jabbour, 2013).

The search terms were checked against the Scopus database due to its relevance to the discipline of management science and quality as an online subscription-based service for indexing scientific citations. Only scientific articles, monographs, chapters from monographs, and review articles were retained.

The research process adopted allowed the identification and analysis of references obtained from the coding system, which led to the identification of research gaps in the literature.

In the next step, the articles were analysed using VOSviewer software (version 1.6.20), a tool to build and visualize bibliographic networks. These networks were used to construct and visualize the cooccurrence of relevant terms appearing in the collected references.

The last step was content analysis of the collected references, as it is a reliable social science research method that analyses texts based on their authorship, authenticity, or meaning (Wu et al., 2020). Content analysis, which is a type of inductive analysis, aims to understand the case under study and gain information about the case, while focusing on the theme or appearance of the word, as a method, and highlighting similarities and differences within categories or codes (Joubish, Khurram, 2011; Koçan, Yildiz, 2023). This phase of the research used MAXQDA 2024 software to process qualitative and mixed data. The software works on

the idea of horizontal and layered coding of data, which are displayed in a wide range of visualization tools, word clouds, charts, tables, mind maps, etc. It can also process mixed quantitative and qualitative content. With the help of MAXQDA software, codes can be organized, coded, grouped to construct themes, and retrieve data as required.

Finally, in the analysis process, the interrelated information concerning the HR function in HR 4.0 and HR 5.0 was organized in parts and coded (Kepplinger, 1989), so that all logically possible connections between these areas and statements concerning other factors could be identified later (Elo et al., 2014). The research methodology adopted allowed the collection of source material of relevance for further analysis and designed empirical research.

## 3. Results

In the first phase of the research, a systematic review of references on the HR function was carried out in terms of the HR 4.0 and HR 5.0 concepts. The search terms were checked in the Scopus database. All research results from this search were then narrowed down by applying refinement mechanisms by domain: to business, management and accounting, economics, econometrics, and finance. Additionally, the search was narrowed to texts in English, as this was the dominant language in all items in the literature.

The study, based on a systematic review of the literature, used a data extraction process that involved individual analyses of the collected references according to the adopted coding system. The result of the search is shown in Table 1.

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

| **According to the SCOPUS database** | **HR 4.0** | **HR 5.0** | **HR + AI** |
|---|---|---|---|
| Subject area, including Business, Management and Accounting Economics, Social Sciences.All documents | 109 | 28 | 256 |
| Articles | 44 | 11 | 113 |
| In English | 44 | 11 | 87 |
| After 2020 | 38 | 9 | 54 |
| Content Verified Based on Abstracts | 24 | 9 | 26 |

Source: own elaboration.

The articles were then analysed using VOSviewer software to visualize the cooccurrences of specific terms appearing in the HR field. The summary terms that appeared most frequently in the networks were used to develop the analysis categories. Figure 1 shows visualizations of HR 4.0 concepts, while Figure 2 shows visualizations of HR 5.0 concepts.

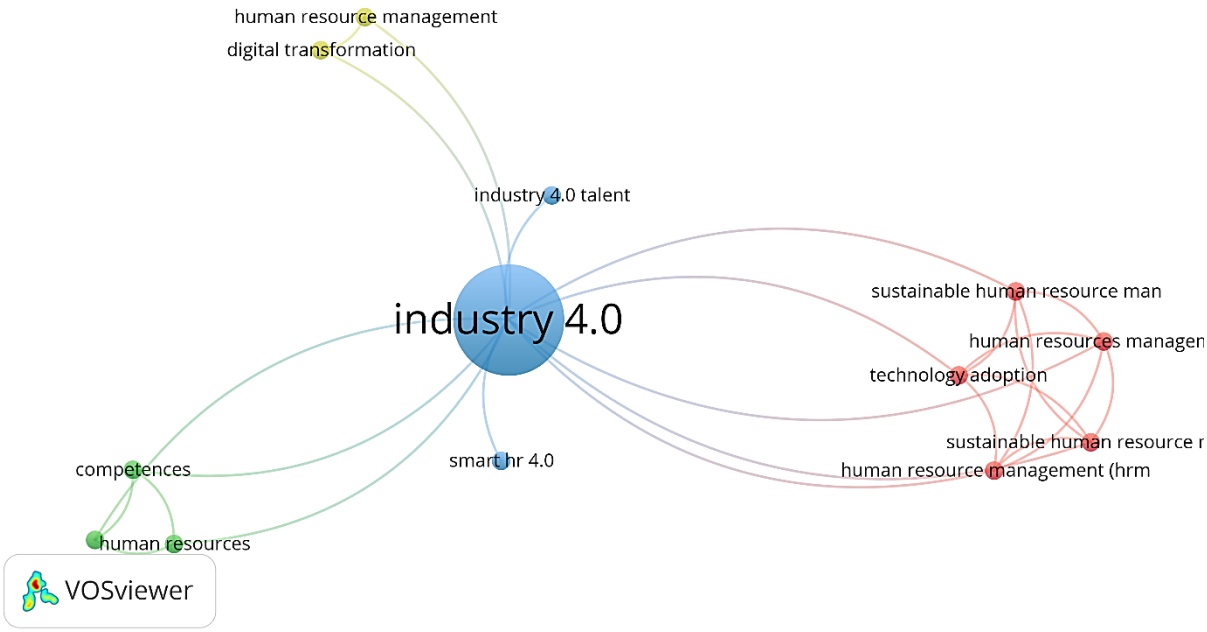


**Figure 1.** Keyword mapping for the concept of HR 4.0: Network for category development.
Source: own elaboration based on systematic literature review.

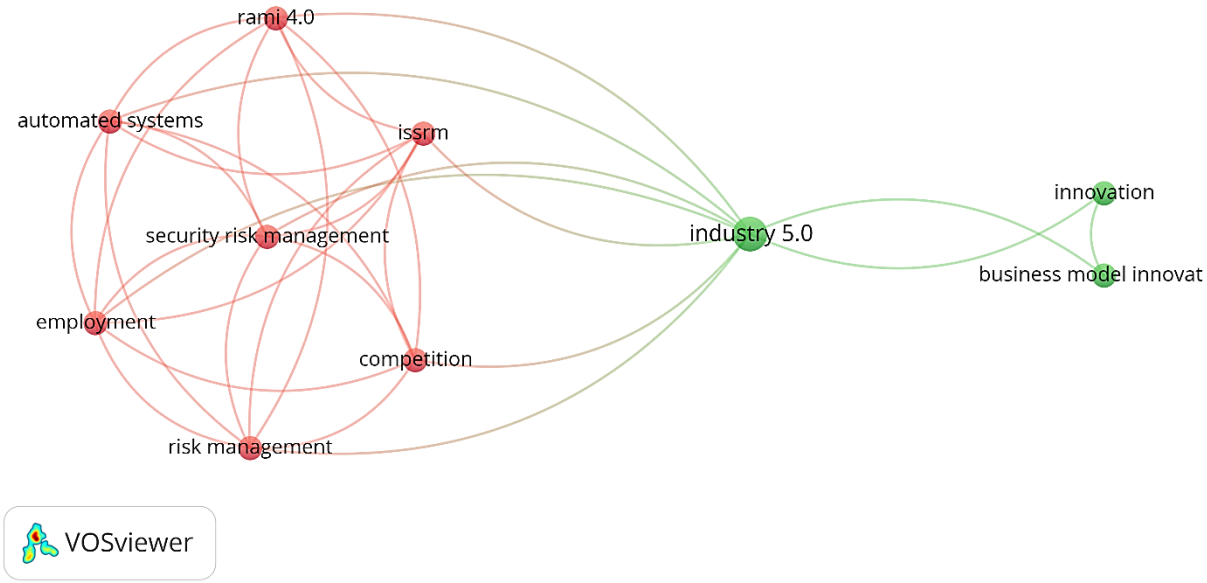


**Figure 2.** Keyword mapping for the concept of HR 5.0: Network for category development.
Source: own elaboration based on systematic literature review.

After collecting the relevant data, an analysis was carried out to check whether all texts addressed the HR function from the perspective of implementing tools specific to the HR concept. It was noted that the significant placement of the concept of artificial intelligence in both figures above was noted. Therefore, it was considered necessary to extend the systematic literature review in the Scopus database by adding another term. HR + AI (see Table 1). The resulting references were narrowed down analogously as before and then visualized in the figure (Figure 3).

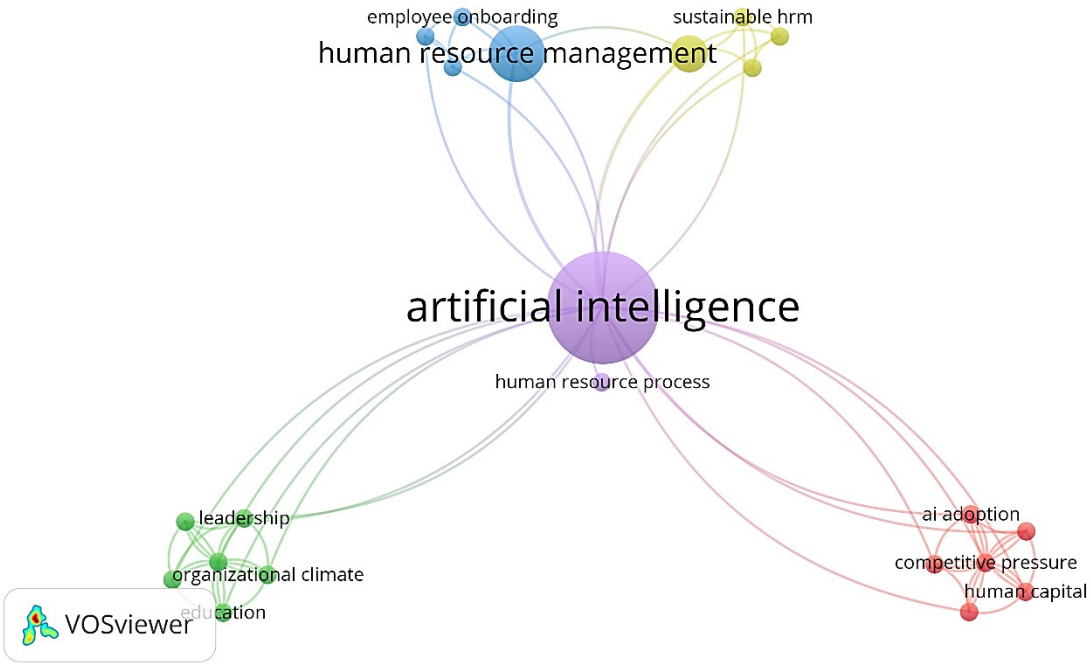


**Figure 3.** Keyword mapping for the concept of HR + AI: Network for Category Development.
Source: Own elaboration based on systematic review of the literature.

The adopted research process allowed the identification and analysis of references obtained from the coding system, which led to the identification of research gaps in the literature.

In the next step, the collected references were analysed using qualitative inductive content analysis. The MAXQDA 2024 qualitative analysis program was used to analyse and visualize qualitative data (Kuckartz, Rädiker, 2019). An analysis framework was created, and the data were processed according to the thematic framework (Albeladi, 2024). The data obtained in the content analysis were first coded. Then, in a second step, categories and themes were found and organized. Finally, the results were defined and interpreted (Denzin, Lincoln, 2000; Fusch et al., 2018; Seggie, ve Bayyurt, 2015).

The references collected in the earlier stage of the study were uploaded to MAXQDA 2024 as separate files in three sets: 1) HR 4.0, 2) HR 5.0 and 3) HR+AI.

This was followed by coding. Coding means that a selected data segment is assigned to a code or vice versa. A code is assigned to a data segment (Kuckartz, Rädiker, 2019). The coding procedures followed a deductive process, a concept-based approach; codes were developed before the data were displayed, and the phenomena discovered there were then classified and assigned accordingly. The analysis was based on the thematic analysis framework (Braun, Clarke, 2006), which is considered a robust method for identifying and exploring themes in qualitative data (Albeladi, 2024).

The code system identified two main codes, in line with the aim of the research, and then subcodes were created for each code by reviewing the content of the individual publications. The frequency of codes is shown in Figure 4 with the number n in brackets.

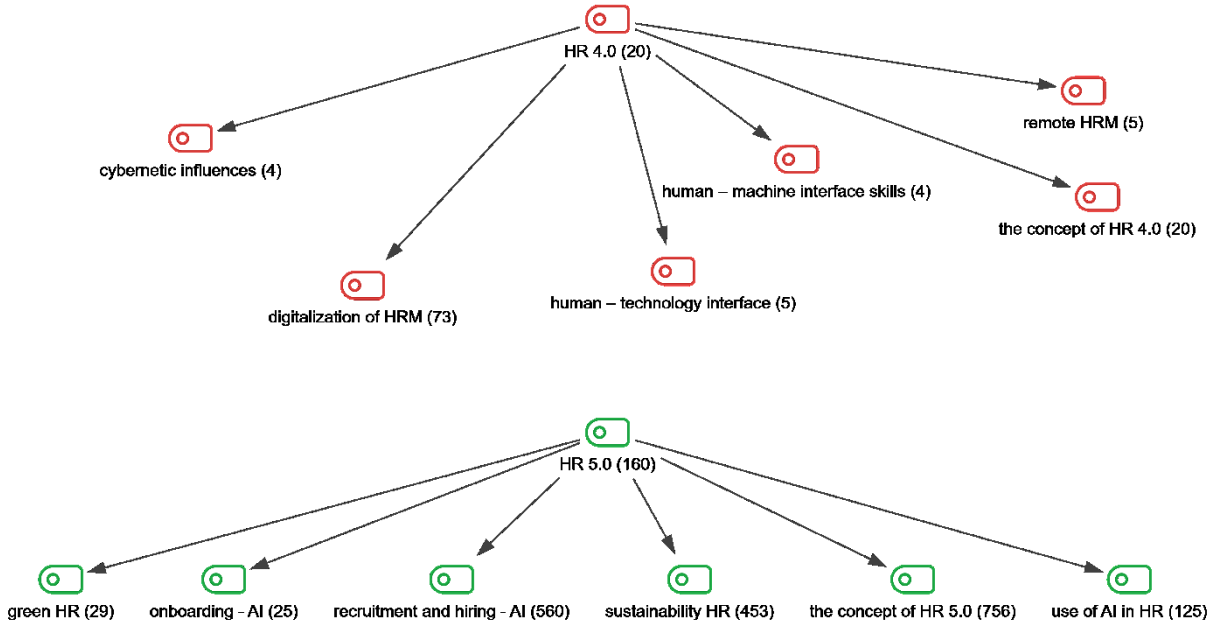


**Figure 4.** Theme code-subcodes-segments model.

Source: own elaboration based on data from the MAXQDA 2024 program.

Table 2, on the other hand, describes the themes and codes along with the results obtained; this is a key element of the analysis process, i.e. the creation and selection of categories along with the totality of all categories in the form of a coherent system.

**Table 2.**
*Distribution of themes and codes*

| Codes and Subcodes | Frequency Source | Code Definition | Source |
|---|---|---|---|
| **HR 4.0** | | | |
| The concept of HR 4.0 | 20 | HR 4.0 marks the beginning of a new era in the planning and management of an individual's work. Activities focus on the availability and imminent implementation of new technologies based on artificial intelligence. Qualifications, skills, and an appropriate learning framework are important issues that support the future HR agenda for an organization. HR factors that support the aforementioned elements include stable employment of key staff; long-term training of employees with multiple skills (multitasking); a remuneration system partly based on skill accumulation; internal promotion within the framework of employer branding; cooperative links; inclusion of line managers in group decisions; and generally egalitarian policies regarding corporate welfare, communication, and employee motivation. | (Stuss, 2023) (Stańczyk, Stuss, 2021) (Zwiech, 2021) |
| Cybernetic influences | 4 | Challenges facing the HR function include handling massive amounts of data, adapting to the rapid pace of change, adopting new business models, and using intelligent services supported by digital tools. To adopt specific technology and improve software processes, ethical issues must be identified and carefully considered. | (Schultz, 2021) (Rahanu et al., 2021) (Maisiri et al., 2019) |

Cont. table 2.

| | | | |
|---|---|---|---|
| Digitalization of HRM | 73 | The reviewed literature highlights that HR digitalization will continue to play a key role in building competitiveness. HR processes such as staffing, compensation, employee relations, and development, driven by ICT, will rely heavily on data analytics and metrics. Technological devices and infrastructure such as the internet, data analytics, robotics, and artificial intelligence are expected to facilitate digitalization. | (Nteboheng et al., 2021)<br>(Ganer et al., 2022)<br>(Renkema et al., 2016) |
| Remote HRM | 5 | The demand for workspace is driven by employment trends. The nature of work is becoming increasingly flexible and virtual, which may have an impact on the future relationship between HR and employees. Smart communication technologies are enablers for remote HR tasks to be performed remotely. It is essential to have the right balance of office, home office, and third space, along with the right IT tools and behavioral aspects to make remote working effective. | (Schultz, 2021)<br>(Chernyak-Hai, Rabenu, 2018)<br>(De Bruyne, Gerritse, 2018)<br>(Kämpf-Dern, Konkol, 2017) |
| Human-machine interface skills | 4 | Change is rapid, and solutions to the human-machine interface are not always obvious, reaching into organizational, socially, and culturally ambiguous paths. Qualifications, skills, and appropriate learning frameworks are important issues that support the future agenda of the organization. The impact of HRM is based on natural and inextricable links between human issues and the adoption of IT practices and trends. | (Nteboheng et al., 2021)<br>(Mefi, Asoba, 2021)<br>(Liboni et al., 2019) |
| Human-technology interface | 5 | There is an increased demand for technology proficiency among HR operations due to increased virtualization. In particular, the increased use of technology means that everyone is proficient in information technology to ensure that the required fluidity of network services, communications infrastructure, and other technology accessories is maintained. Technology is also an important element to influence both the processes and outcomes of the overall HR system. | (Nteboheng et al., 2021)<br>(Mefi, Asoba, 2021)<br>(Liboni et al., 2019) |
| **HR 5.0** | | | |
| The concept of HR 5.0 | 756 | There is still a lack of consensus among researchers on the nomenclature associated with the term HR 5.0. A broad definition should include all HR components associated with artificial intelligence, machine learning, and big data (e.g., AHRM, digital HRM, HR analytics, and e-HRM), some of which may be more appropriate for specific HR activities than others, and all of which may be relevant in an integrated way to ensure the effectiveness and accountability of strategic HRM. | (Rani et al., 2024)<br>(Cameron et al., 2024)<br>(Ganer et al., 2022)<br>(Lu, 2019)<br>(Renkema et al., 2016) |
| Use of AI in HR | 125 | There is a wide expectation for the use of AI technology and big data for decision-making and automation in HR applications. Models link the use of AI in HRM to organizational outcomes such as increased organizational productivity, increased employee wellbeing and reduced turnover, increased organizational commitment, and reduced turnover intention among employees, which in turn results in improved cost-effectiveness within the organization. | (Stuss, Fularski, 2024)<br>(Gînguță et al., 2023)<br>(Gélinas et al., 2022)<br>(Chang, 2020) |

Cont. table 2.

| | | | |
|---|---|---|---|
| Recruitment and hiring - AI | 560 | In the digital age, the recruitment process has undergone a significant transformation, shifting towards innovative candidate sourcing methods. AI applications range from streamlining recruitment processes, where artificial intelligence helps to screen potential candidates based on advanced, predefined criteria, to the integration of AI-powered chatbots designed to handle routine HR queries. | (Stuss, Fularski, 2024) (Figueroa-Armijos et al., 2023) (Nyathani, 2023) (Gélinas et al., 2022) (Said, Khallouk Temsamani, 2022) (Mihova, Ivanova, 2020) |
| Onboarding - AI | 25 | Artificial intelligence is being used to automate the onboarding process. It will answer new employees' most pressing questions to help them catch up quickly, such as giving them the names, locations, and contact details of people they should contact within the first week. May advise new employees to check out the new employee website for useful information, including training modules and guidance on the organization's policies. | (Stef, Crisan, 2024) (Gélinas et al., 2022) (Strang, Sun, 2022) |
| Green HR | 29 | Green HR includes practices that reflect efforts to prevent pollution and promote environmental management through typical HR activities such as green recruitment and selection, green training, green performance management, green compensation and rewards, and training and environmentally conscious performance appraisals and rewards, while organizational enablers of green HR include green organizational cultures, green teams, and environmentally focused employee empowerment engagement. Green HR systems refer to environmental recruitment and selection, and are environmentally focused. | (Ababneh, 2021) (Chiappetta Jabbour et al., 2019) (Beltrán-Martín, Bou-Llusar, 2018) (Longoni et al., 2018) (Guiyao et al., 2017) |
| Sustainability HR | 453 | The integration of AI into HR is not just a technology trend, but a reflection of a broader transformation towards sustainable, human-centered approaches. Central to the sustainable HR philosophy is a commitment to the triple bottom line, which includes economic viability, social responsibility, and environmental protection. Together, these elements define the movement and its goals, ensuring that companies not only focus on economic returns, but also on their wider social and environmental footprint. | (Jia, Hou, 2024) (Kuźniarska, Stuss, 2024) (Lu et al., 2022) (Aust-Before Ehnert et al., 2019) (Zwiech, 2024) |

Source: own elaboration.

In the next step, a code cloud was extracted (Figure 5). It provides a quick overview of the most frequent terms in the collected publications. This allowed the verification of the correctness of some codes, but also indicated the relevance of terms such as the concept of HR 5.0 and recruitment and hiring – AI.

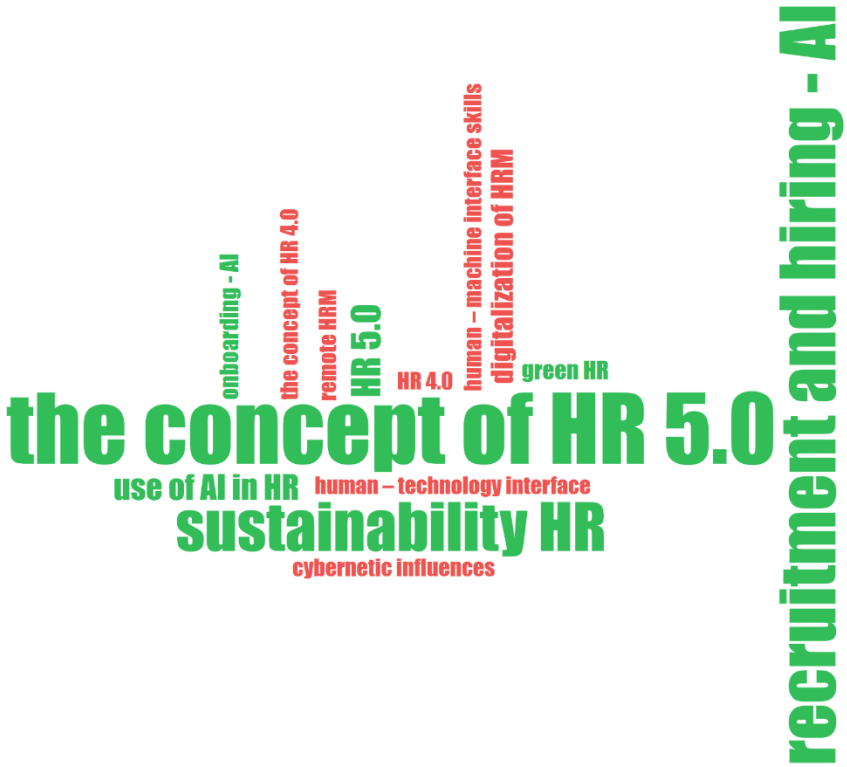


**Figure 5.** Code Cloud.

Source: own elaboration based on data from the MAXQDA 2024 program.

Analysing the relationships between the codes (Figure 6 shows the code system, including the subcategories and codes belonging to the topics analysed and the relationships between the codes), the most relevant current areas of research within the HR 5.0 concept are recruitment and selection using artificial intelligence. There is also an increase in academic texts on the evolutionary changes of the HR function, i.e., the transition from HR 4.0 to HR 5.0.

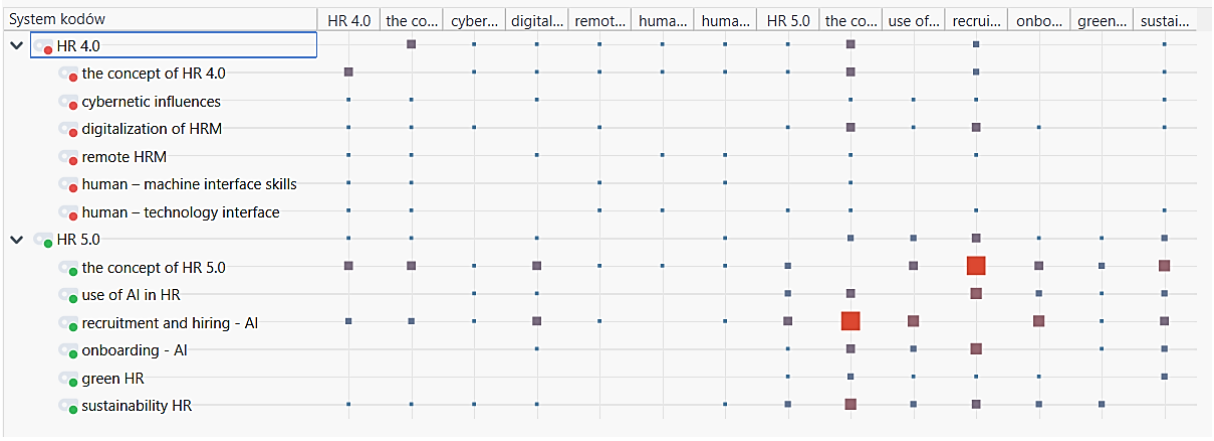


**Figure 6.** Relationships between the Codes.

Source: own elaboration based on data from the MAXQDA 2024 program.

In the case of the HR 4.0 concept, the academic output to date indicates a significant degree of interest in the topic of the use of enabling tools (Figure 7). In the case of the HR 5.0 concept, on the other hand, publications mainly focus on the concept's assumptions and on the topic of responsible HR.

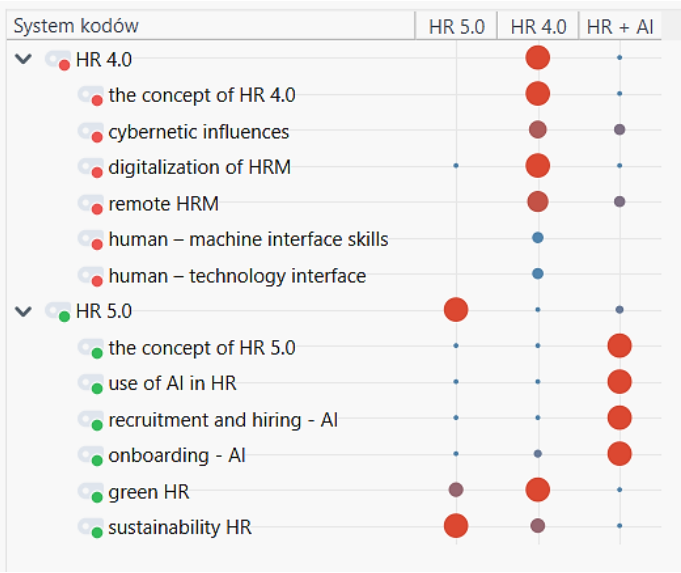


**Figure 7.** Coding results.

Source: own elaboration based on data from the MAXQDA 2024 program.

However, it is important to point out the increased interest of researchers in the possibility of using AI tools in personnel processes independently of theoretical concepts. In this case, the expectations of practice determine the need for research on artificial intelligence in personnel processes.

## 4. Conclusion

Previous research conducted in 2022 on the degree of interest in the HR 4.0 concept (Stuss, 2023) indicated that researchers focused mainly on technological tools to support HR management processes, and most references were identified with the e-HRM concept.

The relationship between the HR function and Industry 5.0 can now be seen being analysed, hence the considerable interest in the concept of HR 5.0, although it should be noted that the name itself does not shine through in publications. Undoubtedly, the most important issue to which a considerable amount of text is devoted is the possibility of using artificial intelligence in HR processes. Expectations are high, but it will be important to examine the practice of using AI. To date, empirical pilot studies of only the recruitment and selection function have not yielded satisfactory results (Stuss, Fularski, 2024). It therefore becomes necessary to lay out a much more multi-thematic empirical study.

However, despite the rigorous methodology used in this study, an important limitation of the results presented should be noted, which is the use of only the Scopus database and its algorithms. This assumption excluded other sources, such as monographs and articles from databases other than Scopus. Consequently, the data collected do not provide a holistic representation of the research spectrum in HR 4.0 and HR 5.0.

## References


1. Ababneh, O.M.A. (2021). How do green HRM practices affect employees' green behaviors? The role of employee engagement and personality attributes. *Journal of Environmental Planning and Management*, *64*(7), 1204-1226. https://doi.org/10.1080/09640568.2020.1814708
2. Albeladi, A.A. (2024). The Challenges of Conducting Qualitative Research in Quantitative Culture: Saudi Arabia as a Case Study. *The Qualitative Report*. https://doi.org/10.46743/2160-3715/2024.6272
3. Aust-Before Ehnert, I., Matthews, B., Muller-Camen, M. (2019). Common Good HRM: A paradigm shift in Sustainable HRM? *Human Resource Management Review*, *30*, 100705. https://doi.org/10.1016/j.hrmr.2019.100705
4. Beltrán-Martín, I., Bou-Llusar, J.C. (2018). Examining the intermediate role of employee abilities, motivation and opportunities to participate in the relationship between HR bundles and employee performance. *BRQ Business Research Quarterly*, *21*(2), 99-110. https://doi.org/10.1016/j.brq.2018.02.001
5. Braun, V., Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*, 77-101. https://doi.org/10.1191/1478088706qp063oa
6. Cameron, R., Herrmann, H., Nankervis, A. (2024). Mapping the evolution of algorithmic HRM (AHRM): a multidisciplinary synthesis. *Humanities and Social Sciences Communications*, *11*. https://doi.org/10.1057/s41599-024-02786-z
7. Chang, K. (2020). Artificial intelligence in personnel management: the development of APM model. *The Bottom Line*, *33*, 377-388. https://doi.org/10.1108/BL-08-2020-0055
8. 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
9. Chiappetta Jabbour, C.J., Sarkis, J., Lopes de Sousa Jabbour, A.B., Scott Renwick, D.W., Singh, S.K., Grebinevych, O., Kruglianskas, I., Filho, M.G. (2019). Who is in charge? A review and a research agenda on the 'human side' of the circular economy. *Journal of Cleaner Production*, *222*, 793-801. https://doi.org/10.1016/j.jclepro.2019.03.038
10. 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

11. 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
12. Denzin, N.K., Lincoln, Y. (eds.) (2000). *Handbook of Qualitative Reserch*. Thousand Oaks, Calif.: Sage Publications.
13. Elo, S., Kääriäinen, M., Kanste, O., Pölkki, T., Päätalo, K., Kyngäs, H. (2014). Qualitative Content Analysis: A Focus on Trustworthiness. *Sage Open*, *4*. https://doi.org/10.1177/2158244014522633
14. Figueroa-Armijos, M., Clark, B.B., da Motta Veiga, S.P. (2023). Ethical Perceptions of AI in Hiring and Organizational Trust: The Role of Performance Expectancy and Social Influence. *Journal of Business Ethics*, *186*(1), 179-197. https://doi.org/10.1007/s10551-022-05166-2
15. Fusch, P., Fusch, G.E., Ness, L.R. (2018). *Denzin's Paradigm Shift : Revisiting Triangulation in Qualitative*. *10*(1), 19-32. https://doi.org/10.5590/JOSC.2018.10.1.02
16. 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
17. Gélinas, D., Sadreddin, A., Vahidov, R. (2022). Artificial Intelligence in Human Resources Management: A Review and Research Agenda. *Pacific Asia Journal of the Association for Information Systems*, *14*, 1-42. https://doi.org/10.17705/1pais.14601
18. Gînguță, A., Ștefea, P., Noja, G.G., Munteanu, V.P. (2023). Ethical Impacts, Risks and Challenges of Artificial Intelligence Technologies in Business Consulting: A New Modelling Approach Based on Structural Equations. *Electronics*, *12*(6), 1462. https://doi.org/10.3390/electronics12061462
19. Guiyao, T., Chen, Y., Jiang, Y., Paillé, P., Jia, J. (2017). Green human resource management practices: Scale development and validity. *Asia Pacific Journal of Human Resources*, *56*. https://doi.org/10.1111/1744-7941.12147
20. 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
21. Jia, X., Hou, Y. (2024). Architecting the future: exploring the synergy of AI-driven sustainable HRM, conscientiousness, and employee engagement. *Discover Sustainability*, *5*(1), 30. https://doi.org/10.1007/s43621-024-00214-5
22. Joubish, M.F., Khurram, M.A. (2011). Outlook on some concepts in the curriculum of social studies. *World Applied Sciences Journal*, *12*(9), 1374-1377.
23. 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

24. Kepplinger, H.M. (1989). Content Analysis and Reception Analysis. *American Behavioral Scientist*, *33*(2), 175-182. https://doi.org/10.1177/0002764289033002010
25. Kitchenham, B. (2004). *Procedures for Performing Systematic Reviews*. Keele, UK: Keele Univ., 33.
26. Koçan, M., Yildiz, E. (2023). Evaluation of Consumer Complaints: A Case Study Using MAXQDA 2020 Data Analysis SoftwareTüketici Şikayetlerinin Değerlendirilmesi: MAXQDA 2020 Veri Analiz Programı Kullanılarak Yapılan Bir Vaka Çalışması. *Cankiri Karatekin Universitesi Iktisadi ve Idari Bilimler Fakultesi Dergisi*. https://doi.org/10.18074/ckuiibfd.1318853
27. Kraus, S., Breier, M., Lim, W.M., Dabić, M., Kumar, S., Kanbach, D., Mukherjee, D., Corvello, V., Piñeiro-Chousa, J., Liguori, E., Palacios-Marqués, D., Schiavone, F., Ferraris, A., Fernandes, C., Ferreira, J.J. (2022). Literature reviews as independent studies: guidelines for academic practice. *Review of Managerial Science*, *16*(8), 2577-2595. https://doi.org/10.1007/s11846-022-00588-8
28. Kuckartz, U., Rädiker, S. (2019). *Analyzing Qualitative Data with MAXQDA*. Springer International Publishing. https://doi.org/10.1007/978-3-030-15671-8
29. Kuźniarska, A., Stuss, M. (2024). Social practices within the framework of sustainable development in 4.0 organizations. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacja i Zarządzanie*, *200*, 217-228. https://doi.org/10.29119/1641-3466.2024.200.16
30. 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
31. Longoni, A., Luzzini, D., Guerci, M. (2018). Deploying Environmental Management Across Functions: The Relationship Between Green Human Resource Management and Green Supply Chain Management. *Journal of Business Ethics*, *151*. https://doi.org/10.1007/s10551-016-3228-1
32. Lu, Y. (2019). Artificial intelligence: a survey on evolution, models, applications and future trends. *Journal of Management Analytics*, *6*(1), 1-29. https://doi.org/10.1080/23270012.2019.1570365
33. Lu, Y., Zhang, M., Yang, M., Wang, Y. (2022). Sustainable human resource management practices, employee resilience, and employee outcomes: Toward common good values. *Human Resource Management*, *62*. https://doi.org/10.1002/hrm.22153
34. Maisiri, W., Darwish, H., van Dyk, L. (2019). An Investigation of Industry 4.0 Skills Requirements. *South African Journal of Industrial Engineering*, *30*(3). https://doi.org/10.7166/30-3-2230

35. Mefi, N., Asoba, S. (2021). Industry 4.0 and Skills Deficiencies in the HRM Function: Case Study of the HRM Department of a Selected Organisation in Cape Town. *Academy of Entrepreneurship Journal*, *28*.
36. Mihova, T.B., Ivanova, I.M. (2020). Digitalization of HR activities in industrial enterprises. *IOP Conference Series: Materials Science and Engineering*, *878*, 012069. https://doi.org/10.1088/1757-899X/878/1/012069
37. 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.
38. Nyathani, R. (2023). AI-in-performance-management-redefining-performance-appraisals-in-the-digital-age. *Journal of Artificial Intelligence & Cloud Computing*, 1-5. https://doi.org/10.47363/JAICC/2023(2)134
39. 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
40. Rani, S., Jining, D., Shoukat, K., Shoukat, M.U., Nawaz, S.A. (2024). A Human–Machine Interaction Mechanism: Additive Manufacturing for Industry 5.0—Design and Management. *Sustainability*, *16*(10), 4158. https://doi.org/10.3390/su16104158
41. Renkema, M., Meijerink, J., Bondarouk, T. (2016). Advancing multilevel thinking and methods in HRM research. *Journal of Organizational Effectiveness: People and Performance*, *3*(2), 204-218. https://doi.org/10.1108/JOEPP-03-2016-0027
42. Said, A., Khallouk Temsamani, Y. (2022). *Use of Artificial Intelligence in Human Resource Management: "Application of Machine Learning Algorithms to an Intelligent Recruitment System",* pp. 203-215. https://doi.org/10.1007/978-3-030-85365-5_20
43. Schultz, C.M. (2021). 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
44. Seggie, F.N., ve Bayyurt, Y. (2015). *Qualitative Research Methods, Techniques, Analysis and Approaches*. ANI.
45. Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, *104*, 333-339. https://doi.org/10.1016/j.jbusres.2019.07.039
46. Stańczyk, I., Stuss, M.M. (2021). Human resource management 4.0. In: *Sustainability, Technology and Innovation 4.0* (pp. 193-212). Routledge. https://doi.org/10.4324/9781003184065-15
47. Stef, A.L., Crisan, E.L. (2024). Analyzing the effects of digital transformation on handling human resources management. *Virgil Madgearu Review of Economic Studies and Research*, *17*(1), 149-173. https://doi.org/10.24193/RVM.2024.17.112
48. Strang, K.D., Sun, Z. (2022). ERP Staff versus AI recruitment with employment real-time big data. *Discover Artificial Intelligence*, *2*(1), 21. https://doi.org/10.1007/s44163-022-

00037-1

49. 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
50. Stuss, M.M., Fularski, A. (2024). Ethical considerations of using artificial intelligence (AI) in recruitment processes. *Edukacja Ekonomistów i Menedżerów*, *71*(1), 53-67. https://doi.org/10.33119/EEIM.2024.71.4
51. Wu, Y.J., Wu, T., Sharpe, J. (2020). Consensus on the definition of social entrepreneurship: a content analysis approach. *Management Decision*, *58*(12), 2593-2619. https://doi.org/10.1108/MD-11-2016-0791
52. Zwiech, P. (2021). Perception of Justice in Performance Appraisal: Empirical Findings from Enterprises from the West Pomeranian Voivodship in Poland. *Procedia Computer Science*, *192*, 4649-4657. https://doi.org/10.1016/j.procs.2021.09.243
53. Zwiech, P. (2024). The impact of perception of organizational justice on employee attitude and behaviour. *Scientific Papers of Silesian University of Technology Organization and Management Series*, *199*, 671-680. https://doi.org/10.29119/1641-3466.2024.199.50