



Artificial Intelligence Applied to Human Resources Management: A Bibliometric Analysis

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Abstract. Artificial intelligence has positively influenced several fields, including human resources. It has simplified the automated search for candidates in social networks, making it possible to filter a large amount of information to find the ideal candidate. It has also made it possible to predict drop-out rates, automate selection processes and allow applicants to participate remotely in training, optimizing human resources management and increasing business productivity. Specifically, during the COVID-19 pandemic and subsequent years, scientific production in this area has experienced a remarkable growth since 2019, with India being the most involved country and Computer Science and Business, Management and Accounting being the main research areas of interest. This bibliometric study, which covers the period 2013–2022 and presents a bibliometric map produced with VOSViewer, reveals four clusters with emerging areas and disciplines that are emerging as research trends: “ML for resource management”, “AI for recruitment management”, “DSS for information management”, and “AI for training”.

Keywords: IA · artificial intelligent · human resources management · human resources · HR · bibliometric · review

1 Introduction

In every major company, the human resources (HR) department is an important asset [1]. This department needs tools to do its job, here artificial intelligence (AI) can be a great ally: scouring social networks in search of candidates, predicting the dropout rate, evaluating a curriculum vitae... [2–4].

The use of AI applied to HR is becoming more and more common and this is demonstrated by this study, in which the following chapters follow:

Section 2: The literature found regarding reviews or bibliometric studies on AI applied to HR in recognized databases in the field of research is presented.

Section 3: this chapter presents the methodology used to carry out the bibliometric study, as well as each of the stages used in the methodology; Set the objectives of the analysis, Data extraction, Data preprocessing, Multi-dimensional analysis, Network extraction, clustering and bibliometric visualization and Overall results of the analysis.

Section 4: the main ideas obtained after the development of this bibliometric study are presented.

Section 5: In the future, it is proposed to carry out work derived from this study.

The main objective is to present a bibliometric study carried out using its own methodology based on data science techniques to show the growing interest of the scientific community in investigating how AI can help the human resources management environment, and from this present result and emerging terms in this environment that will be the subject of study in the future.

2 Related Work

A search for the terms “artificial intelligence”, “AI”, “human resources management” in connection with “review” or “bibliometric” has been carried out in the Scopus database, a database strongly recognized in the field of research, without finding any results.

An indirectly related review has been found [5], not so much focused on management as on functions, see Table 1. In this study the author makes a valuable study of the techniques used in HR by means of AI, but it is not approached from a bibliometric point of view. Therefore, being a growing research topic, it was decided to carry out this bibliometric study on the subject.

3 Bibliometric Study

3.1 Methodology Used

Given the absence of a bibliometric study on HR management through IA demonstrated in the previous chapter, we proceed to carry it out using the following methodology, see Fig. 1, which is presented in the following subchapters.

The following methodology is used [6], see Fig. 1, based on data science methodologies (KDD, CRISP-DM and SEMMA methodologies) and oriented to bibliometrics, this methodology consists of six stages whose use is described in the following subchapters.

3.2 Set the Objectives of the Analysis

The following bibliometric article aims to study the importance that the scientific community has given to the study and use of AI applied to HR management, this is done by understanding the quantity, quality and dimensions (time, authors and areas) of the scientific production carried out in the period 2013–2022 and published in a database, widely accepted by the scientific community such as Scopus [7]. In addition, a bibliometric map will be obtained, showing the main clusters that compose this map and the emerging areas around this article.

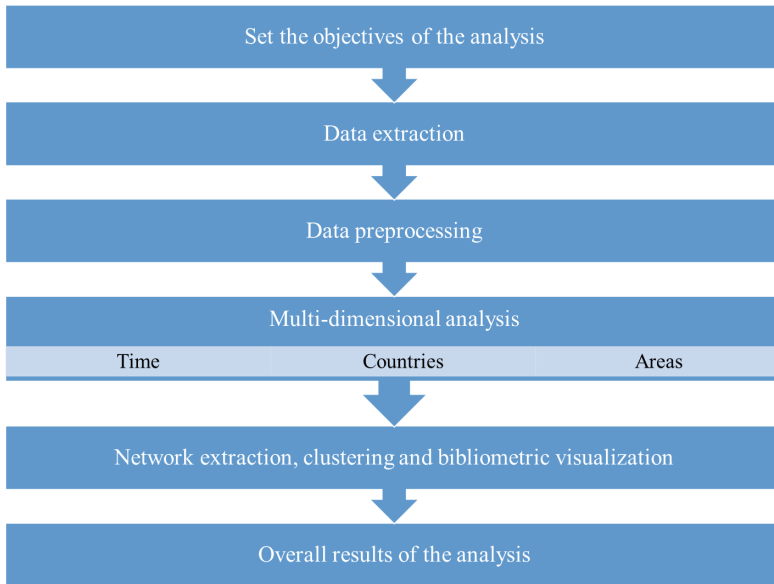


Fig. 1. Methodology used for this bibliometric study.

3.3 Data Extraction

The data used in this study were obtained from the Scopus database, a database widely recognized by the scientific community. The query carried out in August 2023 is:

TITLE-ABS ((“artificial intelligent” OR “AI”) AND (“human resources management”)).

Using the data obtained, the study is continued in the following sub-chapter.

3.4 Data Preprocessing

From the data obtained, those relevant to the objective of the study were selected, a co-occurrence process was performed on the terms using the VOSViewer tool, a widely accepted tool in the scientific environment to develop bibliometric maps, and limited to the time period 2013–2022. Co-occurrence is a phenomenon in which two or more elements, concepts, terms or events appear together in a specific context with a higher frequency than expected, the co-occurrence of concepts in scientific papers can reveal trends, emerging areas of research and relationships between different disciplines [8].

Finally, 129 documents are selected for the study (as a result of the query used in the Scopus database and selected in VosViewre using co-occurrence criteria), continuing with the analysis of the selected dimensions.

3.5 Multi-dimensional Analysis

This subchapter analyzes the dimensions of time, countries and areas using Scopus as a graphical tool.

Documents obtained in the period 2013–2022, see Fig. 2, demonstrate a clear interest from the scientific community in the use of AI applied to HR management. A notable increase in interest can be seen between 2019 and 2020, clearly driven by the covid-19 pandemic, years in which the need for AI to probe social networks for candidates, combined with the use of machine learning (ML) and the need to automate HR procedures at a time when human contact was not allowed, motivated the scientific community to investigate AI in HR management [9].

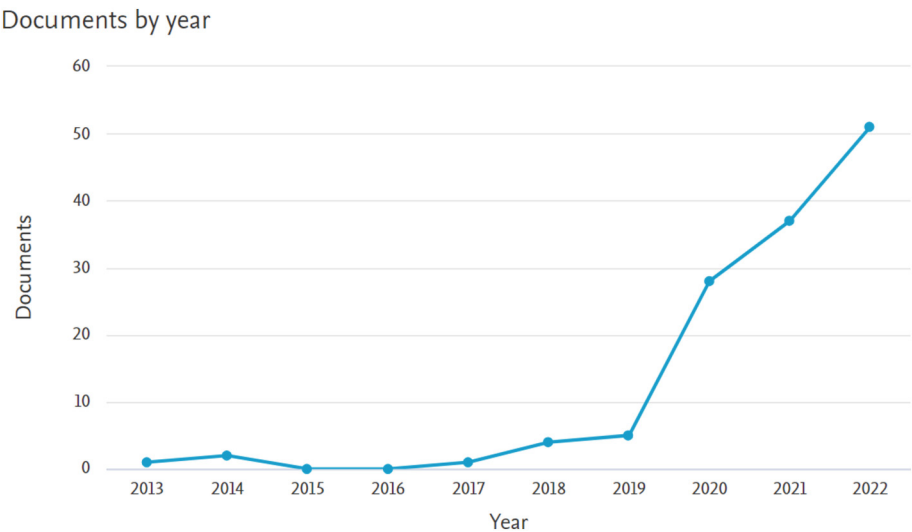


Fig. 2. Publications in the period 2013 - 2022

With the data shown in Fig. 3 (numbers of documents by country), show a great interest centered in India [10], followed at a great distance and in order by China, the United States and the United Kingdom. In last place, France and Poland stand out for their low scientific production in relation to AI applied to HR management.

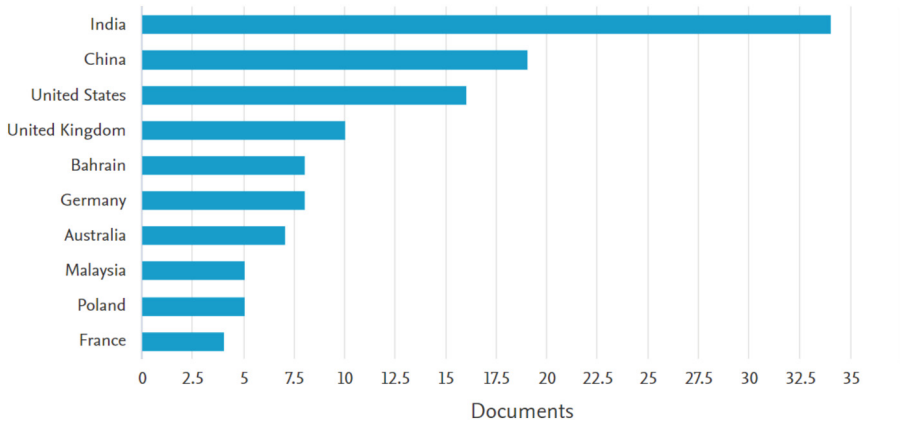


Fig. 3. Documents by country or territory

In Fig. 4, it can be seen that the area of greatest interest is Computer Science followed closely by Business, Management and Accounting, both areas are closely related to the object of study, one being complementary to the other and necessary to study AI applied to HR management.

Documents by subject area

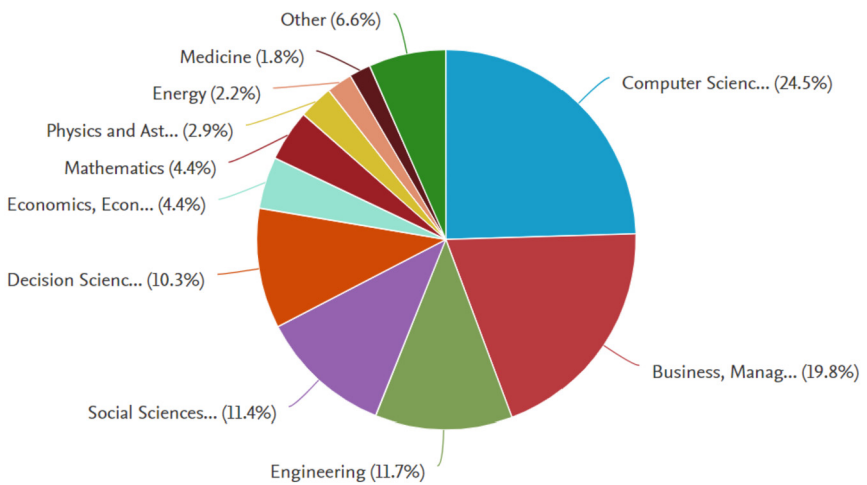


Fig. 4. Documents by subject area

3.6 Overall Results of the Analysis

Using the VOSViewer tool, the bibliometric network is obtained, see Fig. 5, where the main emerging areas can be observed: ML [11], artificial intelligence [12], human resource [13], and decision support systems [14]...in total 17 areas that form four clearly differentiated clusters.

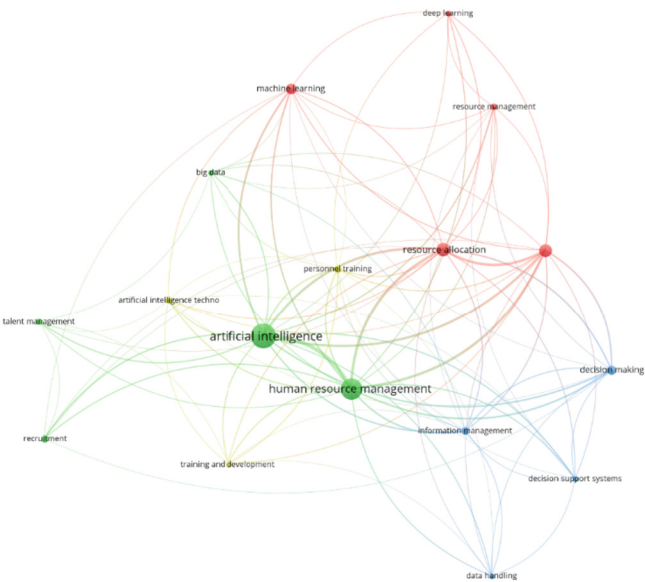


Fig. 5. Network extraction

In Using the terms obtained with VosViewer, five clusters are observed where they can be grouped.

Table 1, the four clusters and the areas or disciplines that comprise them can be observed:

- The ML for resource management is an area that by learning from available data can establish algorithms that help the HR department to locate and manage resources [11, 15–18].
- In AI for recruitment management, AI is not only used to help locate and hire, it is also used to search for talent in a huge database of candidates [19–23].
- In the DSS for information management area, there are applications focused on optimizing selection and management processes while managing all the necessary information [24, 25].
- The AI for training area makes it easier for the HR department to manage the training of all employees, including themselves [26–28].

Using the terms obtained with VosViewer, five clusters are observed where they can be grouped.

Table 1. Cluster of network extraction

ML for resource management	AI for recruitment management	DSS for information management	AI for training
Deep learning	Artificial intelligence	Data handling	Artificial intelligence technology
Machine learning	Big data	Decision making	Personnel training
Natural resources management	Human resource management	Decision support systems	Training and development
Resource allocation	Recruitment	Information management	
Resource management	Talent management		

4 Results and Conclusions

The demonstrated increase in scientific production in relation to AI applied to HR management in recent years is clearly ascending and shows a clear and decisive interest in this study. The turning point was between the years 2019 and 2020 where, due to the need of a pandemic that prevents physical contact, the scientific production on this study increased exponentially.

The country that has developed the greatest scientific production is India and the areas in which it is manifested are Computer Science and Business, Management and Accounting.

The areas and disciplines emerging around AI applied to HR management form four major groups that we cluster into: ML for resource management, AI for recruitment management, DSS for information management and AI for training.

This study demonstrates the importance that the scientific community has given to the study of AI [29] applied to HR management and how new areas of research are emerging.

5 Future Works

After carrying out this study, we consider carrying out future work where we can differentiate two clearly differentiated stages, before covid-19 and after covid-19. We consider that it is a very important moment of interruption as demonstrated by the temporal graph of Fig. 2 whose conclusions are worthy of study.

We also consider in the future making an annual update on this study to see its projection.

This work, due to its conditions, uses a single data source, we intend to carry it out in the future with different data sources.

References

1. Hoke, E., Taraba, P., Peterek, K.: Human resources management in the corporate crisis. *Chem. Eng. Trans.* (2020)
2. Anayat, S.: Human resources management after industry 4.0: blending AI and HRM. In: *Strategic Human Resource Management in the Hospitality Industry: A Digitalized Economic Paradigm*, pp. 97–115. IGI Global (2023)
3. Almesafri, A., Habes, M.: Understanding the use of artificial intelligence (AI) for human resources in the Dubai government. In: Alareeni, B., Hamdan, A., Khamis, R., Khoury, R.E. (eds.) *ICBT 2022. LNNS*, vol. 620, pp. 417–428. Springer, Cham (2022). https://doi.org/10.1007/978-3-031-26953-0_39
4. Li, L., Lassiter, T., Oh, J., Lee, M.K.: Algorithmic hiring in practice: recruiter and HR professional's perspectives on AI use in hiring. In: *Proceedings of the 2021 AAAI/ACM Conference on AI, Ethics, and Society*, pp. 166–176 (2021)
5. Kaur, G., Kaur, R.: A critical review on analysis of human resource functions using AI technologies. In: *AIP Conference Proceedings*, vol. 2555, no. 1. AIP Publishing (2022)
6. Galán, J.J., Carrasco, R.A., LaTorre, A.: Military applications of machine learning: a bibliometric perspective. *Mathematics* **10**(9), 1397 (2022)
7. Kashi, A., Shah, M.E.: Bibliometric review on sustainable finance. *Sustain. (Switz.)* **15**(9) (2023). <https://doi.org/10.3390/su15097119>
8. Cobo, M.J., Jürgens, B., Herrero-Solana, V., Martínez, M.A., Herrera-Viedma, E.: Industry 4.0: a perspective based on bibliometric analysis. *Procedia Comput. Sci.* **139**, 364–371 (2018)
9. Won, J., Lee, D., Lee, J.: Understanding experiences of food-delivery-platform workers under algorithmic management using topic modeling. *Technol. Forecast. Soc. Chang.* **190**, 122369 (2023)
10. Gayatri, A.P., Lavanya, P., Rajitha, C., Butta, N.K., Supraveen, U.J.: Artificial intelligence deployment and the potency of HRM functions. In: *2023 International Conference on Computer Communication and Informatics (ICCCI)*, pp. 1–6. IEEE (2023)
11. Indarapu, S.R.K., Vodithala, S., Kumar, N., Kiran, S., Reddy, S.N., Dorthi, K.: Exploring human resource management intelligence practices using machine learning models. *J. High Technol. Managem. Res.* **34**(2), 100466 (2023)
12. Strohmeier, S., Piazza, F.: Artificial intelligence techniques in human resource management—a conceptual exploration. *Intell. Tech. Eng. Manage.: Theory Appl.* 149–172 (2015)
13. Ammirato, S., Felicetti, A.M., Linzalone, R., Corvello, V., Kumar, S.: Still our most important asset: a systematic review on human resource management in the midst of the fourth industrial revolution. *J. Innov. Knowl.* **8**(3), 100403 (2023)
14. Jian, L.: Design of enterprise human resources decision support system based on data mining. *Soft. Comput.* **26**(20), 10571–10580 (2022). <https://doi.org/10.1007/s00500-021-06659-4>
15. Zhang, Y., Qi, E.: Happy work: improving enterprise human resource management by predicting workers' stress using deep learning. *PLoS One* **17**(4), e0266373 (2022)
16. Mohanan, M.S., Rajarathinam, V.: Deep insight of HR management on work from home scenario during Covid pandemic situation using intelligent: analysis on IT sectors in Tamil Nadu. *Int. J. Syst. Assur. Eng. Manage.* 1–32 (2023)
17. Pourkhodabakhsh, N., Mamoudan, M.M., Bozorgi-Amiri, A.: Effective machine learning, meta-heuristic algorithms and multi-criteria decision making to minimizing human resource turnover. *Appl. Intell.* **53**(12), 16309–16331 (2023)
18. Cantarelli, P., Vainieri, M., Seghieri, C.: The management of healthcare employees' job satisfaction: optimization analyses from a series of large-scale surveys. *BMC Health Serv. Res.* **23**(1), 1–14 (2023)

19. Yu, X., Zhang, C., Wang, C.: Construction of hospital human resource information management system under the background of artificial intelligence. *Comput. Math. Methods Med.* **2022** (2022)
20. Garrido-Pintado, P., García Huertas, J.G., Leal, D.B.: Identity and virtuality: the influence of personal profiles on social media on job search. *Bus. Inf. Rev.* 02663821231176679 (2023)
21. Zhou, Y.: Development and training strategies of college teachers based on data mining technology. *Mob. Inf. Syst.* **2023** (2023)
22. Wu, S.: Intelligent communication management terminal in the construction of human resource management mode. *Wirel. Commun. Mob. Comput.* **2021**, 1–14 (2021)
23. Yang, Y., Wang, Y.: Enterprise human resources recruitment management model in the era of mobile internet. *Mob. Inf. Syst.* **2022** (2022)
24. Bilici, A., Kum, S., Arslan, Ö.: A Decision making human resources information management system for ship management. In: 13th Annual General Assembly of the IAMU, pp. 237–245 (2012)
25. Naz, M.I., et al.: Framework of decision support system for effective resource management. In: 2023 International Conference on Business Analytics for Technology and Security (ICBATS), pp. 1–7. IEEE (2023)
26. Alsaadat, K.: Strategic human resource management technology effect and implication for distance training and learning. *Int. J. Electr. Comput. Eng.* **9**(1), 314 (2019)
27. Gascó, J.L., Llopis, J., Reyes González, M.: The use of information technology in training human resources: an e-learning case study. *J. Eur. Ind. Train.* **28**(5), 370–382 (2004)
28. Gonzales, B., Ellis, Y.M., Riffel, P.J., Yager, D.: Training at IBM's human resource service center: linking people, technology, and HR processes. *Hum. Resour. Manage.: Publ. Coop. School Bus. Adm. Univ. Michigan Alliance Soc. Hum. Resour. Manage.* **38**(2), 135–142 (1999)
29. Marín Díaz, G., Galán, J.J., Carrasco, R.A.: XAI for churn prediction in B2B models: a use case in an enterprise software company. *Mathematics* **10**(20), 3896 (2022)