

ORIGINAL RESEARCH PAPER

Trends and trajectories in Human Resource Analytics: A scopus-based bibliometric study of knowledge domains and research evolution

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ARTICLE INFO

Article History:

Received 03 May 2025

Revised 12 August 2025

Accepted 01 October 2025

Keywords:

Artificial Intelligence

Bibliometric analysis

Human Resource Analytics

Human Resource Management

Scopus database

Sustainable growth

ABSTRACT

**BACKGROUND AND OBJECTIVES:** Human Resource Analytics has become a strategic enabler in modern workforce management, particularly amid digital transformation. However, scholarly research in Human Resource Analytics remains fragmented across regions and disciplines. This study employs bibliometric analysis to map global research output in Human Resource Analytics from 2012 to 2024, identifying trends, influential contributors, thematic concentrations, and underexplored areas.

**METHODS:** A bibliometric analysis approach was applied using data retrieved from the Scopus database. The dataset covered publication metadata, including authorship, institutional affiliation, geographic origin, keywords, sources, and citation counts. VOSviewer software was used to construct visual maps illustrating keyword co-occurrence, co-authorship networks, and citation clusters, enabling a comprehensive overview of research activity and intellectual structure in the Human Resource Analytics.

**FINDINGS:** A total of 211 publications are identified and analysed over 13 years, involving 602 contributors. The analysis highlights 2,674 citations, with an average of 12.67 citations per paper. The corresponding h-index and g-index are 24 and 47, respectively. The results reveal three research themes. They present an increasing global interest, with leading contributions from high-income countries. The three core themes are workforce analytics, Artificial Intelligence in Human Resource Management, and strategic decision-making. Notably, low representation from developing regions and limited use of advanced predictive analytics highlight critical research gaps.

**CONCLUSION:** This study provides a comprehensive quantitative overview of the evolution of Human Resource Analytics scholarship. It guides future research by identifying emerging priorities, regional disparities, and methodological developments, offering valuable insights for advancing data-driven human resource practices and fostering more strategic, evidence-based decision-making in HR management and policy development globally.

DOI: [10.22034/IJHCUM.2026.02.07](https://doi.org/10.22034/IJHCUM.2026.02.07)



NUMBER OF REFERENCES

59



NUMBER OF FIGURES

8



NUMBER OF TABLES

8

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Note: Discussion period for this manuscript open until July 1, 2026 on IJHCUM website at the "Show Article."

## INTRODUCTION

Human Resource Management (HRM) is an essential element of corporate success, overseeing several responsibilities like recruitment, staff development, performance management, and retention. Historically, HR choices were frequently grounded in intuition, experience, and qualitative evaluations (Achoui, 2009). In the contemporary data-driven business landscape, businesses are progressively depending on HRM analytics to facilitate informed, evidence-based decision-making. The transition from feeling to analytics signifies a substantial transformation in the management of HR services, enabling firms to utilize extensive data to enhance labour efficiency, employee engagement, and overall organizational performance. HRM analytics, also known as people analytics or workforce analytics, entails the utilization of data analytical methodologies on HR data to identify patterns, forecast future trends, and enhance HR procedures. This enables HR departments to shift from a reactive to a proactive stance, thereby supporting the strategic objectives of the firm (Almonawer et al., 2023). The increasing reliance on HRM analytics is not only a response to the availability of data but also a necessity driven by the complexities of modern workforce dynamics (Arora et al., 2021). Organizations now face challenges such as managing remote and hybrid workforces, enhancing employee well-being, promoting diversity and inclusion, and addressing skill gaps in a rapidly changing digital economy (Ahmed et al., 2022; Ying et al., 2023). As organizations adopt more sophisticated HR technologies, such as machine learning algorithms and Artificial Intelligence (AI) powered tools, HRM analytics has evolved from simple descriptive reporting to more advanced techniques like predictive and prescriptive analytics (Islam et al., 2022). The use of AI in HRM analytics is particularly promising, offering potential solutions for automating repetitive HR tasks, reducing bias in recruitment, and enhancing employee engagement through personalized learning and development plans (Arora et al., 2023; Al-Hunaiyyan et al., 2021). Moreover, while HRM analytics has been widely adopted in large, data-rich organizations, smaller businesses and public sector institutions may face barriers such as limited data availability, lack of expertise, or resource constraints that prevent them from fully utilizing analytics tools. Understanding these disparities in

HRM analytics adoption can offer valuable insights into how best to democratize the benefits of analytics across different organizational contexts. However, as the field continues to grow, it remains imperative to critically examine the existing literature and map out the intellectual structure of HRM analytics research. There is a need to better understand which areas of HRM are most influenced by analytics, what methodologies are commonly employed, and where the gaps in the literature may exist (Huang et al., 2023). This type of analysis is also fundamental for identifying which technologies and innovations are driving the field forward and which aspects of HR are lagging in analytics adoption. A bibliometric approach not only highlights the most influential publications, authors, and research institutions in the field but also demonstrates citation patterns and intellectual collaborations, offering a clearer picture of how knowledge in HRM analytics is being generated and disseminated. This can also pinpoint which research topics are gaining momentum, which methodologies are favored, and where there might be opportunities for future exploration. The increasing significance of HRM analytics has sparked growing academic interest, resulting in a rapidly expanding body of research across a wide range of topics. Scholars have explored areas such as employee performance prediction, talent acquisition analytics, turnover prediction, and the use of AI in HR processes. Despite the increasing interest in HRM analytics, the academic literature remains fragmented and lacks a unified theoretical or methodological foundation. Studies often vary widely in scope, focus, and research design. For instance, while some scholars concentrate on the predictive capabilities of analytics in employee turnover or recruitment (Minbaeva, 2018; Marler & Boudreau, 2017), others explore its strategic impact on organizational performance (Arora et al., 2021). However, few studies offer comparative analyses across industries, organizational sizes, or geographic regions, which limits the generalizability of findings (Van den Heuvel & Bondarouk, 2017). Moreover, a substantial proportion of existing research is concentrated in Western contexts, particularly in North America and Europe, with limited attention paid to emerging economies or public sector organizations (Álvarez-Gutiérrez et al., 2022). This geographic bias restricts our understanding of how HRA functions under different cultural, regulatory,

and technological conditions. Additionally, many studies rely on qualitative or case-based approaches without leveraging longitudinal or big data analytics, highlighting a methodological gap in empirical rigor (Dahlbom *et al.*, 2020). Furthermore, there is a lack of clarity regarding the adoption challenges faced by Small and Medium-Sized Enterprises (SMEs), which often lack the infrastructure, data maturity, or expertise required to implement advanced Human Resource Analytics (HRA) tools (Huang *et al.*, 2023). Few studies systematically explore the barriers and enablers of analytics adoption beyond large corporations, leaving a significant portion of the organizational landscape underexplored. This study addresses these gaps by conducting a bibliometric analysis of HRA literature from 2012 to 2024 that underscores the need for a comprehensive bibliometric and systematic analysis to synthesize fragmented insights. This includes identifying dominant themes, leading contributors, and future directions, with a focus on revealing underexplored areas and methodological disparities that warrant scholarly attention. This paper aims to provide a comprehensive examination of HRM analytics literature. An in-depth overview of the field of HRM analytics is provided through the analysis of the most relevant academic publications, which is achieved through a systematic literature review and bibliometric analysis. Consequently, the primary objectives of this investigation are as follows:

- *To conduct a systematic literature review of the key research areas, methodologies, and themes in the field of HRA.*
- *To examine the publication trends in the field of human resource analytics.*
- *To determine the most productive authors in the field of HRA.*
- *To classify the most productive institutions in the field of HRA.*
- *To identify the most active countries in the field of HRA.*
- *To examine the most highly cited documents in the field of HRA.*

#### *Literature review*

##### *Conceptual foundation of HRA*

This study conducted a critical review to examine recent literature regarding the implementation or proposed implementation of HR analytics. The Society of Human Resources Management (SHRM) identifies

two primary objectives of HRA: cost reduction and enhancement of workforce competencies to ensure organizational effectiveness (Huselid, 2018). The conceptual basis of HRA encompasses its definition, strategic significance, methodological frameworks, and the practical and ethical dilemmas related to its execution (Opatha, 2020). Manpower is the largest asset of every organization (Khalil *et al.*, 2023), which is why HRM is a crucial constant support of the growth and success of a firm. With the spread of technology and the reinforcement of rivalry, the business environment and dynamics have become increasingly perplexing. The key concept is that by employing analytics, HRM can make better data-driven decisions and concentrate on the strategic employment of human resources (Erro-Garcés and Aramendia-Muneta, 2023). That is, HRM may leverage the transformative capabilities of various technological components, enhance understanding of multiple challenges, and examine different big data issues (Erro-Garcés and Aramendia-Muneta, 2023). To tackle this complexity, scholars have proposed comprehensive frameworks that emphasize both technical aspects, like data accuracy and analytical software. (Vijay & Raju, 2024) calls for a substantial transition towards ethical, strategic, and proficient HR analytics approaches. Their assertions indicate that the challenges include a shortage of skilled professionals in advanced data analysis, insufficient integration of analytics into standard HR practices, and increasing concerns about privacy and the ethical handling of sensitive employee information (Vijay & Raju, 2024). The use of HR analytics is frequently hindered by significant obstacles, despite its transformative potential. A valid working definition of HR analytics is to define it “as the measurement and assessment of key HR outcomes and workforce qualities to support management and decision making”. It refers to any technique to obtain information about the people in a business and then apply those insights to fulfil corporate goals (Jyoti *et al.*, 2020).

##### *Strategic role and applications of HRA*

HRA has evolved from a basic reporting tool focusing on descriptive metrics like demographics, absence rates, and turnover, to a strategic function embedded inside organizational decision-making processes. Some organizations continue to utilize

HR analytics in isolation for administrative insights, while others have started to integrate it with comprehensive predictive and prescriptive models to derive greater organizational value (Arora *et al.*, 2021). This transition signifies an increasing executive desire for data-driven insights to guide workforce planning, succession strategies, and personnel optimization. This progression is not without dispute. Researchers Abellán-Sevilla and Ortiz-de-Urbina-Criado (2023) contend that, while its strategic potential, HR analytics frequently remains underexploited due to cultural opposition within HR departments and a misalignment with business aims. The evolution of conventional HR functions such as recruitment, compensation, and personnel management into data-centric processes has raised concerns about data ethics, privacy, and algorithmic bias, especially in AI-assisted decision-making systems (Alzayed & Al-Hunaiyyan, 2021; Francis *et al.*, 2023). While HR analytics is frequently lauded for enhancing talent distribution and performance assessment (Islam *et al.*, 2022), scholars like Kimura (2023) warn that data quality, contextual comprehension, and organizational preparedness are crucial factors for success. Merely possessing HR data is inadequate; the critical factor is how firms interpret and utilize it within evolving worker contexts. The literature, such as (Arora and Upadhyay, 2024), emphasizes both the potential and the constraints of HR analytics, highlighting the necessity for integrative frameworks that combine technical proficiency with strategic HRM intelligence. The study of (Katfi *et al.*, 2024) provides an extensive examination of HR Analytics, outlining its strategic significance, practical uses, and the requisite cultural transformations for its effective integration in contemporary HRM, however, the paper highlights HR Analytics as a transformative strategy rather than a mere technology tool, necessitating strategic intent, cultural adaptation, and ongoing learning to achieve its full potential in contemporary HRM. Bandi, Rao, and Ali (2021) assert that HR analytics may be categorized into two approaches: the data-driven approach, which is the earlier method, and the business-driven approach, which considers the firms' conditions and the external environment. Some scholars, such as Pape (2016), recommend a data collection framework for 30 types of data to analyse HR activities. The effects of COVID-19 on the workplace increase the need

for a more multidimensional HR strategy (Abellán-Sevilla & Ortiz-de-Urbina-Criado, 2023). Thus, the Employee Experience (EX) Theory in HRM offers a design thinking approach to improve employees' experience in the workplace (Plaskoff, 2017). In addition, resource-based theory and data analytics from Goswami & Mansi. (2025) found a link between Resource-Based Theory (RBT), analytics, employees, and competitive advantage. (Linking the competitive advantage of having talented employees and keeping them. The implementation of HR analytics has risen in prominence since Google introduced the notion of "People Operations". HR analytics is projected to expand by 71% worldwide from 2013 to 2017. Nonetheless, despite the growing enthusiasm and conceptual depth regarding HR analytics, much of the existing literature primarily highlights its strategic advantages without adequately investigating its actual organizational implementation, long-term viability, or impact variability across diverse sectors and cultures.

#### *Empirical findings and global adoption trends*

The HR research institute reports that in 2013, 8.6% of participating organizations in the UAE exhibited leading HR analytics performance, whilst 52.4% demonstrated a following performance (Mahmood *et al.*, 2022). Furthermore, the implementation of more sophisticated and accurate HR analytics metrics is anticipated to motivate organizations to adopt optimal practices in this domain (Jyoti *et al.*, 2020). Moreover, the study of Bandi *et al.*, (2021) emphasizes that HR analytics provide decision-making assistance across the employee life cycle, such as in applicant selection, and can offer strategies to bridge discrepancies between requirements and labor capabilities. The implementation of HR analytics and other HR technologies in any firm positively influences employee performance by yielding significant outcomes (Bandi *et al.*, 2021). The study done by Erro-Garcés and Aramendia-Muneta (2023) attempted to assess the influence of data analytics and robots on the performance of organizations throughout Europe. Evidence suggests that Human Resource Management Practices (HRMP) are significant in clarifying organizations' profitability. HR and technology are mutually supportive resources that contribute to generating superior outcomes. A high and statistically significant link was observed

between earnings and the utilization of data analytics for the aim of monitoring employee performance. Furthermore, the analysis demonstrated strong and relevant relationships between human resource practices and profitability. The article provides insights into the impact of technological and human elements on profitability, underlining the importance of human resource strategy and technology in accomplishing organizational goals (Erro-Garcés and Aramendia-Muneta, 2023). Zehir *et al.*, (2020) contend that big data and AI technologies are revolutionizing strategic HRM and influencing corporate performance, while tracking the growth of HR since 1945 and underscoring their importance in contemporary HR responsibilities. Their study examines multiple issues, including the influence of digital technologies on strategic human resource management and the function of big data and artificial intelligence in the strategic advancement of HR. The paper presents frameworks but lacks offering additional empirical evidence or case studies to support its claims. Although useful for synthesizing information and establishing future study priorities, its conceptual character may confine its 'findings' to observations and conversations rather than experimentally validated results. A study conducted by Jyoti *et al.*, (2020) sought to assess the impact of HRM practices on Teachers' Performance through HRA. The findings demonstrate that HR practices, particularly training and development, performance management, performance appraisal, and empowerment, positively influence teachers' performance. However, its cross-sectional design and sampling method limit the generalizability and causal interpretability of its findings, and its narrow focus on teacher performance overlooks broader educational outcomes. Islam *et al.*, (2022) performed a study in Bangladesh to ascertain the principal parameters affecting the use of AI-based technologies in recruitment. The researchers employed the Unified Theory of Acceptance and Use of Technology (UTAUT) model, incorporating perceived credibility and moderating variables as their analytical framework. The study's results demonstrate that all anticipated connections were statistically significant, except for the extended variable of perceived credibility. Nonetheless, there was no indication that gender or firm size exerted any moderating influence on the proposed hypotheses. Kiran *et al.*, (2022) performed a systematic literature review to examine the

relationship between Human Capital Management (HCM), HRA, and Organizational Performance (OP). The authors developed a theoretical framework to examine the relationship between HCM components and their effect on organizational performance, incorporating HR analytics as a mediating factor. The systematic investigation validated the proposed conceptual model and illustrated that HR analytics empower organizations to oversee their human capital management, resulting in improved organizational performance. Nonetheless, their validation method lacks robustness as it mostly relies on synthesizing previous research rather than evaluating the model with empirical data or stakeholder input, rendering it less applicable and more challenging to implement throughout various settings. Furthermore, Huselid's (2018) study shows that workforce analytics helps leaders and managers reach their goals through better staff management. Although analytics has great potential, the study assumes managers can simply analyze complex worker data. This ignores talent gaps, aversion to data-driven organizations, and the ambiguity of translating strategic goals into HR metrics. Despite its insights, the survey may overstate how easy and ready companies are to incorporate employment analytics. In recent years, the labor market dynamics in the Middle East, especially among the Gulf Cooperation Council countries, have seen a substantial transformation (Shayah and Sun, 2019). As oil-dependent economies endeavor to diversify and transition to a knowledge-based economy, the importance of human capital has grown progressively vital (Achoui, 2009). Recent international evidence further underscores the global expansion of HRA. In a study from the UK, Basnet (2024) found that AI-driven predictive analytics significantly improved employee retention by forecasting turnover risks and enabling targeted interventions. Additionally, Alabi *et al.*, (2024) investigated workforce analytics in Nigeria and demonstrated how data-driven insights can elevate customer service and performance strategy through HR practices. These examples illustrate how HRA is being strategically applied across diverse economic contexts to enhance HR effectiveness and organizational outcomes.

#### *Research gaps and future directions*

Anand *et al.*, (2023) undertake a bibliometric analysis of HRM with a focus on AI from 2012 to

2023. The study uses trend, theme, performance, cluster, co-citation, and co-occurrence analysis, providing significant perspectives on domestic and international citations and bibliographic linkages. A dataset of 659 Scopus-extracted documents was analyzed using VOSviewer for performance analysis and topic cluster inspection. Moreover, this research furnishes valuable perspectives on both domestic and international citations and bibliographic references that shed light on the significance of artificial intelligence within the realm of human resources. Furthermore, [Votto, Valecha, Najafirad, and Rao \(2021\)](#) argue that the tactical processes of recruitment, employee performance assessment and satisfaction, compensation and benefits analysis, best practice evaluation, disciplinary management, and employee training and development systems have increasingly integrated AI. Consequently, they performed a systematic review to examine published sources and literature about the implementation of AI in HRM. Their study delineates the components of tactical HRM/HRIS that are emphasized and highlights research deficiencies to guide future contributions. In another review, [Huang et al., \(2023\)](#) examined the novel idea of personalized HRM, distinguished by the implementation of sophisticated HR analytics and AI to deliver customized HR solutions. They asserted that Personalized Human Resource Management should be executed at the individual level and signifies the next evolution of HRM. Their research established that Personalized HR surpasses traditional standardized HRM regarding productivity, positive HR atmosphere, adaptability, return on investment in HRM, and overall financial performance of the organization. To achieve these objectives, the authors applied a bibliometric analysis from 2012 to 2024. The strategic importance of HRA is significantly acknowledged; nevertheless, substantial research limitations remain, especially concerning geographical representation, empirical validation, and the utilization of advanced analytics. Contemporary research is primarily focused on developed regions, resulting in a substantial lack of studies from developing areas, which limits a comprehensive understanding of contextual difficulties and the implementation of HR analytics in varied situations ([Chhetri et al., 2023](#)). Moreover, despite the numerous proposed conceptual models, there exists a deficiency of empirical research and real-world case studies to substantiate these frameworks

and evaluate their practical relevance ([Edwards et al., 2022](#); [Chhetri et al., 2023](#)). Another constraint is the inadequate application of advanced analytics—specifically predictive and prescriptive techniques—despite its capacity to facilitate proactive, data-driven decision-making; the domain continues to be predominantly governed by descriptive and diagnostic methodologies ([Jana et al., 2022](#)). The literature inadequately explores the long-term sustainability of HR analytics and its application across many sectors and corporate cultures ([Wang et al., 2024](#)). This is exacerbated by insufficiently examined ethical issues, including data privacy and algorithmic prejudice, which are becoming increasingly significant with the expanding incorporation of artificial intelligence into HR systems ([Edwards et al., 2022](#)). To address these limitations, researchers are urged to connect theory and practice by situating future studies within actual organizational contexts, emphasizing data quality, contextual comprehension, and ethical considerations ([Yin & Gallardo-Gallardo, 2024](#); [Jana et al., 2022](#)). Furthermore, the implementation of longitudinal and mixed-methods research designs will augment causal inference and boost the generalizability of results ([Wang et al., 2024](#)). To enhance the field's relevance, rigor, and ethical foundation, it is imperative to advance regional representation, deepen AI integration, and investigate future paradigms like Personalized HR Management.

## MATERIALS AND METHODS

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### *Methodology*

A comprehensive bibliometric approach was adopted to analyze publication research developments in HRA from 2012 to 2024. The methodology encompassed three key phases: data collection, data processing, and analysis. The following search string was used in the title to ensure relevant and comprehensive coverage of relevant literature: (“Human Resource Analytics” OR “HRA” OR “People Analytics” OR “Workforce Analytics”). The search was confined to documents published between January 1, 2012, and May 1, 2024. Filters were applied to limit results, such as articles, conference papers, book chapters, and review papers. Only documents in the English language were included. The inclusion and exclusion criteria are as follows: All retrieved records were screened by title to ensure relevance to the field of HRA. Publications that did not focus

on analytics applications in human resources were excluded. Duplicate entries and irrelevant records (e.g., those focused solely on general data science without HR context) were manually removed. After screening, 211 documents were retained for analysis. Key variables, such as publication year, source type, author affiliations, citation counts, and keywords, were used for further analysis. This study follows established and rigorous practices in bibliometric research. By adopting frameworks by Zupic and Čater (2014) and Donthu et al., (2021), two main bibliometric techniques were employed, which are (1) Performance Analysis and (2) Science Mapping. In the data analysis stage, the dataset was subjected to descriptive analysis using MS Excel, BiblioMagika, and VOSviewer, a specialized software for constructing and visualizing bibliometric networks. The study conducted four forms of analysis:

(1) Citation Metrics Analysis.

(2) Co-authorship Analysis to identify influential authors and their resulting network of collaboration.

(3) Co-citation Analysis to map the citation network relationship of the field.

(4) Keyword Co-occurrence Analysis was conducted to generate themes and research trends.

The resulting visualizations were examined to analyze author collaborations, research clusters, and keyword relationships, providing insights into the interconnectedness of the various research themes. These findings were done to ensure a comprehensive understanding of the research landscape. This bibliometric study enabled a robust examination of the evolution, influence, and future trajectories of

HRA research. This study applied good practices in bibliometric methodology based on previous studies (Wider et al., 2024a; Wider et al., 2024b).

## RESULTS AND DISCUSSION

### Main information

The citation metrics (Table 1) on Human Resource Analytics publications from 2012 to 2024 indicate a significant intellectual contribution stemming from a growing interest in this field. A total of 211 publications have been generated over a 13-year time frame. This points to a consistent research output. There were 602 contributors, with an average of 2.85 authors per paper, reflecting a high level of collaboration. The analysis uncovers 2,674 citations with an average of 12.67 citations per paper. In addition, the citation rate for the 148 cited papers is higher, at 18.07 citations per cited paper. This suggests the influence of selected works. The generated h-index of 24 reflects that at least 24 papers have received 24 or more citations, showing a resounding academic impact. The g-index of 47 suggests that the top 47 papers together received at least 47 (2,209) citations, representing the broad reach of highly cited papers in the domain. The citation sum within the h-Core is 2,395, revealing that a large portion of the total citations is contributed from a small number of papers. The m-index, at 1.846, implies steady research productivity and influence over time. While the citation metrics provide a strong descriptive overview, they also offer deeper insight into the publication dynamics of the HRA field. The relatively high h-index (24) and m-index

Table 1: Citation metrics

Main Information	Data
Publication Years	2012 - 2024
Total Publications	211
Citable Year	13
Number of Contributing Authors	602
Number of Cited Papers	148
Total Citations	2,674
Citation per Paper	12.67
Citation per Cited Paper	18.07
Citation per Year	222.83
Citation per Author	4.44
Author per Paper	2.85
Citation sums within h-Core	2,395
h-index	24
g-index	47
m-index	1.846

(1.846) critically underscore consistent productivity over time. This strongly suggests that HRA is shifting from an emerging topic to an established research area. The skewed distribution—with most citations coming from a small set of highly cited papers reflects a core academic structure. This suggested that only a few seminal studies dominate the HRA literature.

This pattern underscores the need for diversification in theoretical perspectives and more distributed contributions from a broader range of scholars and institutions.

Annual publication trends

Based on Table 2 and Fig. 1, the annual publication

Table 2: Publication by year

Year	TP Total Publication	NCA Number of authors	NCP No. cited paper	TC Total citation	C/P Citation per paper	C/CP Citation per cited paper	H H-index	G g-index	M m-Index
2012	3	7	3	242	80.67	80.67	3	3	0.231
2014	2	4	2	29	14.50	14.50	2	2	0.182
2015	1	2	1	188	188.00	188.00	1	1	0.100
2016	3	5	3	55	18.33	18.33	3	3	0.333
2017	15	32	13	608	40.53	46.77	7	15	0.875
2018	4	10	4	78	19.50	19.50	3	4	0.429
2019	8	17	6	126	15.75	21.00	4	8	0.667
2020	16	46	16	215	13.44	13.44	7	14	1.400
2021	18	49	17	377	20.94	22.18	9	18	2.250
2022	26	70	23	362	13.92	15.74	9	18	3.000
2023	57	163	38	281	4.93	7.39	9	15	4.500
2024	58	197	22	113	1.95	5.14	6	8	6.000
Total	211	602	148	2674	12.67	18.07	24	47	1.846

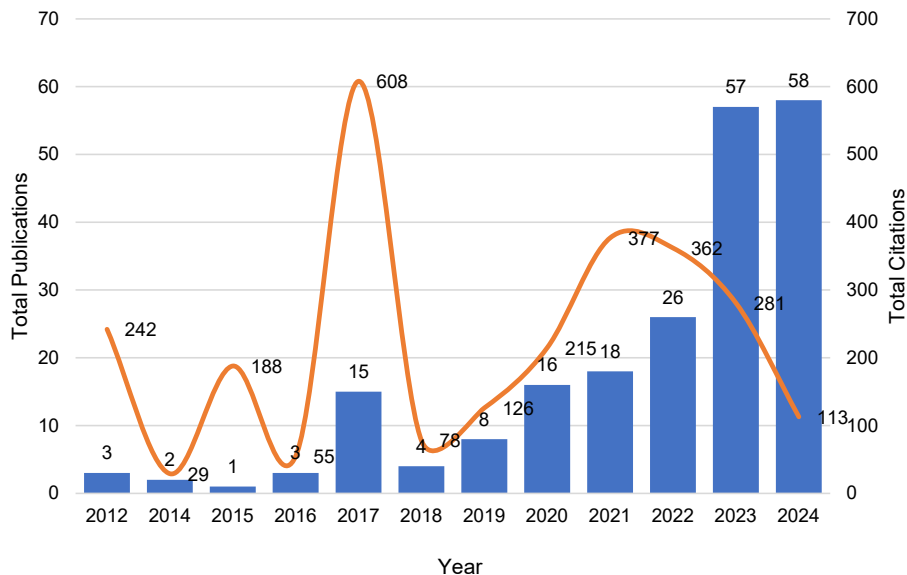


Fig. 1: Total publications and citations by year

and citation trends from 2012 to 2024 reflect a dynamically evolving field in HRA. The early years show low publication numbers, probably indicating limited academic interest. However, a sharp growth from 2016, leading to a peak in 2023 and 2024 with 57 and 58 publications respectively, signifies a major shift in the field. This suggests that HRA has moved to a mainstream research topic, driven by increased recognition of its role in contemporary HR practices. The parallel growth in citations points to a developing field, where seminal research is being extensively referenced. The parallels between the growing publications and citations imply that contributions are not only in numbers but are also considered highly impactful. This underscores HRA's critical role in HR decision-making in the dynamic business field.

Fig. 2 depicts the cumulative total number of publications on HRA from 2012 to 2024. The graph shows a polynomial growth trend, as

evidenced by the equation provided in the chart:  $y=2.5062x^2-16.333x+28.159$  with a commendable coefficient of determination ( $R^2 = 0.9705$ ). This indicates that the polynomial model fits the data very well, capturing 97% of the variance in the cumulative publication trend over the years. Overall, this visualization signifies that HRA is experiencing accelerated growth and is becoming a significant area of research in the academic field.

*Documents profiles*

Based on Table 3 below, it indicates that researcher in HRA demonstrates a strong inclination for journal articles (53.08%) with 112 publications. Conference papers account for 25.12% (53 publications), suggesting active academic discussions at conferences. Book chapters constitute 12.80% (27 publications). This breakdown suggests that the primary medium for disseminating research is journal

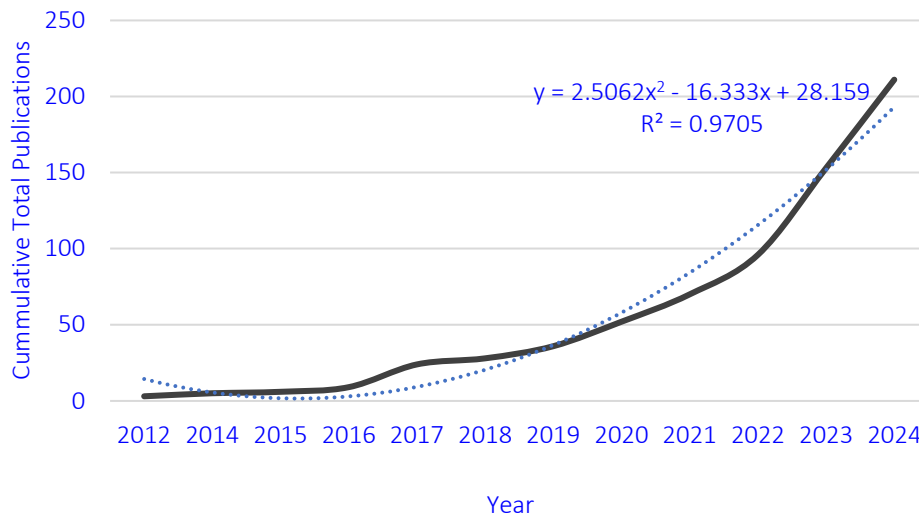


Fig. 2: Cumulative Total Publications by Year (Source: Generated by the authors using biblioMagika®)

Table 3: Document type

Document Type	Total Publication	Percentage (%)
Article	112	53.08%
Conference Paper	53	25.12%
Book Chapter	27	12.80%
Review	14	6.64%
Book	4	1.90%
Short Survey	1	0.47%

Table 4: Source type

Source Type	Total Publication	Percentage (%)
Journal	127	60.19%
Conference Proceeding	36	17.06%
Book	27	12.80%
Book Series	21	9.95%

Source: Generated by the authors

Table 5: Languages

Language	Total Publication	Percentage (%)
English	209	99.53%
Croatian	1	0.47%
German	1	0.47%

Source: Generated by the authors

articles, seconded by conference contributions, reflecting that both in-depth studies and active research discussions are the preferred channels for HRA.

Table 4 shows that for source types, journals are the dominant channel, contributing 60.19% (127 publications) of the total. The second most preferred channel is Conference proceedings, constituting 17.06% (36 publications), highlighting its substantial engagement in academic conferences. Books account for 12.80% (27 publications), and book series account for 9.95% (21 publications). This breakdown suggests that journals are the primary preference for research dissemination, while conferences and books also play a secondary supportive role in expanding scholarly engagement in this field.

Table 5 shows a strong preference for English, accounting for 99.53% (209 publications) of the total. Croatian and German each contribute only 0.47% (1 publication each). This underscores the dominance of English, highlighting its role as the primary language for academic communication in this field, suggesting that English allows a wider accessibility and global reach for academic researchers. Thus, it can be critically inferred that near-exclusive use of English as a publication language reveals both global accessibility and a noticeable potential bias that could limit regional diversity.

Table 6 below suggests that HRA is a highly interdisciplinary field with its intellectual roots in Business, Management, and Accounting. This is evidenced by 63.98% of the publications in these

areas. Closely related is the substantial presence in Computer Science (34.60%) and Engineering (21.80%). This only shows that HRA has a strong reliance on technical and computational methods. The diverse subject area spread underlines the fact that HR Analytics is not only concentrated in traditional HR disciplines but covers various fields, which allows it to leverage insights from multiple areas to propel data-informed decision-making in organizations.

#### *Most productive authors*

The bar chart in Fig. 3 represents the most productive authors in HRA. Prolific researcher Mittal, A., professor of management at Chitkara University, has one of his research interests in employability, with 7 documents, followed by Arora, M., with 6 publications. Prakash, A., Singh, S., and Cavanagh, J. each have 5 publications. The involvement of several authors with 4 to 6 publications suggests that a small core group of researchers drives most of the development in this field. This concentration may imply that collaborations and citations within this group are probably high, leading to the field's growth and also providing seminal work for emerging researchers.

#### *Most productive institutions*

Fig. 4 bar chart shows that the most productive are Chitkara University, Punjab (8 documents), followed by Amity University (6 publications). K.R. Mangalam University and Bharatiya Vidya Bhavan's

Table 6: Subject area

Subject Area	Total Publication	Percentage (%)
Business, Management, and Accounting	135	63.98%
Computer Science	73	34.60%
Engineering	46	21.80%
Decision Sciences	35	16.59%
Social Sciences	30	14.22%
Economics, Econometrics, and Finance	27	12.80%
Mathematics	22	10.43%
Psychology	19	9.00%
Physics and Astronomy	7	3.32%
Environmental Science	5	2.37%
Medicine	5	2.37%
Energy	4	1.90%
Agricultural and Biological Sciences	3	1.42%
Multidisciplinary	3	1.42%
Materials Science	2	0.95%
Arts and Humanities	1	0.47%
Biochemistry, Genetics, and Molecular Biology	1	0.47%
Chemical Engineering	1	0.47%
Neuroscience	1	0.47%
Nursing	1	0.47%

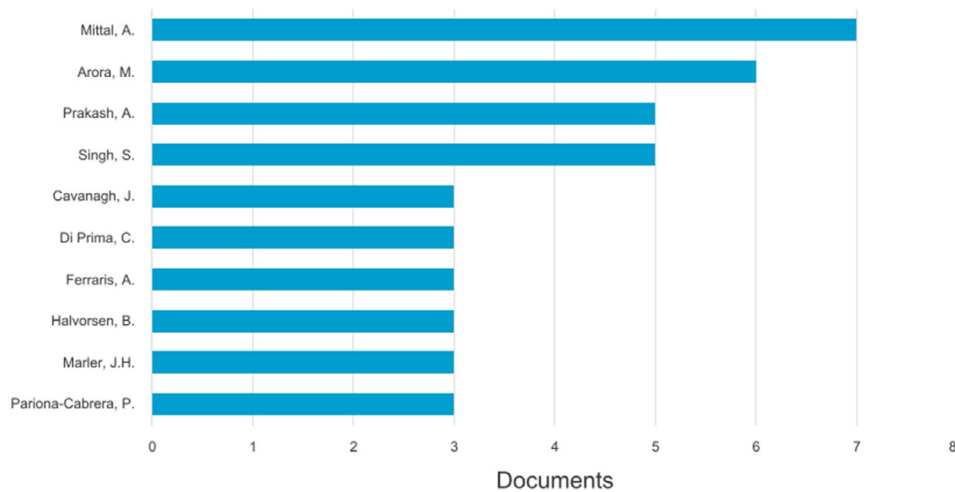


Fig. 3: Most productive authors

Usha and Lakshmi Mittal Institute of Management each contributed 5 publications. RMIT University and the State University of New York, Albany have 4 publications. The chart shows that 6 out of 10 top institutions in the bibliometric analysis are Indian institutions. The bibliometric analysis shows that Indian institutions are contributing strongly to the academic knowledge base of this search analysis. Furthermore, a systematic literature

review conducted by [Chhetri et al., \(2023\)](#) argues that most of the HRA research originates from India. The active involvement of these institutions suggests a growing focus on analytics in the HR field in India. The active engagement of global institutions such as RMIT and the State University of New York, Albany, suggests that research in HRA is not limited to a specific geographical region but is gaining global interest.

*Most productive countries*

Fig. 5 displays the top 10 countries contributing to HRA research from 2012 to 2024. India's contribution is significantly high, with close to 90 publications, trailed by the United States with almost 40 publications. Germany, Australia, and contributions are lower, ranging between 10 and 15. China, the United Kingdom, the Netherlands, the Russian Federation,

and Spain each have fewer than 10 documents. This spread of publication again suggests that Indian is the lead contributor for HRA publications. The dominance of India may be influenced by the pressing demand for HRA in developing economies to optimize talent management and organizational efficiency. The added contribution by European and Asian countries reflects the field's growing international interest and

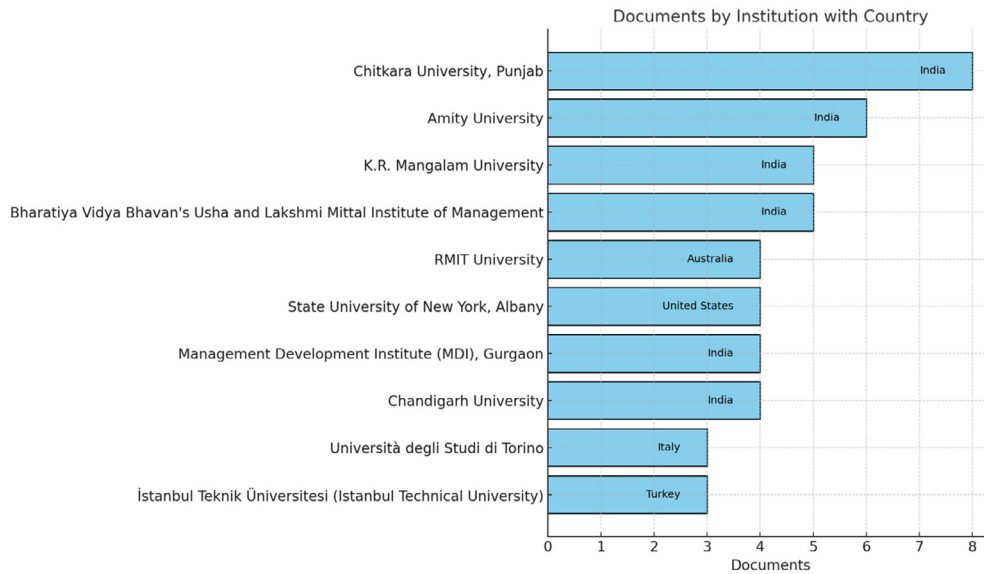


Fig. 4: Most productive institutions with a minimum of three publications

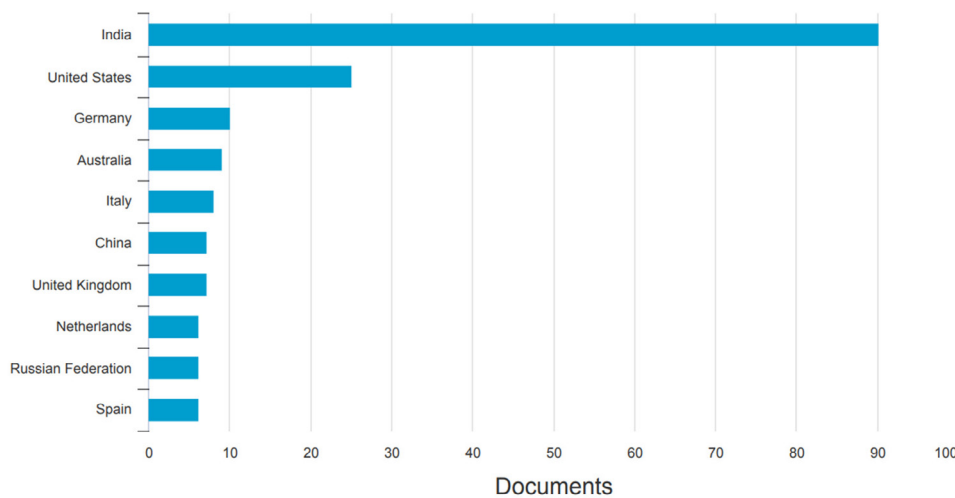


Fig. 5: The top 10 countries contributed to the publications.

Table 7: Top 10 most active source titles

Source Title	TP	NCA	NCP	TC	C/P	C/CP	h	g	m
Lecture Notes in Networks and Systems	9	34	3	5	0.56	1.67	1	2	0.333
HR Analytics in an Era of Rapid Automation	7	16	2	21	3.00	10.50	2	4	1.000
Personnel Review	7	18	7	164	23.43	23.43	4	7	0.667
Management Decision	5	17	5	90	18.00	18.00	3	5	0.750
Journal of Organizational Effectiveness	5	14	3	132	26.40	44.00	2	5	0.250
International Journal of Human Resource Management	4	11	3	423	105.75	141.00	3	4	0.375
Human Resource Management International Digest	4	0	2	7	1.75	3.50	1	2	0.077
Human Resource Management Journal	4	13	4	102	25.50	25.50	4	4	0.800
International Journal of Manpower	3	11	3	65	21.67	21.67	2	3	0.667
Benchmarking	3	9	3	22	7.33	7.33	3	3	1.500

Table 8: Top 15 highly cited articles

No.	Author(s)	Source Title	TC	C/Y
1	Marler J.H.; Boudreau J.W. (2017)	International Journal of Human Resource Management	336	42.00
2	Aral S.; Brynjolfsson E.; Wu L. (2012)	Management Science	209	16.08
3	Rasmussen T.; Ulrich D. (2015)	Organizational Dynamics	188	18.80
4	van den Heuvel S.; Bondarouk T. (2017)	Journal of Organizational Effectiveness	123	15.38
5	Margherita A. (2022)	Human Resource Management Review	112	37.33
6	Fernandez V.; Gallardo-Gallardo E. (2021)	Competitiveness Review	100	25.00
7	(Chalutz Ben-Gal, 2019)	Personnel Review	84	14.00
8	(Dahlbom, Siikanen, Sajasalo, & Jarvenpaa, 2020)	Baltic Journal of Management	66	13.20
9	(Vargas, Yurova, Ruppel, Tworoger, & Greenwood, 2018)	International Journal of Human Resource Management	65	9.29
10	(McCartney & Fu, 2022)	Management Decision	62	15.50
11	(Sharma & Sharma, 2017)	Management Research Review	59	7.38
12	(Qamar & Samad, 2022)	Personnel Review	57	19.00
13	(Falletta & Combs, 2021)	Journal of Work-Applied Management	50	12.50
14	(Chatterjee, Chaudhuri, Vrontis, & Siachou, 2022)	International Journal of Manpower	48	16.00
15	(Tunsi et al., 2023)	Information Sciences Letters	43	21.50

the broadening appeal of HRA research across diverse communities globally.

*Publications by source titles*

Table 7 shows the top 10 most active source titles in HRA research, with Lecture Notes in Networks and Systems as the most active, with 9 publications, but with a low citation impact (C/P = 0.56). HRA in an Era of Rapid Automation and Personnel Review both contribute 7 publications, with Personnel Review showing a significant influence (TC = 164 and C/P = 23.43). Management Decision and Journal of Organizational Effectiveness have 5 publications each, but the Journal of Organizational Effectiveness has a higher citation per paper (C/P = 26.4). This finding suggests that research on HRA is not solely dependent on the volume of publications but also on the quality of the content.

*Highly cited documents*

Table 8 below records that the most cited article is Marler & Boudreau (2017)'s "An evidence-based review of HRA" in the International Journal of Human Resource Management, with 336 citations (C/Y = 42.00), underscoring its impact in the HRA field. Aral, Brynjolfsson, & Wu (2012)'s "Three-way complementarities" in Management Science follows with 209 citations, revealing the importance of integrating HR analytics with other organizational practices. Other notable contributions from (Rasmussen and Ulrich, 2015) and (van den Heuvel and Bondarouk, 2017) also receive high citations, indicating strong interest in understanding the practical application of HRA. These results suggest that highly cited papers tend to focus on strategic frameworks, practical implementation, and barriers to HRA adoption, making them critical references for future research.

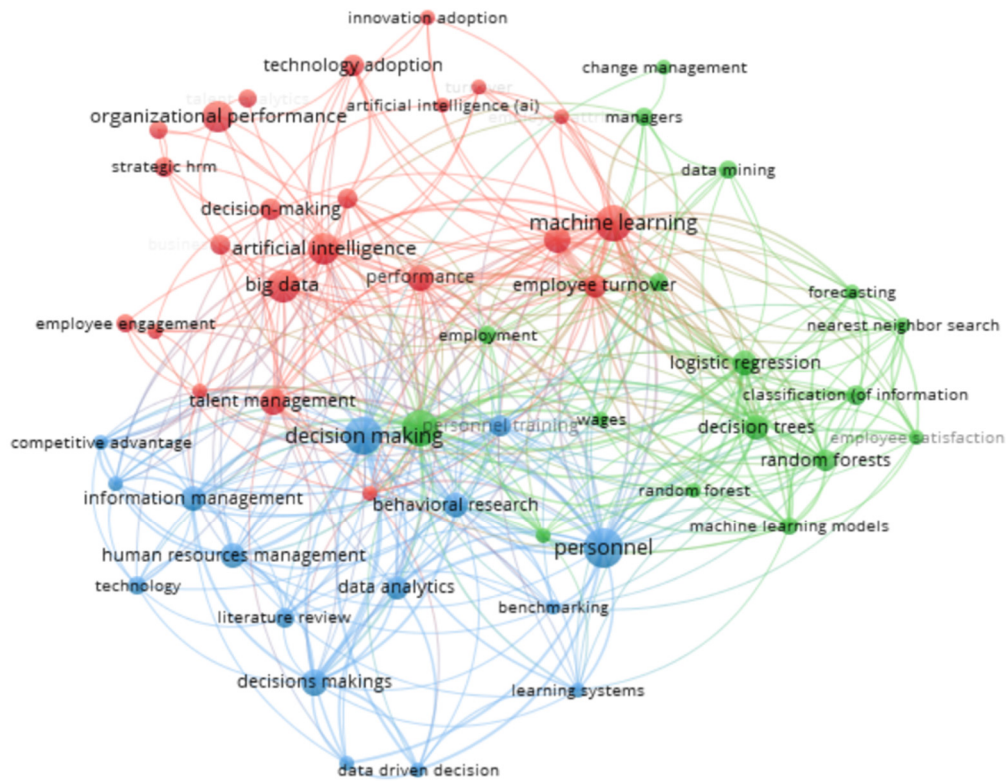


Fig. 6: Keyword co-occurrence network

### Keyword analysis

Fig. 6 below depicts a keyword co-occurrence network graph generated using VOSviewer. The network graph illustrates the thematic patterns generated from frequently occurring keywords in Human Resource Analytics research. Nodes symbolize keywords, with size indicating frequency and links reflecting co-occurrence relationships. Three primary clusters are visible, reflecting key themes within the HRA literature. The **Red Cluster** is reflected by terms such as *machine learning*, *big data*, *technology adoption*, and *AI*. This cluster highlights the emphasis on advanced analytics technologies within HR practices, suggesting an inclination toward using AI and machine learning tools to enhance HR practices. It shows a strong shift towards data-driven decision-making in HR. The **Green Cluster** contains keywords such as *logistic regression*, *decision trees*, and *classification*. The keywords represent the technical focus on predictive modeling. These specific keywords suggest a focus on statistical analytical

techniques to generate insights from HR data. The **Blue Cluster** focuses on traditional HR functions with keywords such as *HRM*, *decision making*, and *behavioral research*. This cluster reflects the use of various forms of analytical techniques to aid HR-related decisions, such as performance management and employee retention. The central positioning of keywords like *machine learning* and *decision-making* highlights a substantial overlap between clusters, implying that technology-driven analytics are deeply connected with practical HR applications. The graph depicts that HRA is increasingly reliant on data-centric approaches to address traditional HR challenges. This signifies the convergence of technical approaches and managerial applications, making HRA a critical component in enhancing organizational performance and competitive advantage. The keyword clusters analysis critically suggests distinct theoretical foundations. The Red Cluster, as shown in the figure below, depicts data science and technology disciplines by its focus on AI and machine learning.

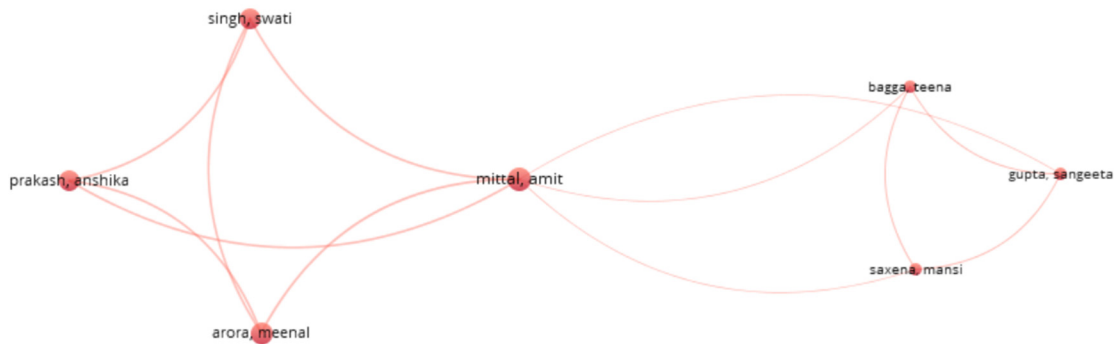


Fig. 7: Co-authorship analysis

The prominent Green Cluster underlines quantitative modeling. In contrast, the Blue Cluster reflects traditional HR and behavioral theories with a focus on decision-making and workforce practices. The central positioning of concepts such as decision making and machine learning highlights a growing interdisciplinary integration. The clustering below shows a pressing need for more cohesive and cross-disciplinary research in HRA.

#### Co-Authorship Analysis

Fig. 7: Co-authorship network graph depicts the collaborative relationships among researchers in the HRA field. Each node symbolizes an individual author, and the lines show co-authorship relationships, with thicker lines indicating stronger collaborations. The network presents that **Amit Mittal** serves as the central figure connecting these groups. There are two noticeable clusters. The first cluster includes **Swati Singh, Meenal Arora, and Prakash Hanshika**, who are closely connected, indicating a strong internal collaboration, where this small group of authors frequently publishes together. In contrast, the second cluster consists of **Teena Bagga, Sangeeta Gupta, and Mansi Saxena**, who display fewer interconnections. Amit Mittal bridges these two clusters, highlighting his influence in fostering working collaboration across different research clusters. Mittal's central position in the network suggests that he is a key researcher who is facilitating the flow of knowledge, which will enhance interdisciplinary collaboration and contribute significantly to the dissemination of research within HRA.

#### Citation analysis on documents

Fig. 8 citation network graph provides an overview of the citation relationships among highly cited documents. Each node here represents a document, and its size demonstrates the number of citations it has received. Links between nodes show citation relationships, and the different colors signify distinct research clusters. The graph displays three main clusters. The Yellow Cluster, dominated by **Marler (2017)** and **Aral (2012)**, represents foundational papers that have heavily influenced research. Their work, respectively, on evidence-based review of HRA and integrating HRA with performance management and information technology, has broad citation links, indicating that they serve as key references for other studies. The Red Cluster is centered around **(Fernandez and Gallardo-Gallardo, 2021)** and **(Margherita, 2022)**. This cluster focuses on systematizing research topics in HR analytics and barriers to HR digitalization. It suggests a focus on key topics in HRA and a strong focus on adoption and implementation challenges faced by organizations. The Green Cluster revolves around **(Greasley and Thomas, 2020)** and **(Gurusinghe et al., 2021)** practice-based research, respectively, on the influence of analytics projects on professional practice and predictive HRA. The recency of their work in this cluster suggests ongoing developmental research in practical applications.

#### Limitations of the study

Despite the detailed and comprehensive nature of bibliometric analysis, this study comes with some limitations. First, the data used in the analysis is

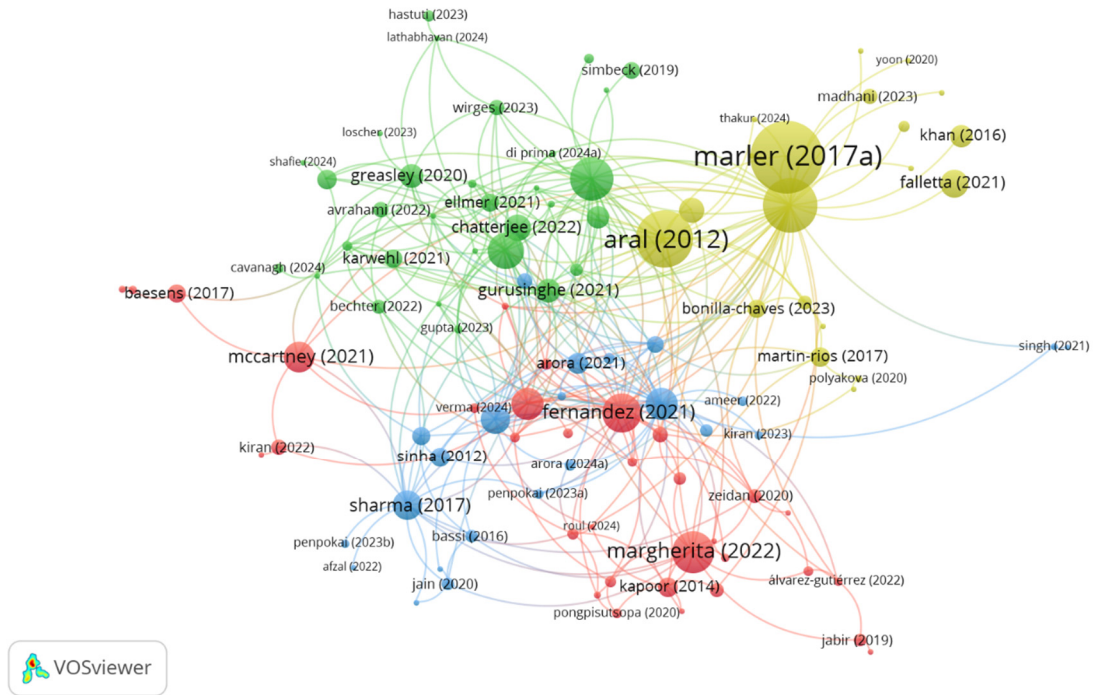


Fig. 8: Citation analysis on documents

limited to the Scopus database, which does not cover all publications in HRA. Second, the overt focus on citation metrics can lead to biases, where more established and foundational works may be sidelined compared to recent contributions that have gained faster traction. Additionally, the use of scientific visualization centered on keyword co-occurrence and citation analysis has its drawbacks. While it is effective in identifying key themes and influential works, it may not fully capture the actual developments within the field in various organizational settings. The analysis primarily focuses on quantitative measures, thus overlooking qualitative insights that may provide deeper insights into how HRA is evolving in practice. Finally, the analysis of co-authorship networks is limited to only the recorded publications of collaborations. Consequently, this form of analysis will not account for informal or interdisciplinary work. Future studies could address these gaps by applying qualitative methodologies and including various databases and their datasets to include wider sources and insights, thus providing a more holistic view of the development and challenges in this field.

#### *Future research directions*

The evolving landscape of HRA presents several promising avenues for further investigation. Building on the cluster analysis conducted in this study, future research should delve into the integration of advanced technologies such as AI and machine learning within conventional HR functions. These tools hold the potential to significantly enhance accuracy in areas like talent acquisition and employee performance assessment. Moreover, there is a pressing need to explore the ethical and privacy-related implications of using digital technologies in HR, an area that continues to pose significant challenges. Value-driven studies could also employ analytics to track and evaluate HR practices, thereby enhancing organizational effectiveness. Another critical direction involves examining how HRA can support strategic decision-making and contribute to long-term workforce sustainability in a competitive and rapidly changing environment. Encouraging interdisciplinary collaborations between HR professionals and data scientists may lead to the creation of more robust and practically viable HRA frameworks. Such collaboration

is important for moving beyond analytics to aligning HRA initiatives with overarching organizational strategies. Ultimately, future studies should focus on narrowing the gap between technological innovation and its practical implementation, ensuring that HRA contributes meaningfully to achieving strategic business objectives. Future research may also consider expert validation or integrating qualitative techniques—such as thematic analysis of full-texts or interviews with HRA practitioners—to triangulate findings and enhance contextual relevance.

## CONCLUSION

In conclusion, the bibliometric analysis of HRA research from 2012 to 2024 uncovers a steady growth and evolution of studies in this field. The analysis yields 211 publications from 602 contributing authors. These publications generated 2,674 citations. The average citation per paper is 12.67, the cited papers are 18.07, per year is 222.83, and per author is 4.44. The analysis managed to have an h-index and a g-index of 24 and 47, respectively. The growth of publications shows a parallel growth in citation metrics, suggesting a consistent interest and influence of HRA on academic research. The field has seen notable contributions from small core groups of authors, institutions, and countries, establishing a well-developed foundation for future research. Visualization mapping techniques using keyword co-occurrence network revealed three core clusters. These clusters have narrowed to themes centered around machine learning and artificial intelligence. Additionally, the keywords such as *decision making* and *organizational performance* signify a strategic shift towards integrating HRA with traditional HR practices. This suggests a focus aimed at improving the decision-making processes. The co-authorship analysis shows that collaboration is concentrated around a core group of researchers. This core group is dominated by a few central figures, such as Amit Mittal, who acts as a conduit in promoting interdisciplinary research and knowledge exchange. Preceding citation analysis highlighted influential works, such as those by Marler (2017) and Aral (2012), as highly influential, evidence-based reviews of HR Analytics and integrating HRA with performance management and information technology, which have broad citation links, indicating that they serve a key role in shaping the discourse on HR Analytics. Overall, the

bibliometric analysis underscores the growth of HRA. HRA has evolved into a multidisciplinary field that blends technical and organizational perspectives. The blend of technical approaches and traditional HR in decision-making has positioned HRA as a critical tool in enhancing overall organizational performance and its competitiveness. This study offers key implications for both researchers and practitioners in HRA. The emergence of key themes like machine learning, AI, and decision-making implies a progressive shift toward data-driven HR policies and strategies. Future research should develop academic frameworks that combine technical tools with practical HR applications. In addition, the dominance of a small group of authors highlights the implications for broader collaboration with diverse perspectives. Finally, strong citation network clusters suggest a solid theoretical base. This implies opportunities to expand into areas such as ethical AI and cross-functional analytics. These insights can help practitioners better align analytics with strategic HR functions and guide scholars toward future research directions.

## AUTHOR CONTRIBUTIONS

First Author: Initiated and framed the core research idea; developed the conceptual and theoretical underpinnings; carried out the systematic literature review; designed the bibliometric methodology; performed the main data collection and analysis; and led the drafting of the manuscript. Second Author: Contributed to refining the research design; assisted in data collection, cleaning, and preprocessing; provided constructive feedback during the analysis stage; and participated in reviewing and editing the manuscript. Third Author: Supported the interpretation of bibliometric results and preparation of visualizations (e.g., co-authorship networks, keyword clusters); contributed to structuring the Results and Discussion sections; and assisted in manuscript revisions. Fourth Author: Coordinated overall project administration; facilitated access to necessary resources and data; ensured alignment of the study with broader scholarly debates in HRM; and contributed to the final critical review and refinement of the manuscript.

## ACKNOWLEDGEMENT

This study was supported by the Public Authority for Applied Education and Training and INTI International University.

## CONFLICT OF INTEREST

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy, have been completely witnessed by the authors.

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## ABBREVIATIONS (NOMENCLATURE)

AI	Artificial Intelligence
HCM	Human Capital Management
HRA	Human Resource Analytics
HRM	Human Resource Management
HRMP	Human Resource Management Practices

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#### HOW TO CITE THIS ARTICLE

Alainati, S.; Senathirajah, A. R. S.; Al-Hunaiyyan, A.; Alameeri, M., (2026). Trends and trajectories in Human Resource Analytics: A bibliometric study of knowledge domains and research evolution. *Int. J. Hum. Capital. Urban Manage.*, 11(2): 323-342.

DOI: 10.22034/IJHCUM.2026.02.07

URL: [https://www.ijhcum.net/article\\_729880.html](https://www.ijhcum.net/article_729880.html)

