INTERNATIONAL JOURNAL OF INDUSTRIAL MANAGEMENT
ISSN: 2289-9286 E-ISSN: 0127-564X
VOLUME 18, NO. 4, 2024, 183 – 192
DOI: https://doi.org/10.15282/ijim.18.4.2024.10330

RESEARCH ARTICLE

# DECODING THE FUTURE OF HUMAN RESOURCE: HOW HUMAN RESOURCE ANALYTICS REVOLUTIONISE THE ORGANISATIONAL LANDSCAPE

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**ABSTRACT -** Technological advances and digitalisation have revolutionised human resource management (HRM) by increasing the quantity of workforce data and widening its access to facilitate decision-making in businesses. This study aims to provide an in-depth understanding of big data analysis (BDA) by evaluating the current and future trends in human resource (HR) analytics through bibliometric analysis. The findings revealed significant research clusters on the knowledge structure and mapping of research streams in HR analytics. Several challenges in BDA application and firm performances were also identified, indicating its current and future trends in HR analytics. Implications for the new HRM landscape include the benefits and risks of using HR analytics tools that organisations must carefully monitor. Moreover, HR practitioners must understand the organisation's business needs and goals, analyse high-quality data that are relevant to the specific problem or question being addressed, and possess the technical skills and resources to implement and use HR analytics effectively.

**ARTICLE HISTORY**
Received : 09-02-2024
Revised : 11-03-2024
Accepted : 13-03-2024
Published : 09-12-2024

**KEYWORDS**
*Big Data Analysis*
*Human Resource Analytics*
*Bibliographic Coupling*
*Co-Word Analysis*

## 1. INTRODUCTION

Human Resource Management (HRM) is rapidly changing and adopting digital HR practices has become essential for organisations to adapt to this new landscape. The world is data-driven, making analytics an important tool for decision-making processes in the business environment (Jabir et al., 2019). HR is no different from any other department in this regard. Bondarouk and Brewster (2016) noted that research on HRM and technology, particularly the impact of IT on HRM, is becoming increasingly important for the future of HR. One such development in this field is HR analytics, which involves using data and statistical methods to analyse and improve human resources processes and practices (Dubey et al., 2019). Organisations can make more informed decisions and improve their business performance by leveraging HR analytics.

HR analytics, which can be understood as people analytics (Polzer, 2022) or workforce analytics (McIver et al., 2018a), is described as HR data that utilises statistical methods, data mining, and predictive modelling. It involves utilising data analysis methods to make better HR decisions (Huang et al., 2023). This will enable organisations to identify patterns and trends for making evidence-based decisions (Samson & Bhanugopan, 2022). Therefore, this article discusses the transition in HR analytics, significantly focusing on modern HR practices. As the elements of HR analytics often include its concept, importance, and applications, various HR analytics tools and the ways organisations implement HR analytics effectively should be explored for their potential for sustainable success in HR practices.

Technological advances have revolutionised the world of HRM, with digitalisation increasing the quantity of workforce data available to businesses. Subsequently, there has been a growing interest in HR analytics, which involves using data and statistical methods to analyse and improve human resources processes and practices (Mccartney & Fu, 2021.) According to Han et al. (2023), technology has significantly impacted human resource management by changing how organisations recruit, train, and manage their employees. For instance, the COVID-19 pandemic has forced many organisations to adopt remote work policies, resulting in a greater reliance on digital tools for employee training and collaboration (Arunprasad et al., 2022). HR analytics can help organisations effectively manage these changes by providing insights into employee behaviour and performance (Kale, 2022).

According to Hamilton and Sodeman, (2020), a significant benefit of utilising big data analytics in HR is determining how to enhance employees' skills and knowledge to develop a competitive advantage and increase overall firm performance. This analytics is mainly relevant during the COVID-19 pandemic as technology has made it simpler for businesses to recruit and integrate new employees remotely (Han et al., 2023). Furthermore, the prominence of utilising

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HR analytics is undeniable as it can assist HR professionals in gathering and analysing data to facilitate informed decision-making. According to Dahlbom et al. (2020), HR analytics enable HR professionals to make data-driven decisions about the workforce, such as identifying areas for improvement in employee engagement or retention. It can also help organisations adapt to the evolving HRM landscape by identifying patterns and trends in employee data that may not be readily evident using conventional methods (Sousa et al., 2019).

Furthermore, HR analytics can empower organisations to make data-driven decisions. HR professionals can make strategic choices that align with business goals and drive organisational success (Talaoui et al., 2023) by analysing historical data (Wang et al., 2022), identifying patterns (Palanisamy & Thirunavukarasu, 2019), and predicting future outcomes (Lepenioti et al., 2020). HR analytics also revolutionise how organisations attract, select, and retain talent. It enables HR teams to identify the most effective recruitment channels (Nocker & Sena, 2019), assess candidate fit, and predict employee performance (Biabanifard et al., 2019). This will ultimately optimise the hiring process and reduce turnover. Additionally, businesses can utilise HR analytics to develop skilled and committed employees according to the organisational goals. As a result, HR managers are better able to make strategic decisions that contribute to the overall success of the company (Talaoui et al., 2023).

Moreover, HR analytics plays a critical role in employee engagement and retention. It allows managers to learn about what drives employee engagement and satisfaction (Zel & Kongar, 2020). Such information will help them to create targeted programmes that can increase employee satisfaction, output, and loyalty, ultimately contributing to a lower turnover rate (Jaouadi, 2022). HR analytics also helps businesses prepare for their future workforce planning. Managers will benefit from modern analytics by understanding staff performance and habits (Sousa et al., 2019) from numerous sources, including employee surveys (Sharma et al., 2022) and performance metrics (Gunay et al., 2019). This data-driven approach shall assist managers in making decisions that support the company's long-term objectives in workforce planning (Pessach et al., 2020). With proper planning on workforce needs issues, organisations can sustain the right talent to prepare for future challenges.

Past research found that 89 percent of organisations currently utilise HR analytics (Fernandez & Gallardo-Gallardo, 2021a), indicating the importance of evidence-based decision-making practices for maintaining competitiveness in today's business landscape (Bonilla-Chaves & Palos-Sánchez, 2023a). It highlights the necessity of HR analytics in the modern business landscape. However, the implementation of HR analytics is not without its challenges. Janssen et al. (2017) identified several significant factors that can impact the successful implementation of HR analytics. These include the availability and quality of HR-related data sources, the capacity to effectively process and analyse large quantities of HR data, and appropriate governance mechanisms to ensure data quality and contextualisation (Wirges & Neyer, 2022).

However, implementing HR analytics can be a complex process and organisations may encounter several issues during implementation (Fernandez & Gallardo-Gallardo, 2021a; Haenlein et al., 2019; Hamilton & Sodeman, 2020; Harney & Collings, 2021; Janssen et al., 2017). Thus, HR analytics is an essential tool for HR professionals to adapt to the changing landscape of HRM. While there are challenges associated with its implementation, the benefits of HR analytics in improving decision-making and overall business performance make it a worthwhile investment for organisations looking to stay ahead in the digital age. Therefore, this paper aims to thoroughly discuss the concepts of HR digital and HR analytics as well as the barriers and effective strategies for organisations to implement HR analytics.

## 2. LITERATURE REVIEW

A growing number of literatures has indicated that HR is an essential component of an organisation (Atmaja et al., 2023) to ensure that employees are engaged, productive, and supported in their duties to ease the burden in the workplace (Hennekam et al., 2021). Considering the recent technology implementation, HR has adapted effectively and efficiently to the shifting business environments (Bondarouk & Brewster, 2016; Das, 2022). The HRM transformation through technological advancements has increased the interest in HR analytics as a valuable instrument for a more competent management ecosystem (Karwehl & Kauffeld, 2021). Conversely, HR analytics has become crucial for modern organisations, offering insightful information for strategic choice-making and improving HRM procedures.

Kashive and Khanna (2022) highlighted several HR analytical tools that are often used in the working sector, including structure query language, system applications and products in data processing, human capital management, TABLEAU, management information systems, and Python. It has flown to a standard whereby HR can leverage the multiple indicator multiple causes (MIMIC) models to read people's behaviour (Rosen et al., 2022). Therefore, HR practitioners should be familiar with the many tech platforms used in HR analytics research and be able to assess which tool would be best for certain HR duties.

While the benefits of HR analytics are significant (Bonilla-Chaves & Palos-Sánchez, 2023b), HR personnel must have the self-efficacy to keep up with the rapid pace of technological development (Medici et al., 2023). There are major concerns regarding the right tool and appropriate technology for a particular person. Analytics difficulty is the main challenge that must be addressed in this movement (Edwards et al., 2022; Aljohani & Alqahtani, 2023). Conversely, training can assist the management in creating an appropriate environment with interactive communication and employee encouragement that positively impacts performance (Mohamad et al., 2023). From an analytic perspective, support from top management is key towards infrastructure development in organisational learning (Perez-Sanagustin et al., 2022).

Furthermore, the content of the training should cover personnel skills and competencies to manage massive amounts of data for organisational performance (Mahmood, 2022). Personnel skills require governance mechanisms emphasising the importance of data quality to ensure that data is properly contextualised and analysed (Janssen et al., 2017). Continuous training in this area can aid HR professionals in leveraging technology to generate data-driven insights and optimise HR outcomes.

## 3. METHODS AND MATERIALS

### *3.1 Bibliometric Approach*

Bibliometric analysis utilises mathematical and statistical approaches to examine various types of literature, such as books and articles, to gain a broad understanding of a new field of study (Donthu et al., 2021). It uses science mapping techniques to evaluate bibliographic databases for visualising and analysing the structure and trends of a particular topic and evaluating the impact of research literature across specific areas, regions, collaborations, journals, institutions, and authors throughout a specific period (Han et al., 2023b). This is done by investigating several bibliographic elements, including the number of published works, references, and significant themes. Such method has various practical uses, such as helping libraries decide which materials to acquire, offering historical data for scholarship research, aiding researchers in finding pertinent information, and measuring the relative impact or influence of publications for further evaluation and ranking by scholars (Engler, 2014).

### *3.2 Search String*

The search string in Table 1 was used to conduct a document search on the Web of Science (WoS) database without any restriction to specific document types, including scholarly journal articles, conference proceedings, books, book chapters, letters, and notes. The search was conducted on 18 March 2023 and English was set as the default language for the title, abstract, and keywords. It yielded a total of 367 publications published between 1991 and March 2023.

Table 1. Search string in WoS database

| Keywords | Justification |
|---|---|
| "digital* human resource*" OR "digital* HR*" OR "HR* digital*" OR "HR* analytic*" OR "predictive HR*" OR "prescriptive HR*" OR "descriptive HR*" | These keywords provide a broad coverage to investigate various facets of the digital transformation of human resources and narrow the research focus by emphasising the analytical and data-driven aspects of HR. The key terms align with current HR trends and advancements as organisations slowly adopt digital technologies and utilise data analytics. |

## 4. RESULTS AND DISCUSSION

The initial document search yielded a total of 367 publications that were published from 1991 until March 2023. They were further filtered to only include journal articles published in 2021 to ensure that all publications were within the full calendar year. This resulted in a total of 243 journal articles.

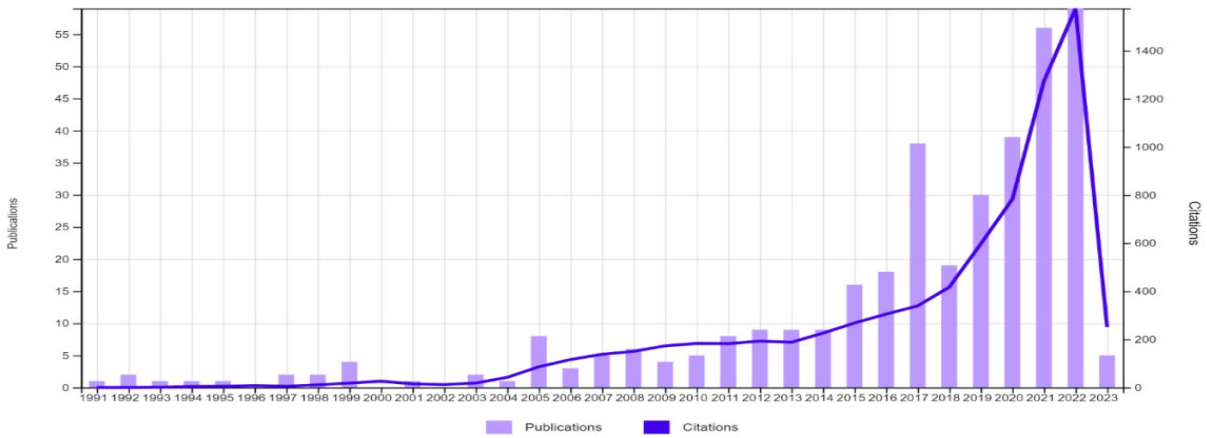


Figure 1. Document search yield

### *4.1 Bibliographic Coupling Analysis*

Bibliographic coupling evaluates the connection between two academic works by examining their shared references. Different documents are perceived to have significant bibliographic coupling if they possess a large number of mutual citations. Only 63 out of the 243 articles met the threshold of 13 citations and created 5 clusters. The top-ranking

documents based on total link strength (TLS) are Margherita (2022) with 154 TLS, Fernandez (2021) with 142 TLS, and Shet (2021) with 131 TLS.

Cluster 1 (red) is labelled as "New Landscape of HRM" and comprises eight publications. The field of HRM is continually evolving as a result of technological advancements and changes in organisational needs. Harney and Collings (2021) proposed a framework comprising internal and external factors that affect HRM, including technological advances, globalisation, and workforce demographics. Meanwhile, Thite (2022) posits on using AI and ML in HR processes, such as recruitment, selection, and performance management. Finally, Shet et al. (2021) investigated the significant factors impacting the implementation of HR analytics.

Table 2. Top 10 documents with the highest bibliographic coupling and total link strength

| Documents | Citation | Total link strength |
|---|---|---|
| Margherita (2022) | 24 | 154 |
| Fernandez (2021) | 26 | 142 |
| Shet (2021) | 19 | 131 |
| Dahlbom (2020) | 18 | 90 |
| Mccartney (2021) | 13 | 86 |
| Greasley (2020) | 16 | 82 |
| Zhou (2021) | 15 | 81 |
| Peeters (2020) | 22 | 80 |
| Van den heuvel (2017) | 44 | 60 |
| Kim (2021) | 19 | 54 |

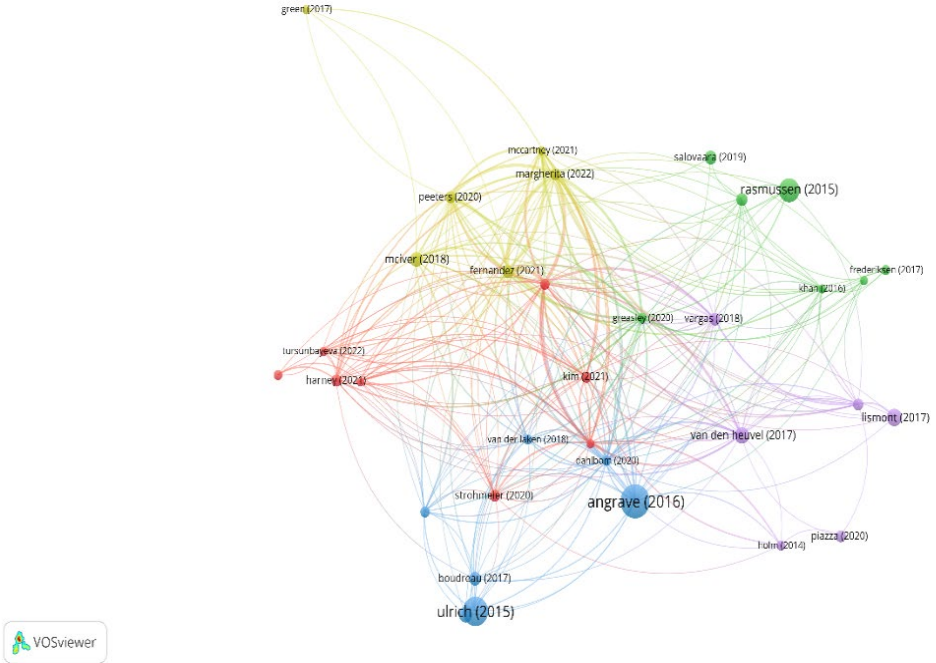


Figure 2. Bibliographic coupling analysis of big data analytics in human resource management

- Cluster 2 (green) is labelled as "Risk of Digital HR" and has seven publications.

  HR analytics is a technology-enabled tool that allows organisations to make data-driven decisions on talent management, incentive structures, organisational design, training budget allocation, and other strategic decisions. Rasmussen and Ulrich (2015) and van der Togt and Rasmussen (2017) noted that the use of HR analytics can lead to several benefits beyond talent outcomes, including improved profits, cyber security, and safety. However, it does come with certain risks that must be considered by organisations (Salovaara et al., 2019).

- Cluster 3 (blue) is labelled as "Trends in HR Analytics" and has seven publications.

  The recent years have witnessed a significant shift in the field of HR, leading to questions about its future and role within organisations. Ulrich (2016a) argued whether HR has reached its final stage or will continue to evolve in response to the changing business environment. Meanwhile, Angrave et al. (2016) warned that current trends may exclude HR from strategic decision-making, which can negatively affect employees. Many organisations have turned

to human capital analytics (HC analytics) to adapt these changes and gain insights into their workforce. HC analytics involves data analysis and visualisation tools to help organisations make informed decisions about their employees (Boudreau & Cascio, 2017).

- Cluster 4 (yellow) is labelled as "HR Analytics Effectiveness" and has six publications.

  HR analytics has the potential to revolutionise human capital management; however, HR professionals must understand its advantages and disadvantages to improve current practices. Peeters et al. (2020) proposed the People Analytics Effectiveness Wheel, which emphasises the importance of resources, senior management support, knowledge, skills, and abilities to effectively implement HR analytics. McIver et al. (2018b) offer a roadmap for an agile workforce analytics process that includes identifying important issues, combining deductive and inductive approaches, verifying and preparing data, and translating insights into action.

- Cluster 5 (purple) is labelled as "HR Analytic Adoption" and consists of 6 publications.

  HR analytics can potentially revolutionise business operations, but its adoption rate is low. Vargas et al. (2018) found that organisational culture, employee resistance, and lack of resources are barriers to adopting HR analytics. However, research suggests that HR analytics will become an established discipline that positively impacts business decision-making by 2025 (van den Heuvel & Bondarouk, 2017). As companies mature, their analytics organisations will improve and encompass more advanced techniques and applications, including the implementation of HR and predictive analytics that emphasise on data governance policies (Lismont et al., 2017). While HR analytics adoption is currently low, it is expected to become an established discipline in years to come.

Table 3. Summary of co-citation analysis according to clusters, cluster label, number of articles, and related publications

| Cluster | Cluster Label | Number of Articles | Representative Publications |
|---|---|---|---|
| 1 (red) | New Landscape of HRM | 8 | Harney & Collings (2021), Thite (2022), Shet et al. (2021) |
| 2 (green) | Risk of Digital HR | 7 | Rasmussen & Ulrich (2015), van der Togt & Rasmussen (2017), (Salovaara et al. (2019) |
| 3 (blue) | Trends in HR | 7 | Ulrich & Dulebohn (2015), Angrave et al. (2016), Boudreau & Cascio (2017) |
| 4 (yellow) | HR Analytics Effectiveness | 6 | Peeters et al. (2020), McIver et al. (2018) |
| 5 (purple) | HR Analytic Adoption | 6 | Vargas et al. (2018), van den Heuvel & Bondarouk (2017), Lismont et al. (2017) |

### *4.2 Co-Word Analysis*

Co-word or co-occurrence analysis is a bibliometric technique used to identify the conceptual structure in HR analytics by analysing the frequency of words appearing together in publications. It aids the transformation of a network in numerous areas of research. The co-word analysis of the 243 articles revealed 73 cited references with a threshold of 4 cited references. It describes the role of HR analytics and contributes to a network of related publications. The VOSviewer software was used to construct bibliometric maps that can explain the large picture of multidimensional scales.

Table 4. Top 15 keywords in the co-occurrence of keywords analysis

| Rank | Keyword | Occurrences | Total Link Strength |
|---|---|---|---|
| 1 | HR Analytics | 64 | 169 |
| 2 | Performance | 32 | 97 |
| 3 | Big Data | 21 | 73 |
| 4 | Management | 20 | 62 |
| 5 | People Analytics | 15 | 61 |
| 6 | Adoption | 13 | 54 |
| 7 | Human Resource Management | 15 | 52 |
| 8 | Human Resource Management | 14 | 49 |
| 9 | Human-Capital analytics | 9 | 46 |
| 10 | Workforce Analytics | 11 | 45 |
| 11 | E-HRM | 11 | 42 |
| 12 | Technology | 9 | 42 |
| 13 | Impact | 13 | 40 |
| 14 | Innovation | 13 | 39 |
| 15 | Science | 9 | 38 |

Table 5. Co-word analysis cluster

| Cluster No and Colour | Cluster Label | Number of Keywords | Representative Keywords |
|---|---|---|---|
| 1 (red) | The Power of HR Analytics and Technology for Strategic Business Impact | 4 | "Human resource management", "Analytic", "technology", "future" |
| 2 (green) | Organisational Success through People Analytics and Big Data Management | 4 | "Management", "big data", "human resource analytics", "people analytics" |
| 3 (blue) | Leveraging Technology to Drive HR Management | 4 | "Human resource management", "adoption", "information technology", "performance" |
| 4 (yellow) | The impact of IT on HRM in the future | 4 | "Human resource management", "impact", "information technology", "future" |

- Cluster 1 (red) is labelled as "New Landscape of HR" and consists of 4 keywords.

  Harney and Collings (2021) and Thite (2022) discussed the current status of Digital HR, the future-oriented HR technology plans, and the plan for achieving that goal through an implementation roadmap. They investigated the current position of Digital HR and highlighted the various difficulties and prospects that businesses may face in implementing this advanced HR technology strategy. Shet et al. (2021) investigated the significant factors impacting the implementation of HR analytics, which include technological, organisational, environmental, data governance, and individual elements.

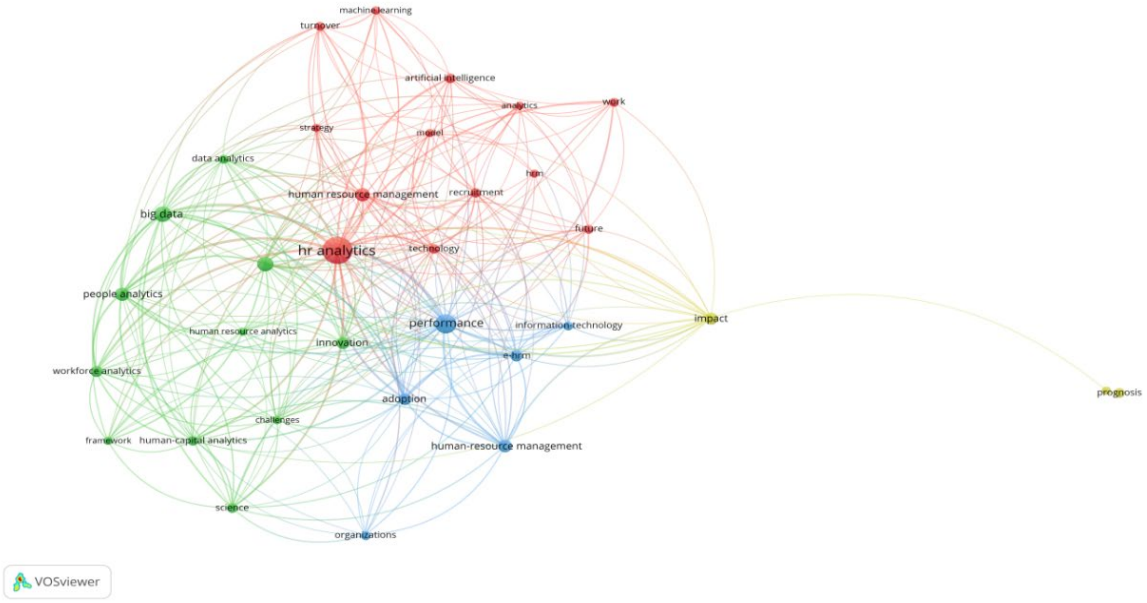


Figure 3. Co-word analysis of future HR analytics impact

- Cluster 2 is labelled as "Organisational Success through People Analytics and Big Data Management" and has 23 items.

  HRM is becoming more data-driven and evidence-based to improve organisational performance (Marler & Boudreau, 2017). Fernandez and Gallardo-Gallardo (2021) identified 14 obstacles that can prevent the adoption of HR analytics, including data and model-related barriers, software and technology-related barriers, people-related barriers, and management-related barriers. However, Reddy and Lakshmikeerthi (2017) highlighted the importance of evidence-based HRM, which uses data and evidence for informed and accurate decision-making in HRM.

- Cluster 3 is labelled as "Leveraging Technology to Drive HR Management" and consists of 15 items.

  The representative keywords in this cluster are "human resource management", "adoption", "information technology", and "performance". HR professionals must adapt to changing business environments to stay relevant. They must also provide innovative solutions to create market value, such as using HRIS to improve decision-making, increase productivity, and save costs (Ulrich, 2016). Meanwhile, Gupta (2013) highlighted the importance of HRIS utilisation in achieving these objectives and that HR professionals need to incorporate this technology to enhance their effectiveness in the workplace.

- Cluster 4 is labelled "The impact of IT on HRM in the future" and has 15 items.

  The representative keywords in this cluster are "human resource management", "impact", "information technology", and "future". HRM has experienced rapid technological advancements, transforming the digital environment in which it operates. Bondarouk and Brewster (2016b) posit that digital technologies through artificial intelligence (AI) have improved HRM data quality and provided new opportunities to improve effectiveness and efficiency. Goel et al. (2022) looked on the development of AI for specific HRM functions, while studies from other disciplines have focused on the consequences of AI towards HRM, jobs, and the labour markets.

## 5. CONCLUSION

This study offers two practical implications. First, organisations must carefully weigh the benefits and risks of using HR analytics and ensure that they have the necessary pre-conditions to make the most of this powerful tool (Aziz, 2023). These pre-conditions include having a clear understanding of the organisation's business needs and goals (Chowdhury et al., 2023), having high-quality data that is relevant to the specific problem or question being addressed (Penpokai et al., 2023), having the necessary technical skills and resources to implement and use HR analytics effectively (Peterson et al., 2023), and ensuring that adequate measures are in place to protect employee data privacy and cybersecurity (Madhani, 2022). Organisations can also consider partnering with external vendors or experts to help them overcome these challenges and implement HR analytics successfully (Horani et al., 2023). Another implication is exemplary in general HR analytics, which can potentially transform organisations. However, it requires adequate resources (Lozada et al., 2023), effective stakeholder management (Cho et al., 2023), and a governance structure to ensure its success (Chowdhury et al., 2023). As noted by Angrave et al. (2016), HR professionals must be willing to engage strategically and operationally to enhance current practices and take full advantage of the potential benefits of HR analytics (Bulsari & Pandya, 2023).

This paper also presents a scientific mapping of the future of human resources. The bibliographic coupling explored the need for HRM scholars and practitioners to adapt to the changing landscape of HRM through digital HR, HR analytics, and future-oriented technology plans. Co-word analysis stressed that HR analytics has become increasingly popular; however, organisations must be aware of the accompanying risks. HR analytics has the potential to revolutionise human capital management, but adoption remains low due to factors such as top management support, data quality, and security concerns.

Nevertheless, this study has several limitations. First, there is a need for further elaboration on which analytical tool suits HR functions for decision-making. To address such limitation, future research may explore the main function of HR, mainly in training, recruitment and selection. Moreover, bibliographic coupling and co-citation analysis are limited by the availability and coverage of citation data, resulting in biased findings. The accuracy of citation records analysis can also be affected by incomplete or inconsistent data. Future research is advised to conduct further analysis on complementing methods within bibliometric.

## ACKNOWLEDGEMENTS

The researchers wish to acknowledge Universiti Malaysia Pahang Al-Sultan Abdullah for funding this project through the Social Science Research Grant Scheme (RDU233410).

## FUNDING STATEMENT

This study was funded by Universiti Malaysia Pahang Al-Sultan Abdullah.

## AUTHORS CONTRIBUTION

Each author was involved and contributed equally to this manuscript. All authors read and approved the final manuscript.

## AVAILABILITY OF DATA AND MATERIALS

The data of this study are available on request from the corresponding author.

## ETHICS STATEMENT

Not applicable.

## CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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