



A Temporal Evolution of Human Resource Management and Technology Research: A Retrospective Bibliometric Analysis

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Abstract

Purpose

Research on human resource management (HRM) and technology has gained momentum recently. This review aims to create a bibliographic profile of the field of HRM and technology using bibliometric techniques, complemented by qualitative analysis, examining 239 articles published in the four key Human Resource (HR) journals.

Design/methodology/approach

First, using Vosviewer software, we analyzed the research productivity by identifying authors, journals, and influential articles, followed by insights on research themes and their evolution. Next, integrating bibliometric and qualitative approaches, we conducted a hybrid inquiry of the field to analyze current theories, methods, and variables.

Findings

The bibliometric analysis highlighted the intellectual structure, key themes, and distinctive developments categorised under four temporal phases that have shaped research in this field. In addition, qualitative analysis present significant theoretical perspectives, the methods employed, and nomological framework of variables.

Originality/value

Our study advances the extant literature on HRM and technology by quantifying the leading bibliometric performance indicators complemented by qualitative evaluation of the field, which entails exploring the possible research strands and related trends that have emerged in the past two decades.

Keywords

Bibliometric, HRM, Technology, AI, Big Data, Digital, e-HRM

Paper Type

Literature Review

Introduction

Technological progress in human resource management (HRM) has proliferated, leading to important insights for HR scholars and practitioners (Bondarouk and Brewster, 2016; Kim *et al.*, 2021), including recent developments in the design and implementation of artificial intelligence-enabled applications for automating and augmenting the function of HRM and

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3 improving business and employee outcomes (Malik *et al.*, 2023 a,b; Prikshat *et al.*, 2023 (a);
4 Prikshat *et al.*, 2023(b)). More recently, scholars have presented a collection of perspectives
5 and research directions impacting HRM in the age of ChatGPT and generative AI models
6 (Budhwar *et al.*, 2023). In this study, we refer to HRM and technology as a field to study the
7 intersection of HRM as systems/bundles of different HR practices (Cappelli and Neumark,
8 2001; Paauwe and Boselie, 2005) and technology as information technology artifacts¹, bundles
9 of material and cultural properties packaged in some socially-recognizable form such as
10 hardware and/or software (Orlikowski and Iacono, 2001). The research on HRM and
11 technology spans early adoption of electronic data processing (EDP) for effective and efficient
12 personnel data management through managing human resource information systems to using
13 e-HRM and internet-based services (Marler and Parry, 2016; Strohmeier, 2007). Following
14 developments in the use of the Internet, HR analytics, mobile, virtual platforms, and advanced
15 technologies, such as big data, cloud computing, artificial intelligence (AI), robotics, and the
16 Internet of Things (IoT), these developments gradually shaped the landscape of HRM and
17 technology research (Budhwar *et al.*, 2022; Dulebohn and Hoch, 2017; Malik *et al.*, 2022(a),
18 Malik *et al.*, 2022(b); Strohmeier, 2020; Vrontis *et al.*, 2021).

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31 Since the pace of development of technological artifacts is rapid, the literature on HRM
32 and technology is following suit (Kim *et al.*, 2021). Many scholars have contributed to the
33 literature through thematic reviews on different aspects of HRM and technology. These
34 thematic review articles have primarily sought to understand the knowledge base of HRM and
35 technology in five key areas: a review of technology in HRM (Kim *et al.*, 2021); specific
36 technological artifacts in HRM (Vrontis *et al.*, 2021); technology in specific HRM practices or
37 systems (Mainga *et al.*, 2009); specific technological artifacts in specific HRM practices or
38 systems (London and Hall, 2011), and lastly the evolution of new terms in a combination of
39 HRM and technology (Strohmeier, 2007). In addition, a few latest articles have also explored
40 the epistemological and ontological perspectives of HR analytics (Ellmer and Reichel, 2021a;
41 Greasley and Thomas, 2020). Given the diversity, significance and quantity of the research on
42 HRM and technology (Malik, Nguyen & Budhwar, 2022; Nguyen & Malik, 2022(a); Nguyen
43 & Malik, 2022(b)), we feel it's noteworthy to explore the intellectual structure (García-Lillo *et*
44 *al.*, 2017) and various attributes on which it is supported through a comprehensive hybrid
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¹ Those bundles of material and cultural properties packaged in some socially-recognizable form such as hardware and/or software (Orlikowski, W. J., & Iacono, C. S. (2001). Research commentary: Desperately seeking the "IT" in IT research—A call to theorizing the IT artifact. *Information systems research*, 12(2), 121-134)

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3 literature review by complementing bibliometric analysis with qualitative analysis and
4 developing a nomological framework.
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6 The study examines the literature published at the intersection of HRM and technology in
7 four major HRM journals: *The International Journal of Human Resource Management*
8 (*IJHRM*), *Human Resource Management (HRM)*, *Human Resource Management Review*
9 (*HRMR*), and *Human Resource Management Journal (HRMJ)*. We selected these four journals
10 for our study due to their high impact factors and for being listed as the leading journals in
11 HRM in the WOS and EBSCO databases. With the help of bibliometric techniques such as
12 citation analysis, co-citation analysis, co-occurrence, and bibliographic coupling, analyzing
13 and evaluating the network of relevant articles and scholars, we identify the factors that have
14 shaped the existing foundation of HRM and technology over the last two decades. Unlike other
15 review articles in this field, we adopt the bibliometric technique adding an objectivity measure
16 (Garfield, 1979). To complement our bibliometric study, we qualitatively evaluate the corpus
17 to develop an integrated nomological framework for advancing research in HRM and
18 technology field. Therefore, our motivation for conducting this study is to analyze the
19 considerable number of articles from an objective and inclusive standpoint, taking into account
20 its history, current state, and future directions, thus helping to unify fragmented insights onto
21 a single platform.
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23 Notable quantitative, systematic, and objective techniques of literature reviews on topics,
24 such as a bibliometric profile of journals (Donthu *et al.*, 2020); bibliographic analysis of
25 specific management topics (Danvila-del-Valle *et al.*, 2019); and the intellectual structure in
26 the scientific domain of management (García-Lillo *et al.*, 2017), also replicable in future
27 reviews, have been published in several top journals. For this study, we employed a
28 bibliometric analysis approach using VOSviewer, a computer program developed by scholars
29 at Leiden University, Netherlands (Van Eck and Waltman, 2010), complemented by qualitative
30 reviews of the corpus and investigated three main research categories:
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- 32 1. Productivity - The demographic patterns of output in the HRM and technology area.
- 33 2. Thematic - The important themes and its evolution in HRM and technology scholarship.
- 34 3. Variables, methods, and theories - Different technologies, HRM practices, research
35 methodologies, theories applied, and nomological framework.
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37 We developed research questions within each of the above research categories. To start with,
38 identifying the impactful sources in the evolution of a field provides an objective view to
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3 understand the key concepts by referring to the most influential work which helps to identify
4 potential gaps and undertake novel research. Therefore, for the productivity category, we
5 examine the following two research questions:

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8 *RQ1 Who are the most contributing authors, and which are the most influential articles?;* and

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10 *RQ2 Which journals have been cited the most in studying HRM and technology?*

11 Next, one of the expected constructive outcome from this literature review is to identify the
12 knowledge themes by synthesizing the existing literature, and presenting the possible research
13 topics in a laconic format. Therefore, for the thematic category, we examined the following
14 research question:

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18 *RQ3 What are the prominent themes, and how have the themes evolved?*

19 Further, identification of underexplored methodology, theoretical lens, and context would
20 provide meaningful insights and help to extend the research field in new directions. Therefore,
21 we examine the following research questions:

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25 *RQ4. What are the most widely used research methodologies adopted by scholars?;*

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27 *RQ5. Which technology(ies) are most studied in relation to HRM by scholars?;*

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29 *RQ6 What are the main theories employed by scholars in studying HRM and technology areas
30 of research?;*

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Lastly, a comprehensive nomological network of existing field contributes towards illustrative
mapping of numerous variables and phenomenon studied within a field in different contexts.
Hence, we examine the following research question:

*RQ7: What are the possible antecedents, consequences, mediators, and moderators tested by
various scholars?*

Our work makes several contributions to the field which lies at the intersection of HRM and
technology. First, our hybrid approach (Paul and Criado, 2020; Tran *et al.*, 2023) of
complementing bibliometric analysis with qualitative analysis covers the breadth and depth of
the field and synthesizes the literature. Therefore, we advance theory and practice through in-
depth retrospective analysis of the field and pave the path for future research directions (Lim
et al., 2022).

Second, using bibliometric technique, through performance and mapping analysis, we
contribute towards a comprehensive representation of the development and evolution of the
field (Donthu *et al.*, 2021; Donthu *et al.*, 2021(a); Mukherjee *et al.*, 2022(a); Mukherjee *et al.*,
2022(b); Mukherjee *et al.*, 2023). This approach enabled us to identify prolific authors,
influential articles, journals, latent themes, new entries, and chronological evolution of the most

discussed topics, instrumental in building the intellectual structure of a field. Such information helps in guiding aspiring researchers seeking a broader understanding of the literature's 'state of the art' (Ferreira, 2011).

Third, using text analytics augmented by qualitative analysis, we highlight the most popular research methodologies used by academics and suggest future methodologies that could improve the field's dynamics. The analysis of text data also reveals the theoretical stances and upcoming areas of interest in the field of HRM and technology. Such inquiry adds value to the existing literature by identifying potential research gaps based on past and present developments.

Last, our nomological framework provides a comprehensive landscape of variables researched at the intersection of HRM and technology. This framework provides insights for future researchers to extend the field by studying different phenomena at micro, meso, and macro levels.

The rest of the paper is organized as follows. Following the introductory section, a short account of the temporal evolution of HRM and technology, mapping critical technological events, is offered. Next, the paper discusses the methodology and software employed to conduct this review. The findings and analysis, discussion and future research directions follow this. Lastly, the concluding section includes the limitations and conclusions.

Temporal evolution of HRM and technology: An overview

In the extant literature, the evolution of technology and its simultaneous influence on HRM has been primarily due to two main technological events which played an important role in transforming HRM: the rise of personal computers (1980-1995) and the proliferation of the internet era (1995-2010) and an increase in the computing power, associated with a decline hardware costs (Johnson *et al.*, 2016; Kim *et al.*, 2021).

Before the personal computer revolution, IBM's mainframe computers dominated the landscape of computing technologies (Campbell-Kelly *et al.*, 2015; Kim *et al.*, 2021). The first phase and proliferation of computing technologies subsequently influenced the HR function to adopt electronic data processing (EDP) for effective management of personnel information of employees. Soon, the HRM function transitioned from EDP to human resource information systems (HRIS). While EDP efficiently managed employee record keeping and payroll, HRIS proved more cost-efficient and gave easy access to information. HRIS became popular due to technology in computer networks and personal computers (Johnson *et al.*, 2016). This era also experienced technological development in manufacturing, followed by a rise in the service

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3 economy (Johnson *et al.*, 2016). With further developments in networks and personal
4 computers, HRM started to move towards electronic databases, enabling the integration of HR
5 systems with business-related systems. This integration led to the development of enterprise
6 resource planning (ERP) followed by electronic HRM (e-HRM). e-HRM can be understood as
7 the planning, implementation, and application of information systems (IS) for HR systems and
8 practices for networking and supporting actors (Strohmeier, 2007).
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13 With this, the strategic value of HRM started to gain focus, stimulating interest in academic
14 and practitioner-based research. Since 2010, HR professionals have been focussing on adopting
15 cloud technologies (Brynjolfsson and McAfee, 2014) which reduces the cost of HR technology
16 without affecting its efficiency. The final wave of digitalization marks the adoption of artificial
17 intelligence (AI) technologies and developments in IoT and big data analytics among HRM
18 practitioners and research scholars (Brynjolfsson and McAfee, 2014; Tambe *et al.*, 2019).
19 Figure 1 captures this temporal evolution and its influence on HRM systems and processes.
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33 **Methodology**

34 To ensure a rigorous review procedure we followed three stages of systematic literature review
35 (SLR) protocol (Paul *et al.*, 2021). Under assembling, we evaluated our research questions,
36 journals, the source quality, search period, search keywords. In the second stage, arranging, we
37 applied exclusion and inclusion criteria for filtering articles. The third stage, assessing,
38 involved application of bibliometric techniques. The design of this study is presented in Figure
39 2. A detailed explanation of database sourcing and management, indicators, and result
40 visualization is appended in Appendix 1.
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56 **Descriptive analysis**

57 *Prolific authors*
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Information on prolific authors provides an overview of those actively contributing to the research discussion. To understand the prolific authors in this review, we ranked all authors in the sample of articles analyzed based on the total number of publications. The ranking of authors based on the total number of publications indicates that Tanya Bondarouk from the University of Twente has published the most articles on HRM and technology ($n = 7$ articles) followed by Marler J H, Dulebohn J H, Parry E, Stone D L, and Strohmeier S (see Table I in Appendix 2). In all these studies, e-HRM is a common area of interest. The investigation of e-HRM focusing on its effectiveness, acceptance, challenges, and consequences on HRM practices and systems plays a key role in contributing to this research field's knowledge building.

It's worth noting that while the author's productivity is important to understand who is actively contributing to the literature, we discuss the influential articles in the next section to complement the foundational literature that build the intellectual structure.

Influential articles

In addition to prolific authors, information on influential articles provides insight into the research area's intellectual structure. We analyzed the articles based on global and local citations to identify the influential articles contributing to the intellectual structure of HRM and technology. Global citations are the total citations based on the Web of Science core collection times cited count. Local citations represent the citations received within the review corpus (Baker *et al.*, 2021). In this review, local citations of an article are computed based on citations received from 239 articles by applying a co-citation analysis of the cited references (a minimum of 5 citations). Since the co-citation represents the collective view of several citing authors, it subdues the possible bias that may occur from an individual author's opinion (García-Lillo *et al.*, 2017).

Interestingly, in the list of global citations, the top 10 articles (see Table II in Appendix 2) are a mix of a 60:40 ratio, such that 60% of articles discuss HRM and technology as the secondary topic, and 40% are the articles with core discussion on HRM and technology. For example, the article with the most global citations was "Fostering Knowledge Sharing through People Management Practices" by Cabrera and Cabrera (2005), followed by "Strategic Human Capital Management in SMEs: An Empirical Study of Entrepreneurial Performance" authored by Hayton (2003). Both articles do not primarily focus on HRM and technology research but are still relevant. The paper by Cabrera and Cabrera (2005) focuses on technology and implication for knowledge-sharing practices, one of the domains of HR practices, whereas Hayton (2003) discusses how HR practices' dynamics are different in high-technology industries as a context.

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3 Unlike global citations, all the top 10 local citation lists discuss HRM and technology as core
4 topics (see Table III in Appendix 2). The article with the most number of local citations is
5 “Research in e-HRM: Review and implications” by Strohmeier (2007), followed by “HR and
6 analytics: why HR is set to fail the big data challenge” authored by Angrave *et al.*, (2016).
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10 The following section applies the science mapping technique to discuss the prolific journals
11 and analyze important themes emerging in this review.
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14 15 **Science mapping**

16 *Prolific Journals*

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18 Details on prolific journals provide an insightful network of interdisciplinary areas, such as
19 which discipline is more connected to the core area of research and the different perspectives
20 other journals provide to the core area and vice versa. We applied co-citation analysis of cited
21 sources to identify the prolific journals with a minimum citation filter of 5. Furthermore, co-
22 citation analysis enabled us to draw a map of journals to understand the closeness and the
23 relationship among different journals, represented as a network map in Figure 3.
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37 One important point to note is that the four journals considered in our study are also indexed
38 as the top journals in the area of HRM among the list of interdisciplinary journals realized
39 through the co-citation of cited sources, strengthening our choice of journal for this study. In
40 the next section, based on the bibliographic coupling and network map, we analyze the clusters
41 and evolution of HRM and technology research.
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47 *Thematic analysis*

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49 Thematic analysis is an effective approach to identifying important themes that have emerged,
50 been discussed, or reflect potential areas of interest that are less explored. Thematic analysis in
51 this review employs bibliographic coupling, creating clusters of articles with a thematic
52 similarity. Bibliographic coupling is a widely used tool for mapping an existing research field
53 (Donthu *et al.*, 2021). It assumes the underlying foundation of similarity between articles is the
54 shared number of literature references (Kessler, 1963). Our analysis yielded 6 clusters which
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we labelled with an appropriate research theme based on recurring terms (see Table IV in Appendix 2).

Cluster 1. Technology-aided Strategic HRM. Cluster 1 is the largest cluster, with 69 articles crediting the most citations (1687 citations) to the HRM and technology research. Major themes covered under this cluster are the strategic importance of technology in HRM, technological innovation in organizations and HR, high-technology industries, technological intensity, high-performance work systems (HPWS), and training. On average, three articles per year have been published from 2001 to 2021. Del Giudice *et al.*'s (2021) "Humanoid robot adoption and labour productivity: A perspective on ambidextrous product innovation routines" is one of the most recent articles in this cluster.

Cluster 2. Electronic Human Resource Management (e-HRM). With 30 articles, cluster 2 contributed 1169 citations to the HRM and technology research. The primary focus of this cluster is electronic human resource management, such as e-Selection, e-HR security, e-leadership, and e-IHRM. Other topics that are covered in the context of e-HRM are HR effectiveness, HR competencies and capabilities, the ethical management of e-HRM, changing role of HR, and value creation by HR using e-HRM. The cluster began to evolve in 2004, with the highest publications in 2009 and 2013. On average, one or two articles per year have been published from 2004 to 2021. The forthcoming sub-areas of interest within e-HRM are the Internet of Things (IoT) and the socio-material perspective. One of the latest articles in this cluster, Myllymaki's (2021) "Beyond the 'e-' in e-HRM: integrating a socio-material perspective," is a review paper acknowledging the equal importance of human and material agents in e-HRM practices from a socio-material perspective.

Cluster 3. Future of work and workplace. Cluster 3 is the most diverse cluster, with 36 articles crediting 1265 citations. The various technological impact on employees, work, and organization represents the central focus of this cluster. This cluster also covers work-life balance, social media, cyberbullying, technological control, employee voice, and telework. Two articles per year have been published from 2003 to 2021. The recent article titled "Mind the channel! An affordance perspective on how digital voice channels encourage or discourage employee voice" by Ellmer and Reichel (2021b) is one of the latest works under this cluster.

Cluster 4. Emerging technologies and HRM. Cluster 4 consists of 41 articles crediting a total of 486 citations. The primary focus of this cluster is on different aspects of HR analytics and advanced technologies in HR. The other important themes in this cluster include the application of algorithms in HR decision-making, artificial intelligence, big data, robots, digital labor platforms, and the gig economy's evolution due to digitalization. In the beginning years

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3 (2009-2013), the cluster focused mainly on HR analytics and decision-making, gradually
4 shifting to emerging technologies such as algorithmic applications, big data, and artificial
5 intelligence. Results show that advanced analytics methodologies started growing
6 exponentially since 2020, with 18 articles published in the following year, 2021 alone. Overall
7 the maximum output of this cluster has been experienced since 2018, with an average of 8
8 publications per year in the last three and half years. One of the latest articles is “Staying close
9 to business: the role of epistemic alignment in rendering HR analytics outputs relevant to
10 decision-makers” by Ellmer and Reichel (2021a).

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17 *Cluster 5. Technology-aided recruitment and website design.* Cluster 5 consists of 25
18 articles on different aspects of recruitment, selection, and various characteristics of recruitment
19 websites of organizations. The cluster credits 616 citations to the HRM and technology
20 research. It primarily focuses on applicant reactions to electronic selection, website design,
21 online HR branding, applicant attraction, and other factors associated with electronic
22 recruitment. The cluster gained traction in the last ten years, with an average publication of one
23 or two articles per year. A new area of research within this cluster primarily looks at the
24 gamification in recruitment and online reviews acting as word of mouth. “Effects of mixed
25 signals on employer attractiveness: A mixed-method study based on signalling and convention
26 theory” by Pernkopf *et al.* (2021) is one of the latest research work within the recruitment and
27 website design cluster.
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Cluster 6. Virtuality and HRM. Cluster 6 is the smallest cluster with 22 articles but
52 interestingly crediting the fourth-highest citations (666 citations) to the HRM and technology
53 research. The central focus of this cluster is virtual teams, virtuality, and impact on employees
54 and organizations due to changes in work. The cluster also comprises research on trust,
55 leadership, counterproductive behaviours of employees, employee satisfaction, and culture in
56 a virtual team context. The cluster began in 2004 with the highest number of publications on
57 different aspects of virtual teams in 2017. One of the latest articles is “Exploring the adoption
58 of virtual work: The role of virtual self-efficacy and virtual work climate” by Adamovic *et al.*
59 (2021).
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Overall, the technology-aided SHRM, e-HRM, virtual teams and virtuality, HR analytics,
e-recruitment, and the impact of technology on the workforce and workplace are the most
sought-after topics in HRM and technology research, followed by the recent focus on new
technologies such as robotics, artificial intelligence, and big data. The next section looks into
the chronological evolution of research terms in HRM and technology.

Chronological analysis of key terms

A chronological analysis was completed by undertaking a co-occurrence analysis of author keywords. Author keywords are a significant indication of research development in an area because they represent the main concepts that authors aim to convey to the scientific community and other readers. These keywords are specific to the field or sub-field representing the manuscript's content and capture the core concepts being discussed or new concepts being introduced. We applied the time-slicing method and ran multiple iterations of co-occurrence analysis with different sets of years. Based on the final outcomes, we mutually agreed to divide the review period into four phases of 5 years each for overlay visualization as this provided a meaningful and insightful representation of the conceptual evolution. Only the last phase, phase IV consists of data beyond five years since we included articles published from January to May 2021.

Insert – Figure 4 about here

Analyzing the author keywords in four phases of 5 years each gives a nuanced understanding of how HRM and technology evolved. This helped us underscore topics that were in the initial years discussed in silos but gradually started to get attention in relation to other topics, creating a more extensive and interconnected web of a network—figure 4 exhibits how literature production in these four journals progressed through four phases.

Insert Figure 5 about here

Phase I (2001-2005). One of the first insights from the network map is that the conversation on HRM and technology was fragmented during this phase (Figure 5). At the start of 2001, HRM and technology discussions were on diverse topics such as culture, behaviours, global economy, labour market, innovation, leadership, employee behaviour, nature of work, automation, strategic competency, and techno-economic paradigm. In 2003, topics such as human resource practices, global HR systems, workforce management applications, and organizational change entered the conversation. Finally, the beginning of 2005 witnessed

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3 studies on technology-assisted supplements, work design, virtual work, virtual teams,
4 globalization, technological change, the Internet, e-learning, the global economy, information
5 technology, and knowledge management. An interesting point to note here is that these
6 concepts were not discussed in conjunction despite the emergence of technology-related
7 artifacts like virtual technologies, the Internet, or e-learning. Further, the theories and
8 perspectives, such as the resource-based view (Lee *et al.*, 2005), social capital theory, social
9 dilemma theory (Cabrera and Cabrera, 2005), and techno-economic paradigm (Hsieh and
10 Tseng, 2002), were explored in the context of people management practices, knowledge
11 management, knowledge sharing, HRM, and social risk. Thus, in Phase I, the emphasis was
12 more on the importance of a macro- and organizational-level understanding of technology in
13 the HRM context.
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30 *Phase II (2006-2010)*. Between 2006-2010, topics such as innovation, information
31 technology, high-performance work practices, strategic HRM, high-technology work and
32 entrepreneurship dominated the discussion. New areas of interest that entered the HRM and
33 technology field were strategic international HRM, global virtual teams, self-managed work
34 teams, the meaning of work, changing workplace, non-standard employment, legal issues, e-
35 HRM, work-life balance, overtime, stress, and technical obsolescence. From a theoretical
36 standpoint, different theories were employed by scholars to study HRM and technology, such
37 as dynamic capability (Khatri *et al.*, 2010), signalling theory (Goldberg and Allen, 2008) and
38 neo-contingency theory (Ramirez and Fornerino, 2007). As represented in Figure 6, though
39 research work was still fragmented, more networks started to form among different topics
40 compared to phase I. The year 2009 saw a rich publication of e-HRM, leading to research on
41 web-based HRM, recruitment, knowledge management, cyber deviance, computer misuse, and
42 cyber aggression in 2010. Phase II saw a broader application of technologies to operational and
43 strategic workplace processes.
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5 *Phase III (2011-2015)*. During 2011-2015, discussion on e-HRM and recruitment gained
6 prominence as topics of research, and researchers started connecting e-HRM with other issues
7 such as organizational trust, employee surveillance, ethics, job satisfaction, workforce
8 demographics, diversity, knowledge economy, SHRM, employee relationship, social-media,
9 and innovation. In addition, the research methods employed started depicting greater variety,
10 such as discourse analysis and mixed methods research was adopted to study the relationship
11 of HRM and technology during this period. Theoretically, scholars used agency theory (Dineen
12 and Williamson, 2012), technology acceptance model (Chu and Chu, 2011), and
13 transtheoretical model of change in their study (Brown and Charlier, 2013). Phase III represents
14 a network map with better-connected topics than previous phases I and II (Figure 7). In this
15 phase, there was an extensive focus on micro-level social and relational aspects of work and
16 employment.
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32 *Phase IV (2016-2021)*. During 2016-2021, the research literature appeared to be more
33 connected, and new technologies and concepts, such as artificial intelligence (AI),
34 gamification, algorithmic management, robotics, cyberloafing, and cyber vetting, were
35 researched (Figure 8). In this last period, we found the context evolving from focusing on
36 organizational performance to focusing on the gig economy worker, employee experience, and
37 employee voice. This phase marks the emergence of different perspectives and theories and the
38 integration and use of a combination of new technologies.
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44 From the chronological perspective, it is evident that technology in the HRM context was
45 studied at a macro and firm level in early 2000s. Gradually, the focus is shifting to narrower
46 technological artifacts such as e-HRM, HR analytics, information technology, big data, and
47 artificial intelligence. An interesting point to note is that few topics were discussed in
48 conjunction with others, which helped develop the research network. These conjunctions are
49 called intellectual turns, which play an important role in connecting one topic with other topics
50 in the same or another discipline. Since intellectual turns are out of this review's scope, we see
51 this as an interesting area for future research. The following section discusses the research
52 methodologies, diverse theories and perspectives, technology focus, and framework using text
53 analytics and content analysis on our review corpus.
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Text analytics

In addition to a manual content analysis of the articles, we also applied automated text data analysis on the article's abstract and title of the articles included in our review corpus using VOSviewer. While term co-occurrence provides the frequency of occurrences of a term using natural language processing algorithms, manual content analysis is helpful for categorizing terms, such as research methods, technology terms, theories or perspectives, and variables. This analysis addressed the last set of research questions in our review.

Research methods

An overview of research methods adopted for studying a field of research highlights the preference towards a particular methodology and reflects the state of maturity of a sub-field. For example, emerging topics lend themselves more to qualitative and exploratory designs, often including reviews to support theory-building, as against theory-testing, which is more suited for established areas of inquiry. Figure 9 depicts the approximate percentage of studies representing preferable methods scholars adopted to conduct their survey in the HRM and technology area.

Our analysis shows scholars' inclination is more towards a quantitative methodology within the empirical category. A few quantitative studies adopted for researching this field involved descriptive statistics, different types of regression analysis, structural equation modeling, meta-analysis, and quasi-experiment. In addition, various choices were evident within the qualitative research design, such as case studies, semi-structured interviews, ethnography, critical discourse analysis, archival data, observation, comparative analysis, and Delphi study.

Insert – Figure 9 about here

Details on the theoretical paper type highlight methodologies such as review and conceptual approaches being adopted by scholars. Another category of studies is the mixed-method approach which only accounts for 7% of the total research in the corpus.

This analysis of methodologies suggests that the quantitative approach is dominant so far in HRM and technology. Nevertheless, independent of researchers' motivations, we note that this calls for greater attention from scholars to engage with the conceptual development of HRM

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3 and technology. Similarly, given the rapid pace of breakthrough technological developments
4 embraced by organizations and in the field of HRM, it is suggested that scholars conduct
5 extensive research using an array of qualitative designs to create a deeper understanding of the
6 phenomenon at the intersections of technology and work, worker, workplace and society. This
7 will help generate new conceptual and theoretical explanations, leading to a better
8 understanding of the relationship between HRM and technology in a social and economic
9 context, thus enriching the field for future research.
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16 *Technological artifacts*

17 Analysis of technology and its related terms (technological artifacts) used in studying
18 technology in HRM can present insights into the most used technological terms or future areas
19 of interest. Figure 10 represents an approximate percentage calculation. It is worth noting that
20 the most popular technological artifacts besides technology and information technology are e-
21 HRM, virtual, HR analytics, Internet, online, information and communication technologies,
22 and digital. The new areas of interest in HRM and technology are - tracking and surveillance,
23 gamification, artificial intelligence, algorithmic HRM, big data, robots, cyber, social media,
24 the Internet of Things, and machine learning.
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40 *Different theoretical lenses, models, frameworks, and perspectives*

41 Numerous theories have been used to research and explain the linkages between HRM and
42 technology. We investigated the articles in our review corpus and found that approximately
43 167 theories, models, frameworks, and perspectives have either been tested, applied, or
44 discussed. Interestingly, the resource-based view is the most prominent theoretical lens for
45 studying HRM and technology. In contrast, the Technology Adoption Model (TAM) was the
46 most preferred for studying technology adoption by HRM in terms of frameworks and models
47 (see Table V in Appendix 2). Our analysis highlights theoretical diversity and multidisciplinary
48 perspectives enquiring about the interface of HRM and technology, indicating the growing
49 interest of scholars in studying this area from different perspectives.
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Nomological framework

To understand the various antecedents, outcomes, mediators and moderators discussed by scholars about HRM and technology, we broadly looked into and analyzed the empirical papers in our corpus. Figure 11 represents a framework of variables impacting HRM and technology phenomena. The antecedents are categorized into micro, meso, and macro factors complemented by demographics and other variables. The micro factors are related to the individual level, the meso at an organizational level, and the macro-level factors refer to external to the organization. Please refer to Table VI in Appendix 2 for an overview of the antecedents and their established relationships with HRM and technology phenomenon.

Insert – Figure 11 about here

The interesting point is that most studies focus on virtual HR, eHRM, new ways of work, social media and the dark side of technology in relation to HRM. This emphasizes the need for research studies in analytics and advanced technology in relation to HRM to identify potential antecedents and outcomes. Another observation is the prominence of recruitment and selection as the most studied sub-function of HRM. While our observations in this section are limited to *what scholars have tested as possible variables to understand different HRM and technology phenomena*, our overall analysis reflects a shift in HRM and technology research from broad to more nuanced and context-specific topics.

Discussion and future research

Our bibliometric analysis of the two decades of work on HRM and technology published in the top four HRM journals yielded exciting insights into its intellectual structure and evolution. In this study, we investigated seven research questions under three main categories. First, we analyzed the prolific authors, journals, and influential articles, which led us to understand the research productivity and intellectual structure. Second, we identified the thematic evolution through author keywords. Third, we looked into the study approaches of scholars in terms of research methodology, context (technological artifacts, HRM practice, process or system), the different theories or models adopted by scholars, and the framework. Our review reflects a growing network of ideas, interdisciplinary sources, and scholars' increasing interest in

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3 exploring HRM and technology research from different contexts and perspectives. Therefore,
4 the discussion below mainly presents six key takeaways from our analysis.
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6 First, our study reflects shifts in HRM and technology from the macro to the micro level of
7 analysis. The initial focus of researching technology impacting the HRM system and nature of
8 work progressed towards studying specific technological artifacts (e.g., artificial intelligence,
9 robotics, big data) related to a particular HRM system (e.g., performance management,
10 recruitment and selection, learning and development). Further, the author keywords analysis
11 indicated that research topics in HRM and technology evolved towards being more nuanced
12 and contextual along with rapid technological advancements. From 2001 to 2010, we observed
13 the dominance of strategic HRM with technology aiding in replacing the routine transactional
14 tasks of HR with strategic business partner roles, and by the beginning of 2009, the focus
15 shifted towards studying e-HRM.
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24 Second, we noticed similar stages of studying a technological artifact concerning HRM. For
25 example, the Internet was studied in relation to the changing nature of work and recruitment
26 assessment methods in the early 2000s and other HRM practices, such as online training. In
27 the following years, the formation of new technological labels from the use and application of
28 the Internet, such as e-lancing, cyberloafing, e-HRM, and Internet of Things (IoT), became the
29 research focus of scholars in conjunction with HRM research in different contexts (e.g.
30 industry, user profile). A similar trend was also observed in analytics, digital and other
31 advanced technologies. This emphasizes commonality in stages of different technological
32 artifacts but with distinct nuances. Future directions indicate the need for detailed research on
33 steps involved in studying different technologies about HRM that can be represented in a life
34 cycle form. Also, exploring what makes one technology different from the other can be an
35 exciting topic.
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44 Third, in continuation to previous insight, we observed the application of types of research
45 methodology, indicating evidence of more quantitative studies being conducted compared to
46 qualitative and other theory-building approaches. Also, review articles accounted for the
47 second most preferred research mode for studying HRM and technology. We emphasize the
48 need for a qualitative, conceptual, and mixed method approach to studying HRM and
49 technology are potential areas of future research.
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54 Fourth, from a theory and models/frameworks perspective, finding an interdisciplinary
55 interest in scholars was interesting. For example, the theory of planned behavior, and
56 organizational behavior (OB) theories, provided insights into the adoption behaviors of
57 technology users. Information systems theories, such as the adaptive structuration theory, led
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3 to identifying e-HRM impact on HRM services using moderation/mediation analysis
4 (Bondarouk *et al.*, 2017). Therefore, employing an interdisciplinary and multi-level approach
5 is the right time to develop a nomological network for identifying the antecedents and outcomes
6 of technological impact on the individual, HR function, and its proximal and distal outcomes
7 at an organizational, institutional and individual level. We also suggest using structuration
8 theory's (Giddens, 1984) lens to understand the production and reproduction of structure when
9 using technology in HRM processes and systems.

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15 Fifth, our framework reveals a scope of studying possible antecedents, mediators, and
16 moderators that may explain the underlying mechanism of “effective HRM and technology
17 implementation in organizations”. Using structuration theory, researchers may identify
18 unintended consequences of implementation and unacknowledged conditions impacting the
19 intended consequences.

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24 Continuing with previous insights, based on our review and observations, we propose
25 potential research directions framed as questions for scholars to advance the field of HRM and
26 technology, classified into four domains associated to our thematic analysis (see table VII in
27 Appendix 2). The first domain, emerging from our cluster 1 and 4, highlights the importance
28 of studying change management and transformational HRM aided by technology (Varma *et al.*,
29 2022). Adoption of advanced technologies such as AI, chatbots, and robots as an integral
30 resources at workplace calls for research on dynamics between people and machine. An
31 interesting study by Makarius *et al.* (2020) on AI adoption underscores cognitive, relational,
32 and structural implications of AI and employees. Socialization of two types of workforce, one
33 with emotional intelligence and other devoid of emotions, challenges the established HR
34 function and its norms. Few of the latest studies (Islam, 2023; Azam, 2023), supports our
35 findings to steer the focus on role of HRM during digital transformations. The second domain,
36 a combination of cluster 2 and 3, emphasis the need of bringing the soft aspect of HRM such
37 as emotional intelligence and well being (Saha *et al.*, 2023). The second domain also includes
38 the importance of understanding the dark side of digitalization (Bamel *et al.*, 2022) as future of
39 work, workers, and workplaces transforms (Lim, 2023). The third domain, appends to the
40 findings of cluster 5, highlighting the future need to study technology concerning other sub-
41 functions of HRM, such as learning and development, performance management, employee
42 engagement, talent management including reskilling and upskilling employee (Khor and Tan,
43 2023; Kumar, 2023; Malik *et al.*, 2021), rewards, and career planning of employees. Lastly,
44 the fourth domain emerging from studies in cluster 6 calls attention to the growing interest of
45 scholars in studying hybrid and virtual work environments. Studies on phenomenon such as
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3 socialization in a virtual work environment (Cimperman, 2023), engaging and learning
4 company culture while working remote are some of the interesting avenues to explore. Overall,
5 new emerging technologies in association with HRM practices and processes hold the potential
6 to be studied as a future area of research.
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11 **Limitations and conclusion**

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13 From a limitations point of view, our study includes only the top four HR journals. However,
14 our analysis suggests that the initial research and many prolific articles are published in
15 interdisciplinary journals and referred to in current conversations. Therefore, including articles
16 from other disciplines will provide a cross-disciplinary perspective offering different possible
17 trends in future research. As our research was limited to 20 years and has considered only four
18 journals, we may have missed certain influential papers, and we acknowledge this as our
19 limitation. However, given the hybrid approach, we created this boundary to undertake a
20 comprehensive qualitative analysis to unearth the details of research methodologies, theories,
21 and variables at micro, meso, and macro levels that fall at the intersection of HRM and
22 technology. Further, we understand that the recent trends in technology indicate a surge in
23 generative AI (Budhwar *et al.*, 2023) and AI-augmented HRM (Priksat *et al.*, 2023(b)) having
24 a phenomenal impact on HRM. Given the scope of this study, which is limited to papers until
25 May 2021, we are unable to include these in the current analyses. However, we see this as a
26 significant shift, and hence, based on our preliminary analysis, we have included this in Figure
27 4 to reflect the tentative impact of these technological shifts on the HRM field. We strongly
28 recommend that future research at the intersection of HRM and technology takes this trend into
29 account.
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43 Through this research, we analyzed an evolving and stimulating HRM and technology
44 research area. Analysis of the 239 articles published between 2001 and 2021 in 4 top journals
45 of HRM suggests there have been four phases in research on this topic: a technology-assisted
46 HRM and nature of work phase (covering the years from 2001 to 2005), the introduction of
47 various technological artifacts and increased focus on e-HRM phase (between 2006 and 2010),
48 a phase of the integrative study and different perspectives (from 2011-2015), and the most
49 recent phase from 2016-2021 is the study of HR analytics and new advanced technologies with
50 continued effort to integrate the scattered knowledge and take more contextual approach.
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56 We observed that the most prolific authors approached one technological artifact from
57 different perspectives, contexts, and research methods. For example, while Bondarouk and
58 Parry have their primary interest in e-HRM, Dulebohn and Marler study diverse topics such as
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3 virtual teams, HR analytics, algorithmic HRM, and digital technology. The work of Strohmeier
4 includes review articles and an interesting perspective on adopting research methods such as
5 the Delphi study on the Internet of Things (IoT).
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8 The intellectual structure portrays a gradual shift of research on HRM and technology from
9 a general perspective to an exploratory and critical perspective. Starting from a discussion on
10 technology, in general, and creating an impact on organizational performance, the research
11 arena has now begun investigating specific technological artifacts in particular contexts, such
12 as international HRM, gig economy, and specific HR functions such as recruitment and
13 selection, learning and development, and employee voice. Though most studies have been
14 conducted using quantitative techniques and review approaches, a comprehensive approach
15 with qualitative, conceptual, and mixed-methods can bring interesting insights worth
16 exploring.
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19 In conclusion, our study's bibliometric analysis affirms that the HRM and technology
20 research field is flourishing. While few technological artifacts, such as e-HRM and HR
21 analytics, have been studied extensively and can be considered as approaching the maturation
22 stage, the proliferation of advanced technologies calls for the next level of advancement and
23 integration in research linking HRM and technology.
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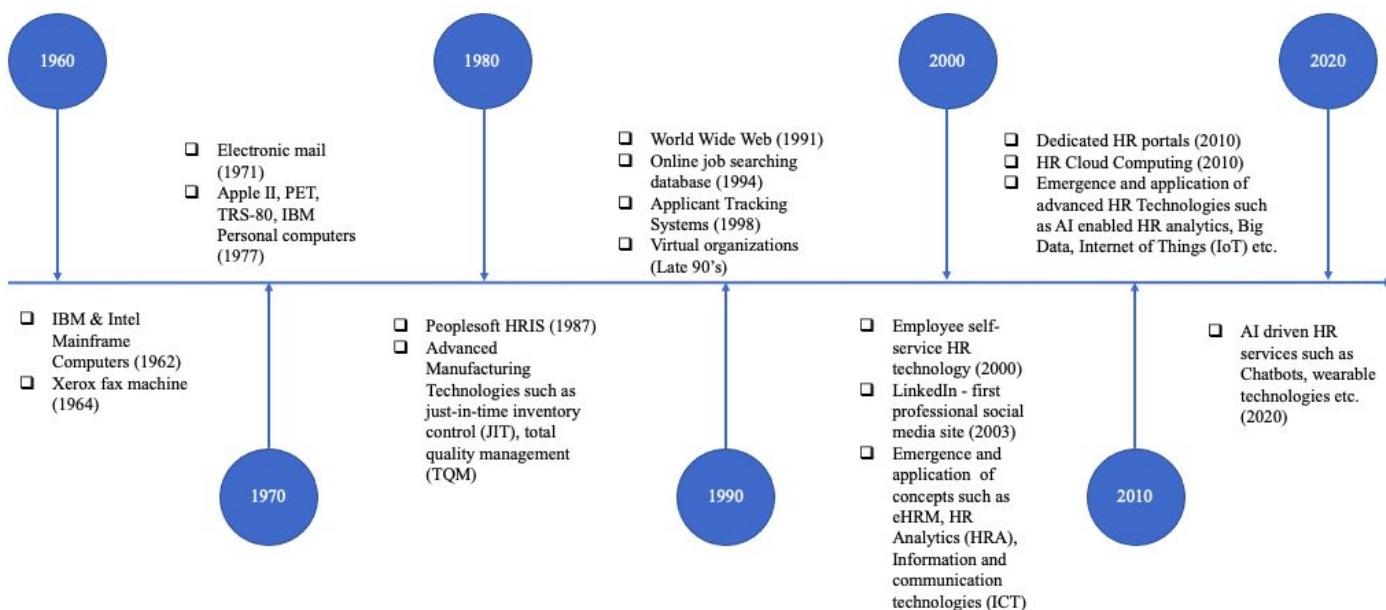


Figure 1. Temporal evolution of HRM and technology

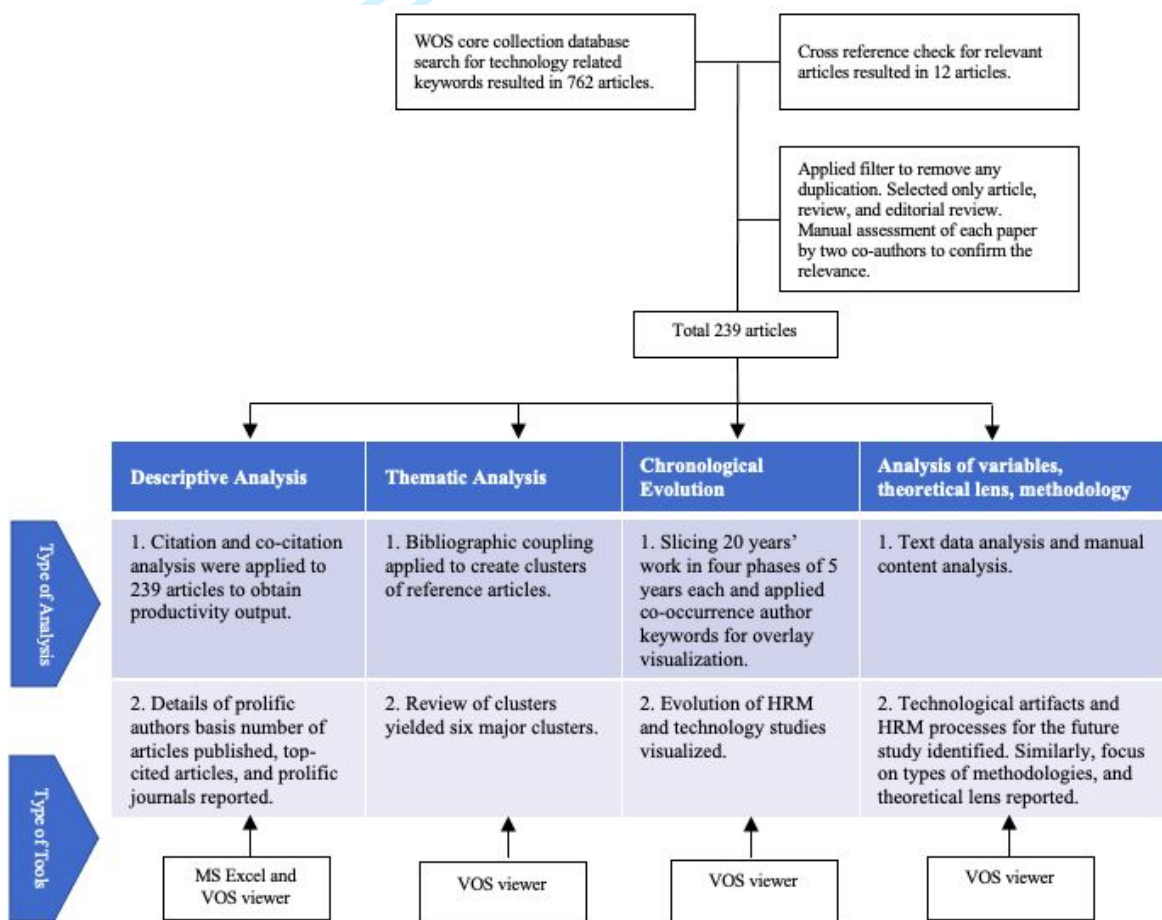


Figure 2. Stages of Research Design and Outcome

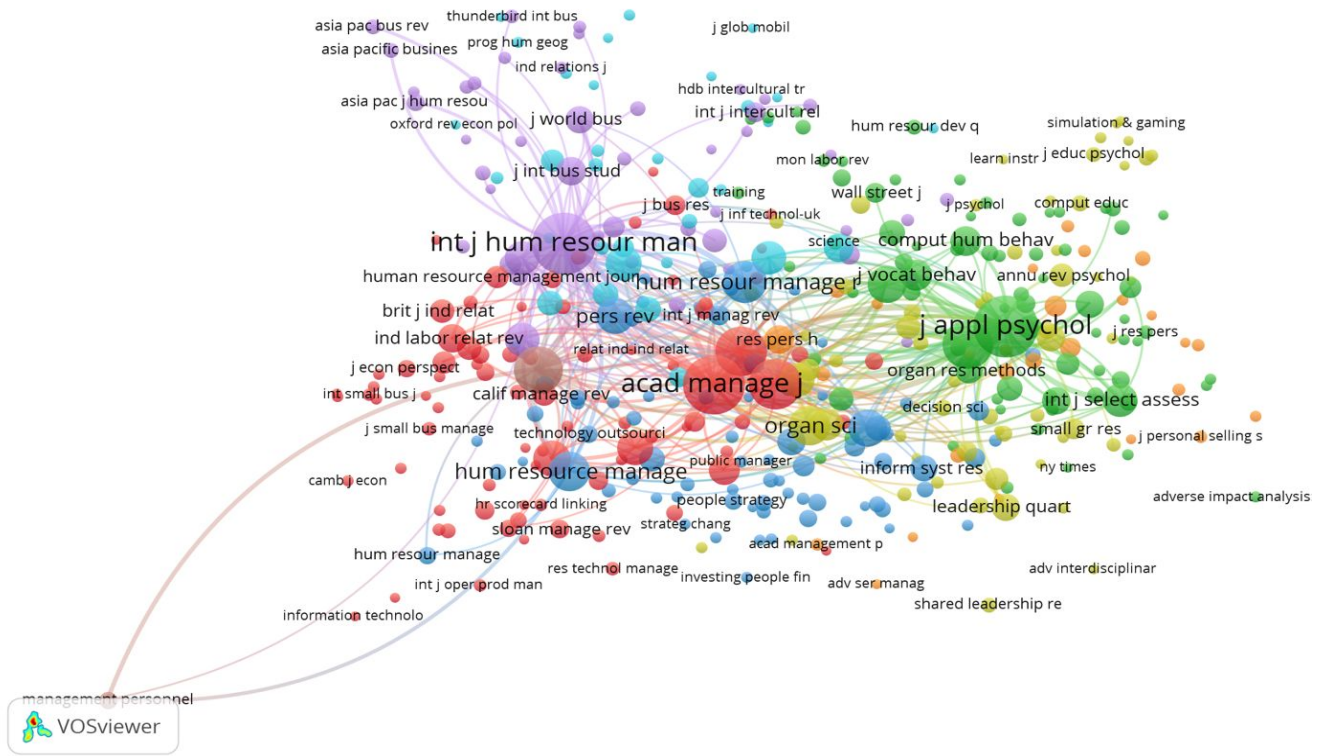


Figure 3. Co-citation map of cited sources in HRM and technology between 2001-2021 (minimum citation 5). Note. This figure illustrates a network map of interdisciplinary journals.

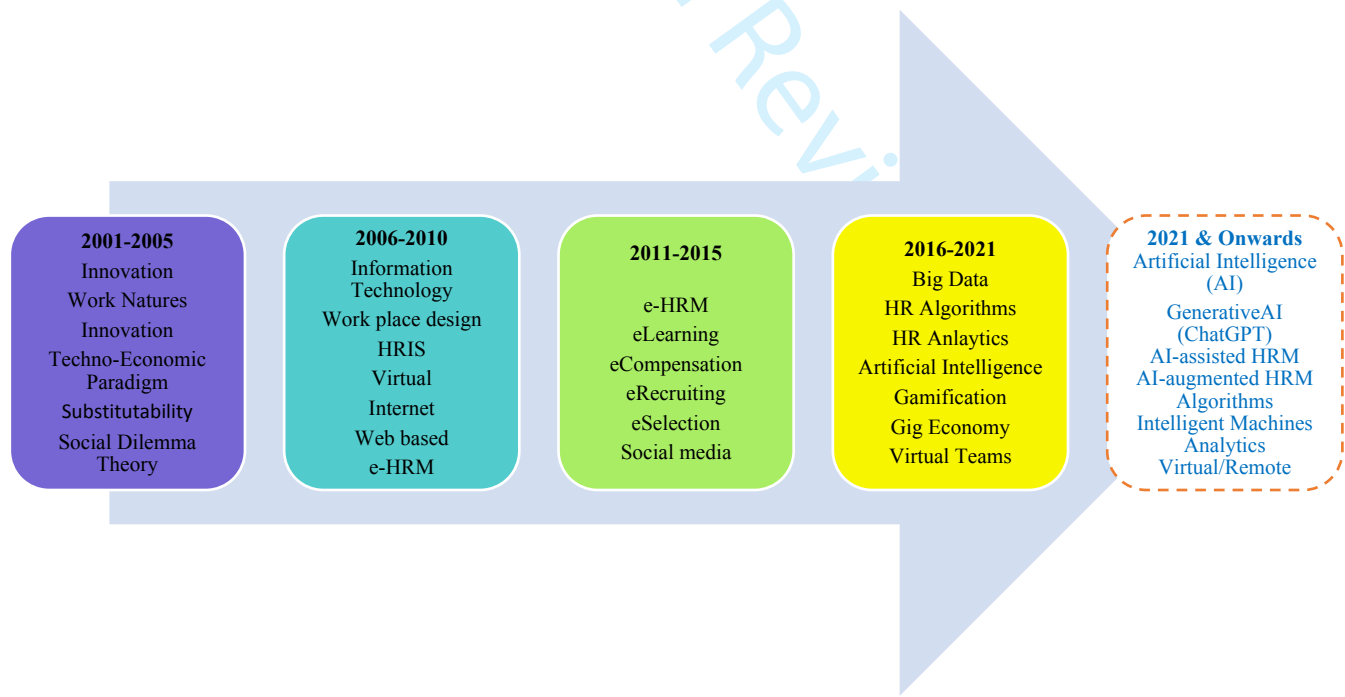


Figure 4. Time Slicing through 4 phases of articles in HRM and technology between 2001-2021. Note. Important keywords were identified through a network map using co-occurrence author keywords analysis in VOSviewer. The dotted box represents recent dominant areas of research in HRM and technology as reflected in our preliminary analysis of the period from May 2021 to February 2024 which did not get covered in our original scoping of the paper.

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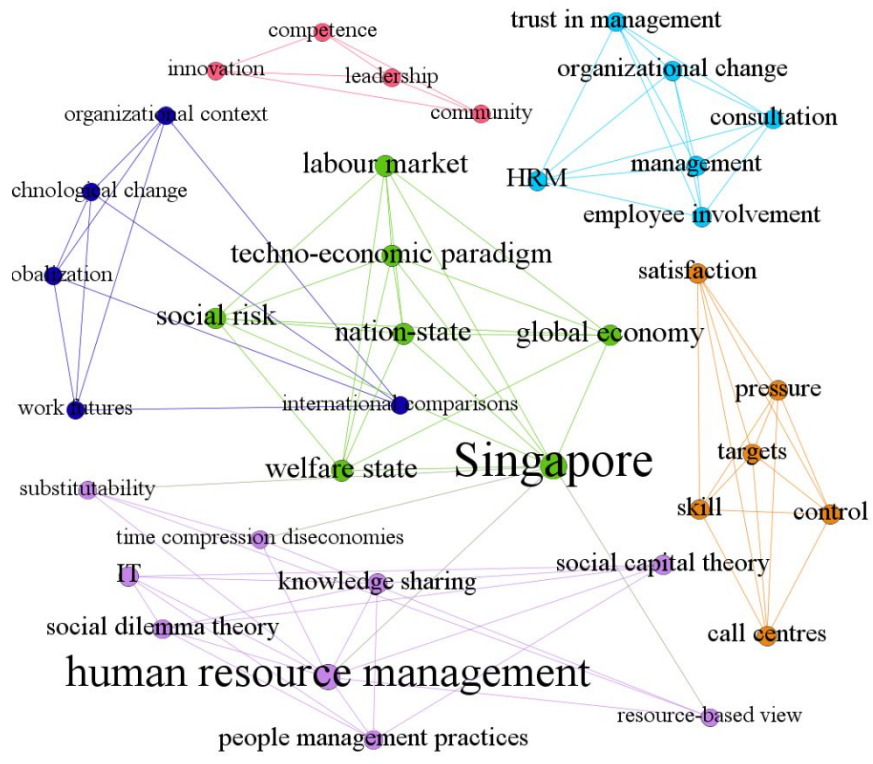


Figure 5. Co-occurrence map of author keywords - Phase I (2001-2005).

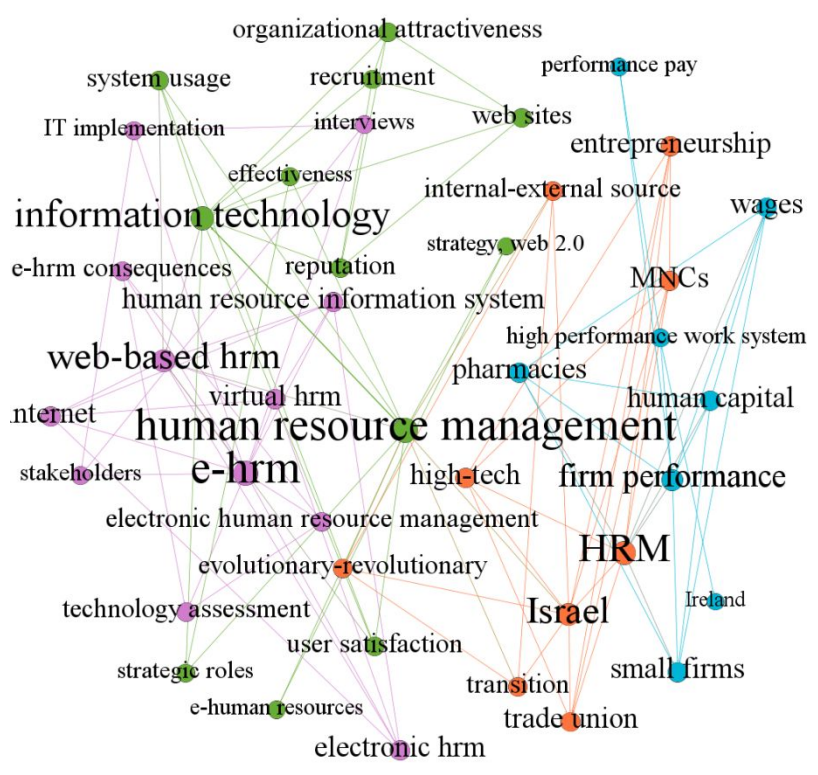


Figure 6. Co-occurrence map of author keywords - Phase II (2006-2010).



Figure 7. Co-occurrence map of author keywords - Phase III (2011-2015).

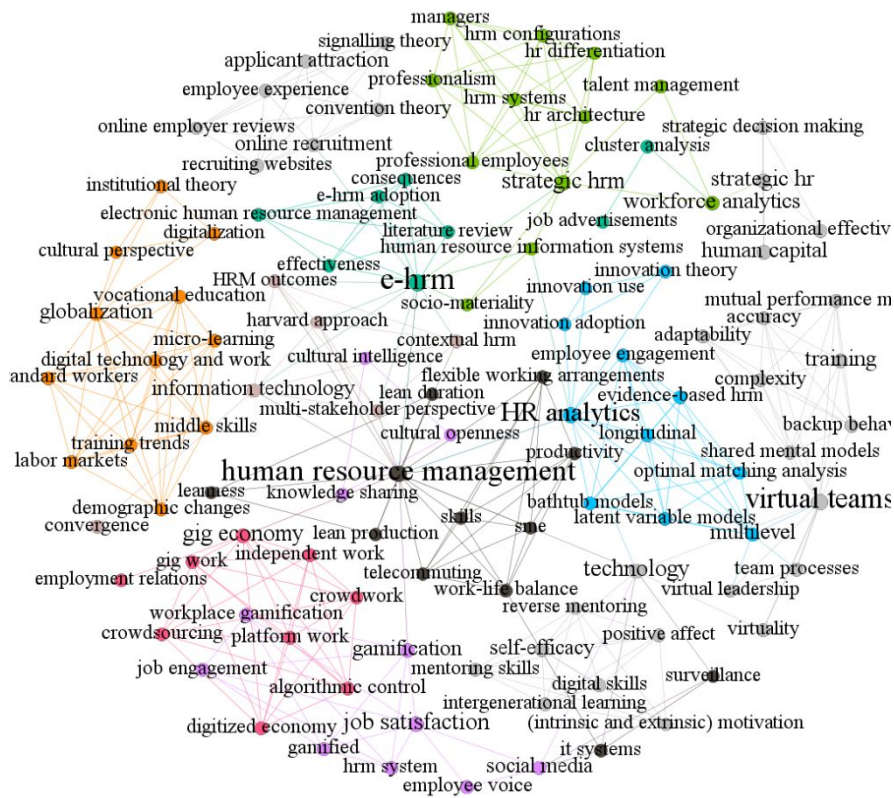


Figure 8. Co-occurrence map of author keywords - Phase IV (2016-2021)

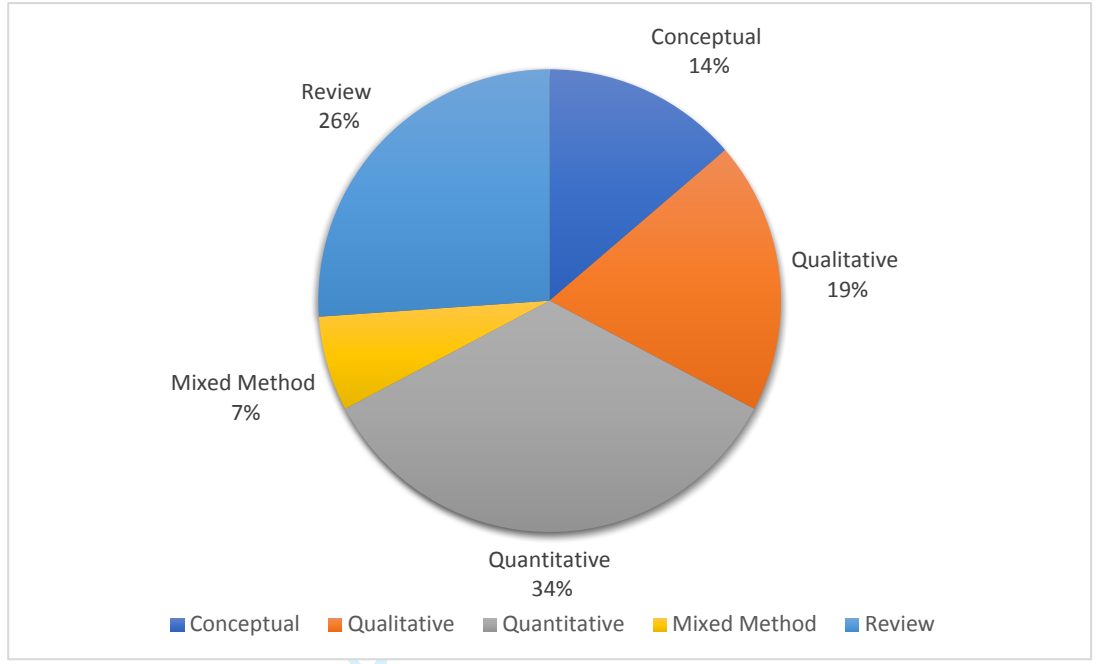


Figure 9. Approximate % distribution of methods used in HRM and technology research (2001-2021)

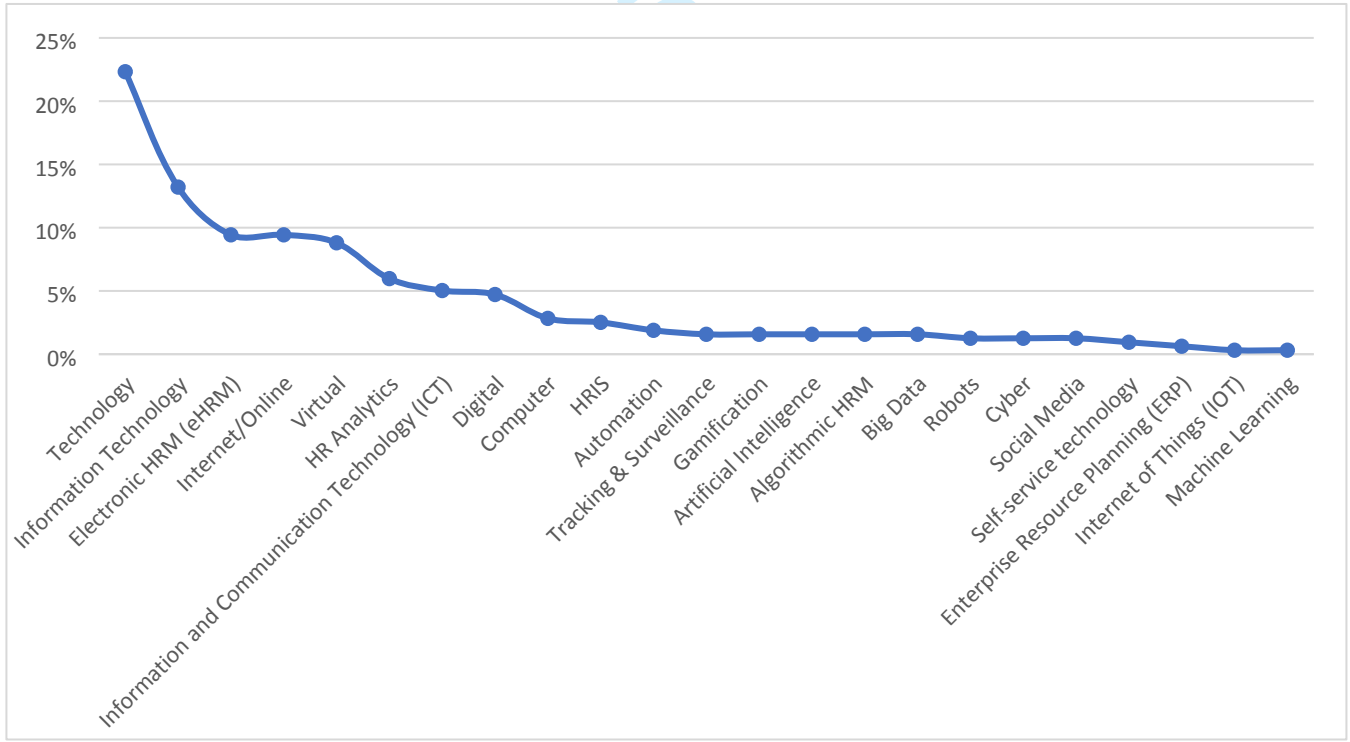


Figure 10. Approximate percentage of focus on a particular technology in relation to HRM (2001-2021)

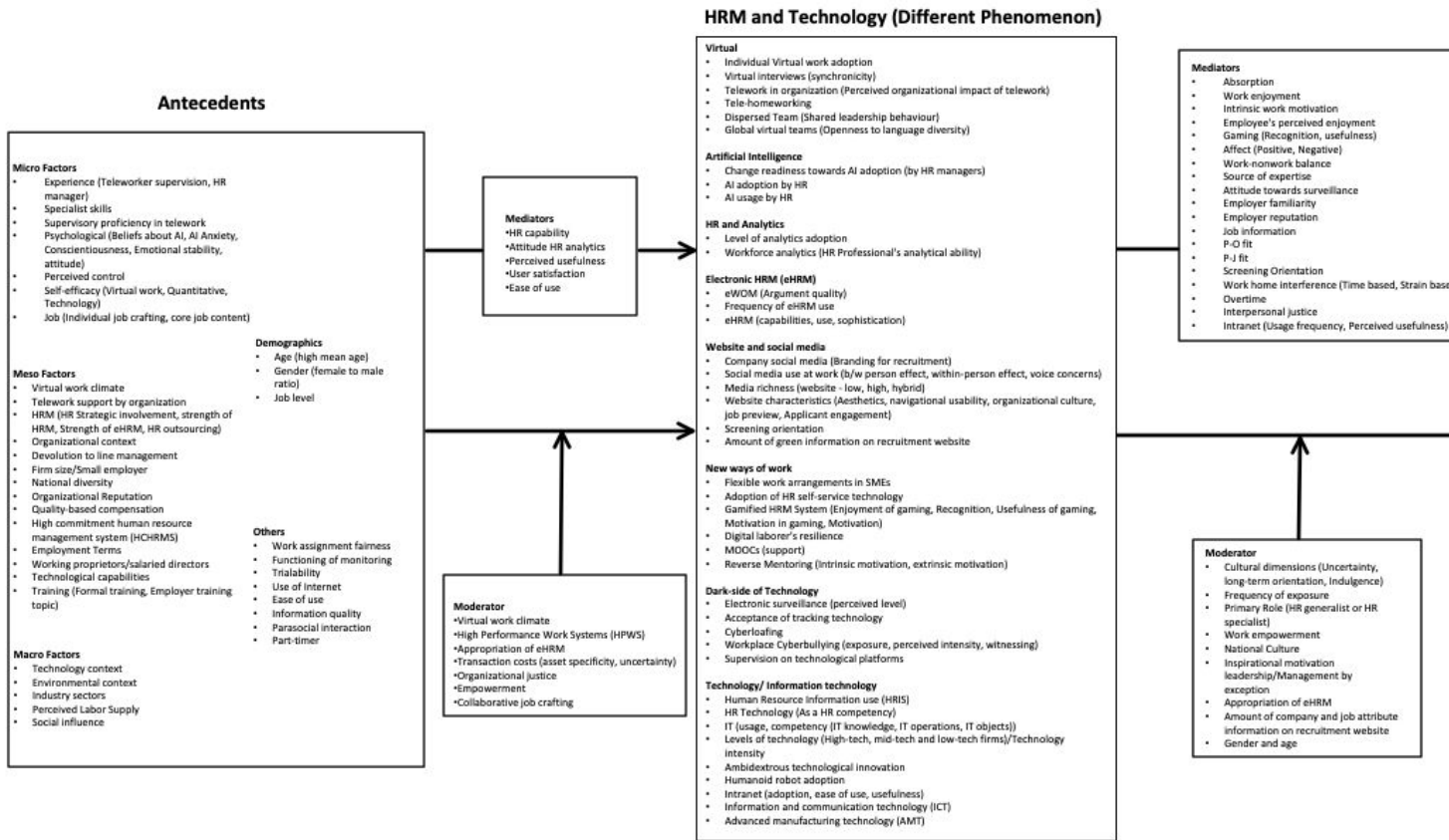


Figure 11. A framework of variables impacting HRM and technology phenomenon.

Source: All figures are the authors own creation.

Appendix 1

Database sourcing and management

First, based on the research topic, we decided on the target journals and period necessary for our study. Since we wanted to study articles on technology in the context of HRM and ensuing HRM practices or systems, we finalized the top four HR journals with high-impact factors (more than 5) that actively contributed towards our study's research topic from 01/01/2001 – 31/05/2021. After finalizing the target journals, for the selection of articles, we followed critical considerations (Kraus et al., 2022) divided in three steps of evaluation. Step one included reading articles on HRM and technology to identify concepts and terminologies used by scholars. In step two, we conducted a keyword search in the Web of Science (WOS) core collection database on the title, abstract, author keywords, and keyword plus (the algorithm of WOS that provides terms from the record's cited references or bibliography). The keywords included terms from manual reading in step one, such as techn*, "artificial intellig*", AI, cloud, digit*, analytic*, "big data", big-data, web, virtual*, electronic*, "information system*", internet, eHR*, e-HR*, autom*, computer*, metric*, online, "intelligent automation", "internet of things", IoT, machine*, robot*, intelligen*. We thus tried to incorporate the maximum possible keywords studied under HRM and technology. This search yielded a total of 762 articles. In step three, we used a filter on document type to select only articles, editorial articles, and review articles as they go through multiple revisions and are regarded as rigorous and peer-reviewed knowledge (Ramos-Rodriguez and Ruiz-Navarro, 2004). After filtration and removal of duplicates, two co-authors assessed each article to confirm the relevance of the articles concerning the topic of our study, and finally, we arrived at a final list of 227 articles through consensus. The 523 articles we didn't include for the final analysis were rejected since technology, and other related keywords were used either in methodology or as a passing term without any core or secondary contribution to the study. In addition to the WOS database search, we identified 12 articles relevant to our research through a cross-reference check and included them in our review corpus. Finally, we arrived at 239 articles for the final bibliometric analysis.

Once the dataset was cleaned, the VOSviewer software application was employed for subsequent bibliometric and final analysis. The VOSviewer application helps build, visualize relationships graphically, and perform analysis based on the underlying research networks on the topic (Van Eck and Waltman, 2010).

Indicators and results visualization

We used bibliographic data and text data as input for our bibliometric analysis. Our study used a wide range of descriptive and relational bibliometric indicators. The bibliometric analysis techniques considered were co-occurrence, citation, bibliographic coupling, and co-citation. Under each technique, based on the requirement of the research question, we selected the appropriate unit of analysis. We utilized the citation and co-citation analysis to identify prolific authors, influential articles, and journals. The principal focus of this analysis is on the total number of articles and citations, as these are important indicators of productivity and influence (Svensson, 2010). If an article is heavily cited, it is considered important. This proposition rests on the assumption that authors cite documents they consider important for their work. Co-citation is defined as the frequency with which two units are cited together (Small, 1973). A fundamental assumption of co-citation analysis is that more the two items are cited together, the more likely their content is related. We applied bibliographic coupling analysis to identify hidden themes. Bibliographic coupling uses the number of references shared by two documents to measure their similarity. The more the bibliographies of two articles overlap, the stronger their connection is (Kessler, 1963).

The chronological evolution of important topics was investigated using co-occurrence of author keywords. The author keywords indicate the authors' self-evaluation of concepts important to represent the research area and clarify concepts that have not been subject to sufficient analysis. In addition, co-occurrence in author keywords provides a network of conversation on ideas within research communities. The term co-occurrence map based on text data was applied to assess variables, methods, and theories. The fundamental of text data analysis is built on natural language processing algorithms. Lastly, network maps provide an overall picture in a presentable visual form that helps identify possible future research lines.

Appendix 2. Supporting Data in Tables

Table I

Top 10 contributing authors to HRM and technology research based on total publications.

Sl. No.	Author	LA	TP
1	Bondarouk T.	University of Twente	7
2	Dulebohn J.H.	Michigan State University	6
3	Marler J.H.	University at Albany	6
4	Stone D.L.	University of New Mexico	5
5	Parry E.	Cranfield University	5
6	Strohmeier S.	Saarland University	4
7	Ruel H.J.M.	University of Twente	3
8	Lepak D.	University of Massachusetts Amherst	3
9	Lukaszewski K.M.	Wright State University	3
10	Ulrich Dave	University of Michigan	3

Note: LA-last affiliation. TP-total publications.

Source: Authors own creation

Table II

Top 10 influential articles based on global citations (Web of Science) in HRM and Technology research.

Rank	Article title	Author(s)	Year	Citations	TA	Type of Article
1	Fostering knowledge sharing through people management practices	Cabrera E.F. and Cabrera A.	2005	480	Information technology	Conceptual
2	Strategic human capital management in SMEs: An empirical study of entrepreneurial performance	Hayton J.C.	2003	161	Human resource information systems (HRIS)	Quantitative
3	Employee recruitment: Current knowledge and important areas for future research	Breaugh J.A.	2008	129	Internet, web-based	Review
4	Employee involvement, organizational change and trust in management	Morgan D.E. and Zeffane R.	2003	112	Information technology	Quantitative
5	Electronic Human Resource Management: challenges in the digital era	Bondarouk T. and Ruel H.J.M.	2009	103	e-HRM, digital	Review (Editorial)
6	The influence of technology on the future of human resource management	Stone D.L., Deadrick D.L., Lukaszewski K.M., and Johnson R.	2015	100	Information technology, e-HRM, internet	Review
7	Strategic HRM in North America: looking to the future	Lepak D. and Shaw J.D.	2008	99	Technology	Review

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8	Trust and leadership in virtual teamwork: A media naturalness perspective	DeRosa D.M., Hantula D.A., Kock N., and D'Arcy J.	2004	95	Virtual teams	Review
9	Are we there yet? What's next for HR?	Ulrich D. and Dulebohn J.H.	2015	88	HR analytics	Conceptual
10	An evidence-based review of e-HRM and strategic human resource management	Marler J.H. and Fisher S.L.	2013	86	e-HRM	Review

Note: TA-technological artifacts.

Source: Authors own creation

Table III

Top articles based on local citations with 10 or more citations derived using VOSviewer.

Rank	Article title	Author(s)	Year	Citations	TA	Type of Article
1	Research in e-HRM: Review and implications	Strohmeier S.	2007	30	e-HRM	Review
2	HR and analytics: why HR is set to fail the big data challenge	Angrave D., Charlwood A., Kirkpatrick I., Lawrence M., and Stuart M.	2016	14	HR analytics	Review
3	The influence of technology on the future of human resource management	Stone D.L., Deadrick D.L., Lukaszewski K.M., and Johnson R.	2015	12	Information technology, e-HRM, internet	Review
4	Making human resources strategic by going to the Net: reality or myth?	Marler J.H.	2009	11	e-HRM	Conceptual
5	An evidence-based review of HR Analytics	Marler J.H. and Boudreau J.W.	2017	11	HR analytics	Review
6	Desired goals and actual outcomes of e-HRM	Parry E. and Tyson S.	2011	11	e-HRM	Qualitative
7	Concepts of e-HRM consequences: a categorisation, review and suggestion	Strohmeier S.	2009	11	e-HRM, information systems	Quantitative

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8	Electronic Human Resource Management: challenges in the digital era	Bondarouk T. and Ruel H.J.M.	2009	10	e-HRM, digital	Review (Editorial)
9	An evidence-based review of e-HRM and strategic human resource management	Marler J.H. and Fisher S.L.	2013	10	e-HRM	Review

Note: TA-technological artifacts.

Source: Authors own creation

Table IV

Cluster overview

Cluster	Major Focus	TP	TC	Top Articles	Article Title	ALS
1	Strategic HRM, innovation, high-technology industry, technological intensity, and training	69	1687	Lee S.H., Phan P.H., & Chan E. (2005)	The impact of HR configuration on firm performance in Singapore: a resource-based explanation.	219
				Wickramasinghe V. & Wickramasinghe G.L.D. (2020)	Effects of HRM practices, lean production practices and lean duration on performance.	216
2	Various aspects of electronic human resource management (e-HRM)	31	1208	Marler J.H. & Fisher S.L. (2013)	An evidence-based review of e-HRM and strategic human resource management.	455
				Bondarouk T., Parry E., & Furtmueller E. (2016)	Electronic HRM: four decades of research on adoption and consequences.	334
3	Changing workforce, workplace, employee experience, social-media, and other related technological impact on employee, work, and organization.	36	1265	Ryan A.M. & Wessel J.L. (2015)	Implications of a changing workforce and workplace for justice perceptions and expectations.	127
				Ruta C.D. (2005)	The application of change management theory to HR portal implementation in subsidiaries of multinational corporations.	118

4	HR analytics, algorithmic HR, digital platform, advanced technologies (artificial intelligence, big data, robot) and gig economy.	41	486	Larsson A.S. & Edwards M.R. (2021)	Insider econometrics meets people analytics and strategic human resource management.	312
				Kim S., Wang Y., & Boon C. (2020)	Sixty years of research on technology and human resource management: Looking back and looking forward.	233
5	Technology aided recruitment and website design.	25	616	Intindola M.L., Lewis G., Flinchbaugh C., & Rogers S.E. (2017)	Web-based recruiting's impact on organizational image and familiarity: too much of a good thing?	215
				Chen C.-C., Lin M.-M., & Chen, C.-M. (2012)	Exploring the mechanisms of the relationship between website characteristics and organizational attraction.	213
6	Virtual, virtual teams, global virtual teams, trust, and work.	21	666	Liao C. (2017)	Leadership in virtual teams: A multilevel perspective	204
				Schmidtke J.M. & Cummings A. (2017)	The effects of virtualness on teamwork behavioral components: The role of shared mental models.	172

Note: TP = total publications, TC = total citations, ALS = article link strength.

Source: Authors own creation

Table V

Top 10 theories/models/frameworks/perspectives/lens applied or discussed in HRM and technology research.

Sl. No.	Theories/Models/Framework/Perspective/Lens	Origin	Example Citations	No. of articles
1	Resource Based View	Barney (1991)	Bustinza et al. (2019), Antonioli & Della (2016), Marler & Fisher (2013), Bondarouk & Ruel (2013), Parry (2011)	14
2	Institutional Theory	Meyer & Rowan (1977)	Meijerink et al. (2021), Cooke et al. (2019), Simon & Esteves (2016), Marler & Fisher (2013), Dineen & Williamson (2012)	9
3	Technology Acceptance Model (TAM)	Davis (1985)	Kaše et al. (2019), Winkler et al. (2013), Huang et al. (2013), Brown & Charlier (2013), Chu and Chu (2011)	8

4	Media Richness Theory	Daft & Lengel (1986)	Griswold (2021), McColl & Michelotti (2019), Marlow et al. (2017), Hoch & Dulebohn (2017), Baum & Kabst (2014)	8
5	Signaling Theory	Spence (1973)	Malik et al. (2020), Poba-Nzaou et al. (2020), Intindola (2019), Martin et al. (2015), Chen et al. (2012)	7
6	Human Capital Theory	Becker (1962)	Hamori (2019), Torre et al. (2018), Mainga et al. (2009), Slaughter et al. (2007), Lengnick-Hall & Lengnick-Hall (2006)	6
7	Social Cognitive Theory	Bandura (1989)	Adamovic et al. (2021), Suseno et al. (2021), Liao (2017), de Guinea & Webster (2015), Strohmeier (2007)	6
8	Social Exchange Theory	Homans (1958), Blau (1964)	Garcia-Arroyo & Osca (2019), Park (2018), Strohmeier (2013), Mulki & Jaramillo (2011), Cabrera & Cabrera (2005)	6
9	Contingency Theory	Burns & Stalker (1961)	Bustinza et al. (2019), Marler & Fisher (2013), Georgiadis & Pitelis (2012), Han & Liao (2010), Ramirez & Fornerino (2007)	5
10	Social Identity Theory	Tajfel & Turner (1986)	Madden & Loh (2020), Martin et al. (2016), Madlock (2013), Dineen & Williamson (2012), Williamson et al. (2010)	5

Note: Top theories applied or discussed in 5 or more articles within the review corpus.

Source: Authors own creation

Table VI

Overview of the antecedents and their established relationships with HRM and technology phenomenon.

Typology	Antecedent	Dimensions	Example Citations	Association with HRM and technology phenomenon
Micro Factors	Experience (Teleworker supervision, HR manager)		Park & Cho (2022), Parry (2011)	Teleworker supervision (Non-teleworking - not supported, Teleworking supervisors - positive) HR Manager (Supported - eHRM, Not supported - eHRM sophistication)
	Specialist skills		Kotey & Sharma (2016)	Positive

	Supervisory proficiency in telework		Park & Cho (2022)	Non-teleworking - positive, Teleworking Supervisors - positive
	Psychological (Beliefs about AI, AI anxiety, Conscientiousness, Emotional stability, Attitude)	Attitude (Attitude towards monitoring in private life, general attitude towards surveillance)	Suseno et al. (2022), Hamori (2021), Kim et al. (2016), Abraham et al. (2019)	Beliefs - Positive, Anxiety - Negative, Conscientiousness - Negative, Emotional stability - Negative, Attitude - Supported
	Perceived control	Control over monitoring, experience with monitoring	Abraham et al. (2019)	Supported
	Self-efficacy (Virtual work, Quantitative, Technology)		Abraham et al. (2019), Vargas et al. (2018)	Virtual work - Supported, Quantitative - Positive, Technology - Positive
	Job (Individual job crafting, Core job content)		Wong et al. (2021), Hamori (2021)	Individual job crafting - Positive, Core job content - supported
Meso Factors	Virtual work climate		Adamovic et al. (2022)	Positive
	Telework support by organization		Park & Cho (2022)	Non teleworking supervisors- not supported, Teleworking Supervisors - positive
	HRM (HR strategic involvement, Strength of HRM, Strength of eHRM, HR outsourcing)		Marler & Parry (2016), Bondarouk et al. (2017), Parry (2011)	HR strategic involvement - Supported, Strength of HRM - Not supported, Strength of eHRM - Not supported, HR outsourcing (Not Supported - eHRM use, Positive-eHRM sophistication)
	Organizational context	Firm size, technology competence	Pan et al. (2022)	Not supported - firm size, supported - technology competence
	Devolution to line management		Parry (2011)	Not Supported - eHRM use, Negative - eHRM sophistication

	Firm size/Small employer	Total employees, Total wage costs, number of locations	Kotey & Sharma (2016), Hamori (2021)	Firm size - Positive, small employer - Not supported
	National Diversity		Muethel et al. (2012)	Positive
	Organizational Reputation		Dineen & Williamson (2012)	Positive
	Quality-based compensation		Dineen & Williamson (2012)	Positive
	High commitment human resource management system (HCHRMS)		Park et al. (2019)	Positive
	Employment Terms		Kotey & Sharma (2016)	Not supported
	Working proprietors/salaried directors		Kotey & Sharma (2016)	Not Supported
	Technological capabilities		Bustinza et al. (2019)	Positive
	Training (Formal training, Employer training topic)		Hamori (2021)	Formal training - Supported, Employer training topic - Not supported
Macro Factors	Technology context	Relative advantage, complexity	Pan et al. (2022)	Not supported - relative advantage, negative - complexity
	Environmental context	Industry, regulatory	Pan et al. (2022)	Not supported - industry, supported - regulatory environment
	Industry sectors		Kotey & Sharma (2016)	Positive
	Perceived labor supply		Dineen & Williamson (2012)	Positive
	Social influence		Vargas et al. (2018)	Positive
Demographics	Age (high mean age)		Muethel et al. (2012)	Negative
	Gender (female to male ratio)		Muethel et al. (2012)	Positive
	Job level		Hamori (2021)	Not supported

Others	Work assignment fairness		Park & Cho (2022)	Non teleworking - positive, Teleworking Supervisors - positive
	Functioning of monitoring	Enhancing productivity, Exerting control, supporting coordination and planning	Abraham et al. (2019)	Supported
	Triability		Vargas et al. (2018)	Positive
	Use of Internet		Kotey & Sharma (2016)	Positive
	Ease of use		Winkler (2013)	Not supported
	Information quality		Winkler (2013)	Supported
	Parasocial interaction		Goldberg & Allen (2008)	Positive
	Part-timer		Hamori (2021)	Not supported

Note: Positive/Negative represents directionality. Supported/Not supported represents significant or not significant.

Source: Authors own creation

Table VII

List of potential research questions

Research Domains	Potential Research Questions
Domain 1: Change Management and Transformtional HRM	<p>This domain focuses on research in areas of change management and transformational HRM as technology becomes an integral part of organizations:</p> <p>RQ1: How human resource management as a function repositions itself during digital transformation of organization?</p> <p>RQ2: Role of human resource management in influencing leaders and employees during digital transformation: what, when, and how?</p> <p>RQ3: How would a mixed-method approach be best employed to understand the multi-level impacts of emerging technologies on HR roles and employees' experiences during digital transformation?</p> <p>RQ4: How emerging technologes are redefining strategic human resource management? A qualitative comparative study of multi organizations.</p>
Domain 2: Emotional Intelligence, Well-Being, and Dark Side in New Future of Work	<p>This domain focuses on Soft HRM such as emotional intelligence, well-being, and dark sides of digitalization when future of work, workers and workplace gets redefined as digitalization unfolds:</p> <p>RQ1: How workplace cultural transformation redefines HRM policies? A richer understanding of the linkage between HRM policy and workplace using theoretical perspectives based on paradox and complexity.</p> <p>RQ2: How is emotional intelligence an important ability and trait in leaders for driving future of work?</p> <p>RQ3: How is human resource management curbing the side effects of behind the screen work, workers and workplace?</p>

1
2
3 Domain 3: Technology
4 aided HRM Processes
5 and Systems

This domain focuses on research in sub-functions of HRM beyond recruitment and selection in association with advanced technologies:
 RQ1: How does the HRM-technology interface redefine employee experience and its effects on organizations? A longitudinal study.
 RQ2: How can advanced technology be developed for talent management strategies to address moonlighting?
 RQ3: What is the effect of emerging technologies in designing and implementing talent management strategies?
 RQ4: How is HRM upskilling HR skills to maintain the sanctity of HR role? An ethnography and comparative study in multiple industries.

13 Domain 4: Hybrid and
14 Virtual Work
15 Environments

This domain focuses on research in hybrid and virtual work environments emerging post Covid19 outbreak:
 RQ1: What is the perceived value of hybrid and virtual work environment?A comparative study.
 RQ2: What is the effectiveness of hybrid work place? Developing a scale to measure the ROI.
 RQ3: Developing a taxonomy of informal socialization in virtual work environments.

21 Source: Authors own creation

Personnel Review

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3 **A Temporal Evolution of Human Resource Management and Technology Research: A**
4 **Retrospective Bibliometric Analysis**
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10 **Srumita Narzary**

11
12 Doctoral Scholar, Organizational Behaviour and Human Resource Management
13 Indian Institute of Management, Tiruchirappalli, India
14 srumita.f20001@iimtrichy.ac.in
15
16
17
18

19 **Upam Pushpak Makhecha**

20
21 Associate Professor, Organizational Behaviour and Human Resource Management
22 Indian Institute of Management, Tiruchirappalli, India
23 upam@iimtrichy.ac.in
24
25
26

27 **Pawan Budhwar**

28
29 50th Anniversary Professor of International HRM
30 Aston Business School, Aston University, UK
31 p.s.budhwar@aston.ac.uk
32
33
34

35 **Ashish Malik***

36
37 Professor
38 Queen's Business School
39 Queen's University of Belfast, NI, UK
40 a.malik@qub.ac.uk
41
42
43
44

45 **Satish Kumar**

46
47 Professor in Finance and Accounting
48 Indian Institute of Management, Nagpur, India
49 satish@iimnagpur.ac.in
50

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52 *Corresponding author

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