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Mapping the Evolution of HRM for an Aging Workforce: A Bibliometric and Visualization Review

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Abstract

Aging is particularly pronounced in developed countries, and some developing countries, like China, are also facing an even larger and faster-paced impact. This trend is constantly shaping new labor structures, introducing new issues and challenges for human resource management (HRM) departments. This paper uses VOSviewer and Scimago Graphica to conduct a bibliometric and visualization analysis of academic outputs on the human resource (HR) practices for an aging workforce. Based on 164 papers from the Web of Science (WoS) database, the analysis includes publication trends, major contributors, regional differences, and keyword analysis. The study finds that this field remains attractive for scholars in most European countries and parts of Asia and North America, while that is not the case for other regions such as Africa and South America. Network visualization categorizes key themes into seven clusters, ranging from individual perceptions, organizational adaptions to general policies, while overlay visualization suggests that the field has evolved from superficial facts such as demographic shifts to in-depth solutions, such as inclusive HR practices and sustainable employment. Nevertheless, significant gap exists in the artificial intelligence (AI) related and non-Western contexts, and future HR systems must be carefully redesigned to support extended working years through evidence-based strategies.

Keywords: Bibliometric and Visualization Analysis, Aging Workforce, Inclusive Hr Practices

Introduction

Aging has become one of the inevitable global issues (United Nations, 2025a). The percentage of the world's population aged 65 and over almost doubled between 1974 and 2024, from 5.5% to 10.3% (United Nations Population Fund, 2025). The UN population projections predict that this number will double again, to 20.7%, between 2024 and 2074. According to the World Population Prospects (2024), life expectancy at birth reached 73.3 years in 2024, which is 8.4 years more than that in 1995. In the meanwhile, fertility rate keeps reducing from about 5 live births per woman over a lifetime in 1950 to 2.25 live births in 2024, and it is projected to decline further to 2.1 births per woman by 2050. Therefore, the world is witnessing lower fertility and mortality rates, making aging a phenomenon that can hardly be reverted.

Population aging is fundamentally reshaping the labor market (Kumar & Suresh, 2018; Kunze et al., 2021). To address the financial pressures on pension systems, many governments, such as Germany, Denmark, and China, are all raising the statutory retirement age, thereby extending the working years (Carta et al., 2021; Pilipiec et al., 2021). By 2030, an estimated 150 million jobs worldwide will be filled by workers aged 55 and above (Bain, 2023). Consequently, greater age diversity will place higher demands on workplace climate, prompting companies to rethink their HR approach.

However, it is not easy for companies to adapt to this change. On the one hand, some of older workers will probably lose their skills, especially under the background of the rapid expansion of AI. (Kuijpers et al., 2020; Wu & Konrad, 2021). On the other hand, widespread age discrimination, high adaptation costs, and intergenerational conflict all pose threats to corporate HR transformation. (Bae & Choi, 2023; Neumark, 2022; Riach & Rich, 2010; Suh, 2021).

Solving these problems requires more than policy adjustments like retirement delay, and it necessitates a fundamental redesign of the talent management system to accommodate longer careers and the evolving capabilities of employees at different life stages (Fan et al., 2023; Kuijpers et al., 2020; Parker & Andrei, 2020). This article aims to address this need by tracing the theoretical development of HRM research on an aging workforce, focusing on emerging trends, thematic clusters, and gaps.

HRM for an Aging Workforce

An overview of research by highly cited authors in this field, such as Kooij DTAM, Boehm, and Zacher, reveals that they primarily use chronological age of 50 and above to define the group of "older employees". This benchmark is widely accepted because it is relatively close to the traditional retirement age. However, some scholars still target the workforce aged 45 and above to avoid overlooking observations of the responses of the workforce in the early stages of aging to HR policies.

Notably, Parker & Andrei (2020) distinguished three organizational meta-strategies for mature employees based on a systematic literature review, describing them as inclusion, individualization, and integration. An inclusive strategy refers to using an inclusive approach in recruiting, hiring, and evaluating older employees, so that they feel respected and treated fairly. (Boehm & Dwertmann, 2015; Rudolph & Zacher, 2021; Shore et al., 2018; Van Den Groenendaal et al., 2023). Individualization strategies emphasize tailoring the work

environment and conditions to each employee's unique needs to boost his or her performance. (Allen et al., 2021; Bal & De Lange, 2015; Kuijpers et al., 2020; Rudolph & Baltes, 2017). Finally, the integration strategy refers to the fact that as the aging population increases, older employees as a group can achieve economies of scale and bring benefits. (Fasbender & Wang, 2017; Pitt-Catsouphes & Matz-Costa, 2008; Rudolph et al., 2018). Older employees are a repository of knowledge and a treasure trove of talent in the workplace, and their potential remains to be explored (Kuijpers et al., 2020; Weir, 2023). Therefore, a key challenge for HRM is to turn the aging from a threat into an opportunity, and enable them to thrive in their later years.

Numerous articles have been published on HR policies related to aging. Different scholars have discussed aspects such as inclusive, flexible, development, and maintenance HR policies (Armstrong-Stassen & Schlosser, 2011; Boehm et al., 2014; Eppler-Hattab et al., 2020). However, these papers remain scattered and lack a systematic overall summary. Therefore, it is particularly important to clarify the knowledge framework of this field and identify the current stage of research.

Bibliometrics and visualization analysis are conducted in this study. Specifically, the research questions include:
1. What are the publication trends in the field of HRM for an aging workforce?
2. Who are the major contributors to research on HRM for an aging workforce (authors, journals, and articles)?
3. What are the differences in research findings on HRM for an aging workforce across different countries and regions?
4. What are the core themes, emerging areas, and research gaps on HRM for an aging workforce?

By answering these questions, this study possesses both theoretical and practical significance. It summarizes and organizes existing high-quality literature in this field, enriching readers' understanding of the area. On the other hand, a clear understanding of the composition of research findings in this field can provide suggestions for companies seeking solutions to employee aging and also provides possibilities for developing more reasonable workforce arrangement policies.

Methods and Data Source

Methods

This study uses bibliometrics and visualization methods to analyze literature related to HR practice for an aging workforce. Specifically, this paper uses bibliometric analysis to obtain the number of publications each year, categories, major contributing authors, journals, articles, countries, institutions, and keywords (Visser et al., 2021). Following that, this study uses VOSviewer and Scimago Graphica as visualization tools. VOSviewer is used to generate keyword co-occurrence network diagrams and overlay diagrams, while Scimago Graphica is used to generate keyword maps.

Data Source

WoS was chosen as the database for this review primarily because of the high quality and impact of the papers it indexes. This characteristic is essential for forming a reliable analysis

of the current state of research (Visser et al., 2021). In comparison, although other databases, such as Scopus, Google Scholar, contain a considerable number of articles, they cannot guarantee quality through excellent peer review and other screening methods (Martín-Martín et al., 2021). Furthermore, WoS can be easily integrated with visualization software such as VOSviewer, so that it remains an important database source for many scholars to write bibliographic and visualization review articles (Mongeon & Paul-Hus, 2016).

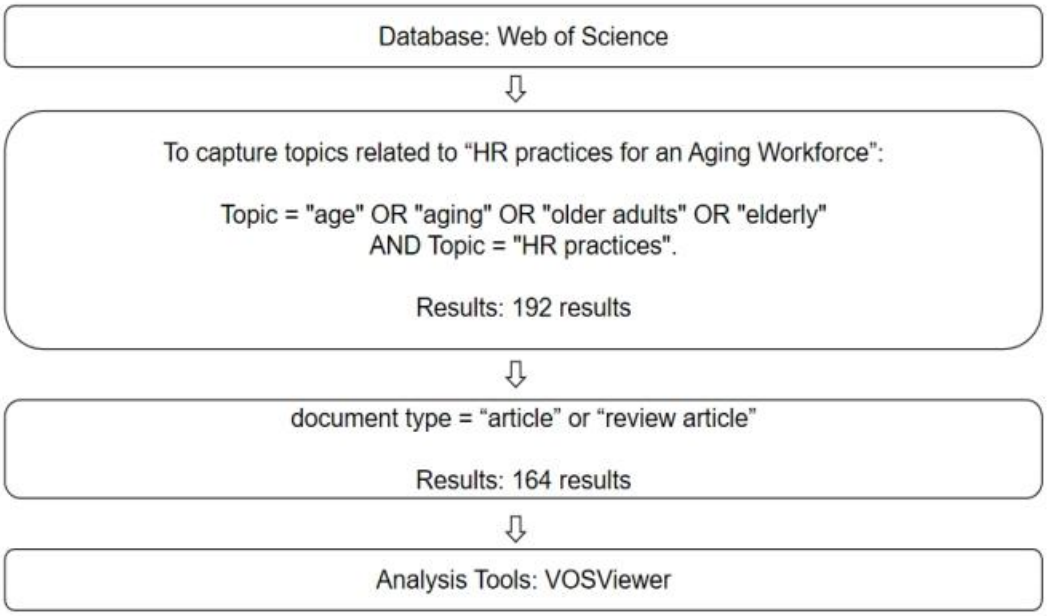

Figure 1. Search and filtration process in the WoS database.

As Figure 1 shows, to capture articles related to HR practices for an aging workforce, the search criteria for the WoS database were firstly defined as Topic = "age" OR "aging" OR "older adults" OR "elderly" AND Topic = "HR practices". 192 results were generated at that time. However, the final outcome was 164 results, after defining the document type to articles and review articles, excluding early access papers, book chapters, proceedings, and other document types.

Results and Discussion

This section will reflect the current research stage on HR practices for an aging workforce through quantitative analysis. First, publication trends will be introduced from the perspectives of WoS index, publications, citations and disciplinary categories. Second, analysis of major contributors will include key authors, mainstream journals, and highly influential articles. Third, distribution of major countries and institutions involved in research activities will be discussed. Finally, keyword networks and overlay analysis will be conducted to suggest key themes and indicate potential gaps.

Publication Trends

After categorizing the 164 selected articles by WoS index, it can be found in Table 1 that 130 articles (79.27%) were indexed in the Social Sciences Citation Index (SSCI); 33 articles (20.12%) were indexed in the Emerging Resources Citation Index (ESCI); and only 11 studies (6.71%) were indexed in the Science Citation Index-Expanded (SCI-Expanded). These figures reflect

that research on HR practices related to aging is mainly concentrated in the social sciences, with some emerging journals also paying attention to this topic, while there is still room for further exploration of the connection between the scientific field and this theme.

Table 1
Web of Science Index of the 164 articles

Web of Science Index	Record Count	% of 164
SSCI	130	79.27
ESCI	33	20.12
SCI-EXPANDED	11	6.71

It can be seen from Figure 2 that publications and citations on the topic of HRM related to aging have changed over time (2011-2025). Prior to 2018, the number of publications showed a slow upward trend, increasing from 2 in 2011 to 6 in 2018. Afterward, the increasing rate accelerated significantly, climbing to a peak of 25 in 2021. Although the number of publications declined slightly in the following years, the average annual number of publications remained significantly higher than the pre-2018 level, which was less than 10 publications. This is likely due to the impact of the COVID-19 pandemic, which highlighted the vulnerability of older employees and temporarily alleviated concerns about aging.

Meanwhile, the number of citations for articles in this field also showed a continuous upward trend, gradually increasing from 34 in 2011 to a peak of 719 in 2024. The decline in citations in 2025 is likely due to the fact that the data used for calculation only covers up to September 2025. Overall, the steady increase in citations reflects the continued academic focus on this topic.

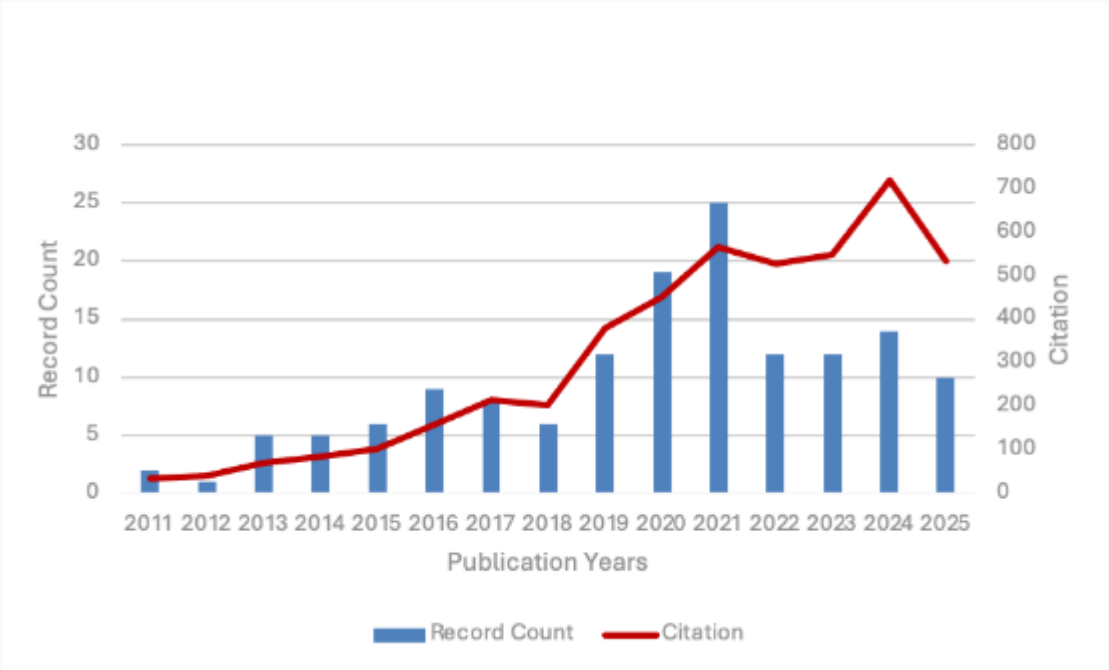

Figure 2: Publication Years

The WoS categories analysis of the 164 selected articles on HR practices related to aging, as shown in Table 2, reveals that the top three categories are *management*, *Applied psychology* and *industrial relations and labor*. 106 articles were categorized under *management* (64.63%), making it the dominant category. *Applied psychology* and *industrial relations and labor* follow with 53 and 43 publications respectively, taking up 32.32% and 26.22% of all the publications. *Business* ranked fourth with 20 publications (12.20%), while *interdisciplinary psychology* (6.71%), *gerontology* (4.88%), and *social sciences interdisciplinary* (4.27%) followed closely with 11, 8, and 7 publications respectively. Finally, *economics, environmental science and environmental studies* also entered the top ten with 5 publications each (3.05%). This evidence suggests that the research on HR practices for an aging workforce involves multiple disciplines such as management, economics, psychology, gerontology and environmental science, providing possibilities for further interdisciplinary research in the future.

Table 2
Top 10 WoS Categories of the 164 articles

Web of Science Categories	**Record Count**	**% of 164**
Management	106	64.634
Psychology Applied	53	32.317
Industrial Relations Labor	43	26.22
Business	20	12.195
Psychology Multidisciplinary	11	6.707
Gerontology	8	4.878
Social Sciences Interdisciplinary	7	4.268
Economics	5	3.049
Environmental Sciences	5	3.049
Environmental Studies	5	3.049

Key Contributors

Leading authors

As shown in Table 3, in the field of HR practice for an aging workforce, eight top authors published four or more papers. De Lange AH and Kooij DTAM tied for first place with 7 papers (4.27%), demonstrating their in-depth research and outstanding insights in this area. Van der Heijden BIJM and Deller J followed closely behind, ranking third and fourth with 6 (3.66%) and 5 (3.05%) publications respectively. Finally, four authors, including Jansen PGW, Napathorn C, Wilckens MR, and Wöhrmann AM, each published 4 papers (2.44%), contributing collectively to the development of this field.

Table 3
Leading Authors contributing to research on HR practices for an aging workforce

Authors	Record Count	% of 164
De Lange AH	7	4.268
Kooij DTAM	7	4.268
Van Der Heijden BIJM	6	3.659
Deller J	5	3.049
Jansen PGW	4	2.439
Napathorn C	4	2.439
Wilckens MR	4	2.439
Wöhrmann AM	4	2.439

Leading Journals

Table 4 shows the top 8 journals in this field with 4 and more publications among the 164 papers. *Work, Aging and Retirement* leads with 14 articles (8.54%), and the *International Journal of Human Resource Management* follows with 13 articles (7.93%). These two journals pay particular attention to the HRM issues in the context of an aging population. Extensive publications in journals such as *Personnel Review, Human Resource Management Journal,* and *Human Resource Management* further confirms that this is a core topic in HRM academic research. *Frontiers in Psychology* (8 articles) and *Human Resource Development Quarterly* (4 articles) emphasize the importance of psychological and developmental perspectives, and *Sustainability* (5 articles) demonstrates the field's increasingly close connection to broader themes such as sustainable work and employability.

Table 4
Leading Journals contributing to research on HR practices for an aging workforce

Publication Titles	**Record Count**	**% of 164**
Work, Aging and Retirement	14	8.537
International Journal of Human Resource Management	13	7.927
Frontiers in Psychology	8	4.878
Personnel Review	8	4.878
Human Resource Management Journal	7	4.268
Sustainability	5	3.049
Human Resource Development Quarterly	4	2.439
Human Resource Management	4	2.439

The Most Influential Articles

In the context of an aging population, the ten most cited papers in the field of HR practice highlight how age affects the relationship between HRM and employee or organizational performance, as shown in the Table 5. A meta-analysis by Kooij et al. (2010, 289 citations) confirmed that age is a moderating factor in the relationship between HR practices and attitudes. Their subsequent research in 2013 and 2014 further demonstrated how HR practices affect employee well-being and performance in different ways, and how a range of practices support older employees. At the same time, Boehm et al. (2014), with 231 citations, also considered age-inclusive HR practices as an effective way to boost corporate performance. Zacher (2015)'s article introduced the concept of "successful aging in the

workplace", and D' Amato & Herzfeldt (2008) investigated intergenerational differences in learning orientation. Several other highly cited works have expanded on this discussion. For example, Jiang et al. (2017) explored demographic differences and perceptions of HR practices (129 citations); Jerónimo et al. (2020) linked green HR practices to sustainability (cited 106 times); and Chang et al. (2013) pointed out some determinants of employee turnover (99 citations). These studies collectively form the theoretical foundation of the field.

Table 5
The 10 most influential articles on age-related HR practices research

Rank	Authors	Article title	Citations
1	Kooij et al. (2010)	The influence of age on the associations between HR practices and both affective commitment and job satisfaction: A meta-analysis	289
2	Boehm et al. (2014)	Spotlight on age-diversity climate: the impact of age-inclusive HR practices on firm-level outcomes	231
3	Kooij et al. (2013)	How the impact of HR practices on employee well-being and performance changes with age	205
4	Zacher (2015)	Successful Aging at Work	170
5	D' Amato & Herzfeldt (2008)	Learning orientation, organizational commitment and talent retention across generations A study of European managers	163
6	Kunze et al. (2013)	Organizational Performance Consequences of Age Diversity: Inspecting the Role of Diversity-Friendly HR Policies and Top Managers' Negative Age Stereotypes	139
7	Jiang et al. (2017)	Understanding Employees' Perceptions of Human Resource Practices: Effects of Demographic Dissimilarity to Managers and Coworkers	129
8	Kooij et al. (2014)	Managing aging workers: a mixed methods study on bundles of HR practices for aging workers	127
9	Jerónimo et al. (2020)	Going green and sustainable: The influence of green HR practices on the organizational rationale for sustainability	106
10	Chang et al. (2013)	Work Design-Related Antecedents of Turnover Intention: A Multilevel Approach	99

Regional Differences

Country-wise Analysis

Country-specific analysis reveals that Europe and Asia dominate research on HR practices related to aging. The Netherlands leads with 31 papers (18.90%), followed by China (29 papers, 17.68%), the UK (23 papers, 14.02%), and the US (22 papers, 13.42%), while Germany contributes 16 papers (9.76%). Other active contributors include Australia and Canada (11 papers each, 6.71%), and Belgium, Switzerland (8 papers each, 4.88%). India, Italy (7 papers each, 4.27%), and Greece, Portugal (6 papers each, 3.66%) make moderate contributions. Some countries also made smaller but noteworthy contributions, such as France and Spain (5 papers each, 3.05%), and Finland, Ireland, Norway, Saudi Arabia, Singapore, Thailand (4 papers each, 2.44%). Most countries in Africa, Asia, and Latin America contributed only a few publications, reflecting limited global research enthusiasm on the issue.

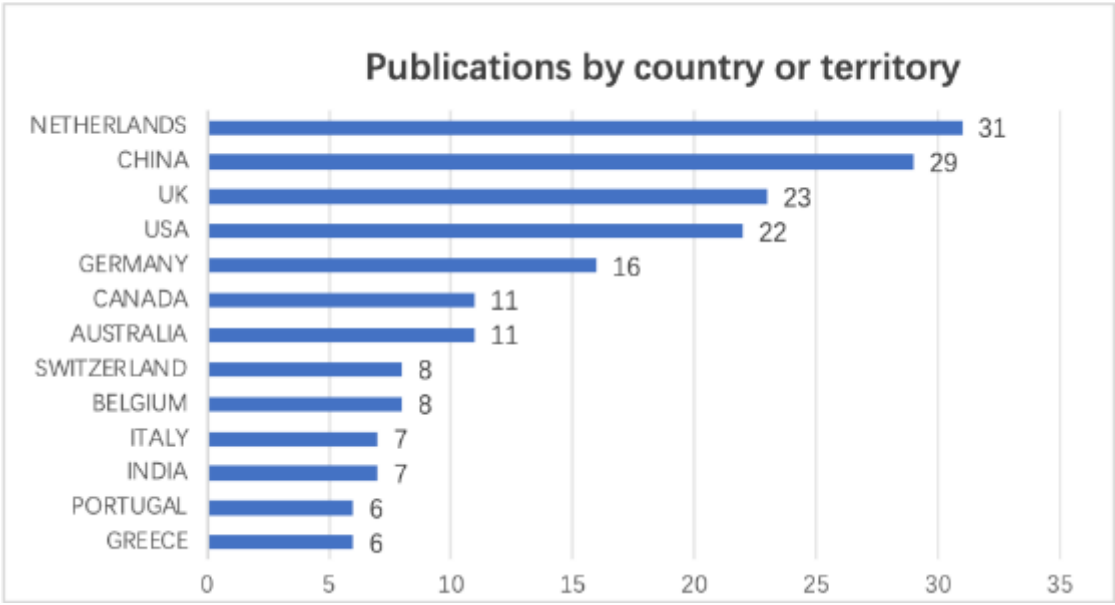

Figure 3: The Publication Countries

Analyzing from a global perspective, it's easy to see that European scholars contribute the most publications in this field. Of the top 13 countries listed in Figure 3, eight (Netherlands, UK, Germany, Switzerland, Belgium, Italy, Portugal, and Greece) are from Europe. Asia also shows significant interest, with China leading the way, followed by India, Japan, and Singapore. North America follows, with the United States (13.4%) and Canada (6.7%) making the largest contributions. In contrast, Oceania contributes less, with Australia (6.7%) and New Zealand (1.8%) being the largest contributors. Finally, Africa and South America contribute negligibly.

If linking those academic contributions from a particular country or region with the level of economic development or the degree of aging there, it is not difficult to find the connection. Publications from developed economies dominate, with key contributors including the Netherlands, the United States, the United Kingdom, Germany, Canada, Australia, and Japan. Emerging economies follow, with China (15.9%) making a particularly significant contribution. Finally, developing economies contribute very few publications, resulting in limited influence. Those countries facing significant demographic shifts are more likely to conduct related research. In contrast, many low-income countries have much younger populations, with the

proportion of people aged 65 and over typically below 5%, resulting in minimal or no research contributions. The scale and urgency of population aging have significantly impacted the quantity of academic output, suggesting that more diverse regional contributions are likely to emerge as the global demographic transition progresses.

Institution-Wise Analysis

Table 6 lists the institutions that have made the largest contributions to HR practices related to aging. The analysis shows that European universities are the leading contributors in this field. Given that the Netherlands has been identified as a leading country in the number of publications in this field, it is not surprising that the top four of the top seven institutions (The Open University of the Netherlands, Radboud University Nijmegen, Tilburg University and University of Groningen) are all located in the Netherlands. They published 10, 9, 9, and 8 articles respectively, accounting for more than one-fifth of the total publications. This again demonstrates the Netherlands' outstanding contribution and prominent position in this field. Moreover, the next three institutions are also from Europe. Kingston University from the UK and the University of Luneburg from Germany contribute 6 publications each (3.66%), and the University of St. Gallen from Switzerland contributes 5 articles (3.05%). These institutional strengths and policy priorities have created fertile ground for high-quality, internationally renowned academic research, explaining why the Europe has become a central hub in this field.

Table 6
Top Affiliations contributing to research on HR practices for an aging workforce

Affiliations	Record Count	% of 164
OPEN UNIVERSITY NETHERLANDS	10	6.098
RADBOUD UNIVERSITY NIJMEGEN	9	5.488
TILBURG UNIVERSITY	9	5.488
UNIVERSITY OF GRONINGEN	8	4.878
KINGSTON UNIVERSITY	6	3.659
LEUPHANA UNIVERSITY LUNEBURG	6	3.659
UNIVERSITY OF ST GALLEN	5	3.049

Keywords Analysis

Based on the 164 papers, 64 unique keywords that appeared at least twice are identified using VOSviewer. These keywords are grouped into 7 distinct thematic clusters, which will be listed in Table 7. Both network analysis and overlay analysis will be conducted to map the development of HR for aging workforce research. Figure 4 shows the network analysis. The size of the nodes represents their frequency of occurrence, which explains why words like “older workers”, “human resource management”, “HR practices”, and “retirement” are particularly large. As highly interconnected themes, these keywords form the conceptual hub of the field. The connections between nodes represent their relationships in keyword co-occurrence, authors, institutions, and even countries.

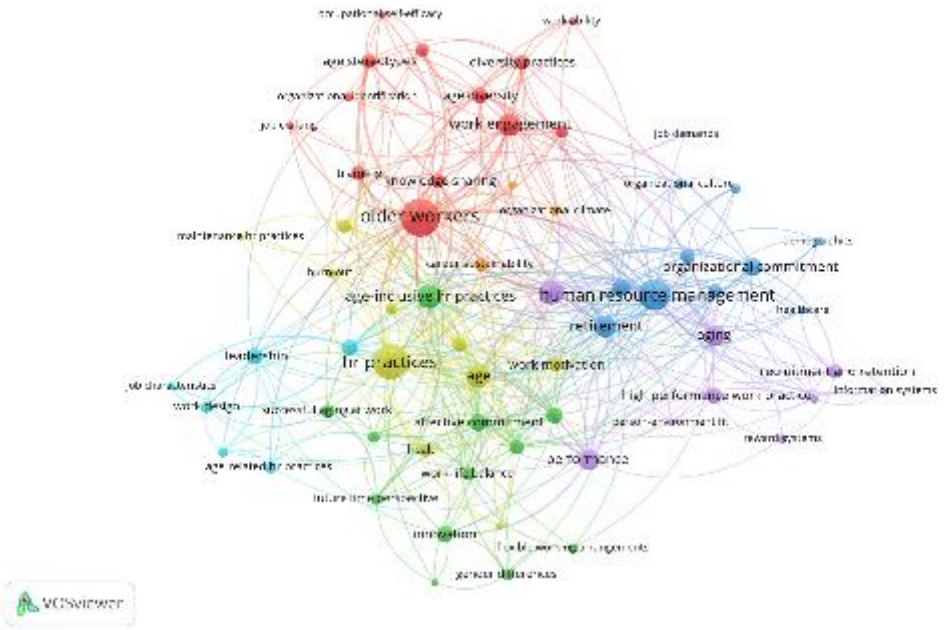

Figure 4: Keyword Co-Occurrence Network

Based on the strength of these connections, seven clusters can be categorized as shown in the Table 7. Cluster 1 (red) contains 13 nodes, with keywords including “age discrimination”, “age diversity”, “age stereotypes”, “diversity”, “diversity practices”, “job crafting”, “knowledge sharing”, “occupational self-efficacy”, “older workers”, “organizational identification”, “training”, “work ability”, and “work engagement”. Cluster 2 (green) contains 12 nodes, with keywords including “affective commitment”, “age-inclusive HR practices”, “flexible working arrangements”, “future time perspective”, “gender differences”, “innovation”, “life-span psychology”, “person-job fit”, “proactivity”, “strategic HRM”, “successful aging at work”, and “work-life balance”. Cluster 3 (blue) contains 10 nodes, including “aging workforce”, “demographics”, “healthcare”, “human resource management”, “human resource practices”, “organizational commitment”, “organizational culture”, “retirement”, "talent management”, and “work-related attitudes”. Cluster 4 (yellow) contains 10 nodes, including “age”, “burn-out”, “development HR practices”, “employability”, “health”, “HR practices”, “learning”, “maintenance HR practices”, “sustainability”, and “work motivation”. Cluster 5 (purple) contains 10 nodes, including “aging”, “high performance work practices”, “information systems”, “job demands”, “job satisfaction”, “performance”, “person-environment fit”, “productivity, recruitment and retention”, and “reward systems”. Cluster 6 (cyan) contains 6 nodes, including “age-related HR practices”, “job characteristics”, “leadership”, “psychological needs”, “turnover”, and “work design”. Cluster 7 (orange) contains 3 nodes, including “career sustainability”, “organizational climate”, and “perceived organization”.

Table 7
7 Clusters for the Keywords

Cluster	Keywords
Cluster 1	age discrimination, age diversity, age stereotypes, diversity, diversity practices, job crafting, knowledge sharing, occupational self-efficacy, older workers, organizational identification, training, work ability, work engagement
Cluster 2	affective commitment, age-inclusive HR practices, flexible working arrangements, future time perspective, gender differences, innovation, life-span psychology, person-job fit, proactivity, strategic HRM, successful aging at work, work-life balance
Cluster 3	aging workforce, demographics, healthcare, human resource management, human resource practices, organizational commitment, organizational culture, retirement, talent management, work-related attitudes
Cluster 4	age, burn-out, development HR practices, employability, health, HR practices, learning, maintenance HR practices, sustainability, work motivation
Cluster 5	aging, high performance work practices, information systems, job demands, job satisfaction, performance, person-environment fit, productivity, recruitment and retention, reward systems
Cluster 6	age-related HR practices, job characteristics, leadership, psychological needs, turnover, work design
Cluster 7	career sustainability, organizational climate, perceived organization

These seven clusters bring together key terms in the field of HRM policies for aging populations, revealing the current research focus. Scholars can either focus on individual employee experiences, such as job engagement and burnout, or consider a wider organizational or societal context, such as organizational culture, organizational climate, demographics, and retirement. They can examine both antecedents, such as job demands, job characteristics, and psychological needs, and consequences, such as job satisfaction, performance, productivity, and turnover. They can either research into specific policies, such as flexible working arrangements, knowledge sharing, and talent management, or a collection of strategies, such as development HR practices, maintenance HR practices, and age-related HR practices.

The overlay visualization incorporates the time factor, as shown in Figure 5. It's clear that early research in this field, marked with cool colors, focused on objective facts and key issues such as "demographics", "aging workforce", "retirement", and "HRM". Later research, marked with warm colors, was deepening and expanding upon previous work, and gradually exploring specific measures to address this aging dilemma, such as "age-related HR practices".

This shift reflects a move by scholars from recognizing the problem to solving it, hoping to derive effective HR policies for addressing aging issues through more empirical research.

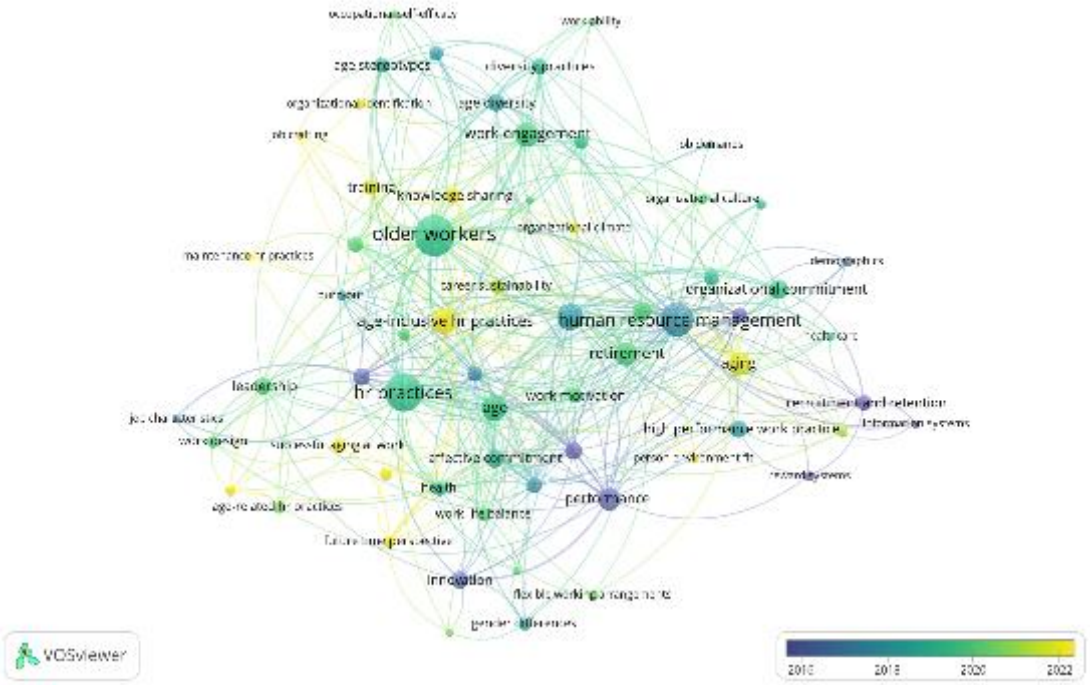

Figure 5: Keyword Co-Occurrence Overlay

A keyword cloud can be generated by importing the keywords from these 164 articles into the Scimago Graphica software. The most frequently occurring keywords are displayed in the largest size. Therefore, the keyword cloud in Figure 6 shows “older employees”, “human resource management”, and “performance” as the largest words, indicating the central location of the field. Around the central term, it is not difficult to find more specific and feasible HR strategies proposed by scholars, such as training, knowledge sharing, talent management, and flexible working arrangements. Surrounding these HR strategies are related concepts that influence individual feelings and organizational performance.

Figure 6: Keyword Cloud Map

Conclusion and Limitations

In summary, this study conducted a bibliometric and visualization analysis of 164 articles in the field of HR strategies related to aging. It found that as aging deepens, this field remains highly attractive to scholars, especially those in management and applied psychology field. However, in terms of major contributors, researchers come from most European countries and a small number of Asian countries, with the leading position of Dutch scholars being undeniable. Seven clusters of keywords indicate that HR policies regarding aging are transitioning from recognizing the impact of this issue on individuals, organizations, and the society to concrete solutions. Moreover, this paper also reveals some research gaps, such as the combined impact of aging and widespread adoption of AI, and the fact that existing research is too concentrated in Europe, with limited relevance to aging issues in other regions.

This paper has certain limitations as well. The first one is limitation of the database. Beyond the 164 papers selected in this study, there may be more influential articles included in other databases. Another limitation is the error in the defining process. Considering the choices in defining the criteria, some relevant literature in the database may not have been identified and included in the calculation. Finally, as a bibliometric and visualization study, this paper emphasizes macro-level research trend analysis rather than substantive in-depth research. Therefore, further systematic reviews are needed to deepen the understanding of this field.

Despite these limitations, this paper still provides meaningful insights on the current research state and future prospects in this field. It encourages more interdisciplinary research that integrates AI developments with aging issues, and suggests that countries outside Europe can also pay attention to potential demographic shifts and research into localized policies to address this problem.

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