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Mapping Research Trends on the Ageing Workforce and Economic Performance in Europe: A Bibliometric Analysis

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ABSTRACT

Population ageing is one of the most significant demographic transformations in contemporary Europe, with major implications for labour markets, productivity, pension systems, and healthcare sustainability. Although research on population ageing, healthy ageing, older people's labour market participation, and related economic issues has expanded considerably, the literature remains fragmented across economics, demography, public health, and social policy. This study addresses that gap through a comprehensive bibliometric analysis of research on the ageing workforce and its economic implications in Europe.

The analysis is based on English-language articles and review articles indexed in the Social Sciences Citation Index of the Web of Science Core Collection. Using a structured search strategy combining ageing-, economic-, and Europe-related terms, 1,437 publications published between 1993 and 2025 were identified. Bibliometrix-based performance analysis and science mapping were applied to examine publication trends, leading contributors, source influence, geographical distribution, and thematic structures.

The results show a rapidly growing, highly collaborative field with an average annual growth rate of 15.95%. The United Kingdom emerged as both the most productive and the most cited country. Ageing & Society and Sustainability were the leading publication outlets, while Social Science & Medicine showed the strongest citation impact. Keyword co-occurrence analysis revealed a thematic structure centred on ageing, migration, and economic growth, alongside retirement, pensions, labour market participation, inequality, mental health, human capital, and public health.

Overall, the study shows that this research field has become dynamic, interdisciplinary, and policy-relevant, while also highlighting the innovation potential of older workers in knowledge-based and age-diverse work environments.

INTRODUCTION

One of the defining global demographic trends of the twenty-first century is population ageing. The number of individuals aged 65 years and older has almost doubled over the past two decades and currently constitutes approximately 10% of the global population. In Europe, the process of demographic ageing is particularly advanced, with half of the population older than 45. Moreover, the number of people aged 65 and above already surpasses the number of children under the age of 15, reflecting a substantial shift in the continent's age structure (Tragaki, 2024). Projections indicate that over the coming three decades, the number of individuals aged 65 years and above is projected to rise twofold, reaching 1.6 billion in 2050, when this age group will constitute over 16 percent of the global population (UN DESA, 2023).

The proportion and absolute number of older adults are rising, driven by substantial increases in life expectancy alongside sustained declines in fertility rates. Life expectancy at birth has increased substantially worldwide over the past seven decades. It rose by more than 19 years between 1950 and 2021, rising to 73.8 years for women and 58.4 for men despite temporary setbacks during the COVID-19 pandemic. Furthermore, it is projected to increase further, reaching 80 years for women and 75 years for men by 2050 (UN DESA, 2023). In the European Union (EU), longevity remains significantly higher than the global average: life expectancy reached approximately 84 years for women and 78.7 for men in 2023, with several Member States exceeding 82 years (Eurostat, 2023). This implies that life expectancy at age 65 in the EU is now almost 20 additional years on average, indicating sustained survival gains at older ages. Meanwhile, the Total Fertility Rate (TFR) has declined since the 1960s, averaging 1.46 across OECD countries (OECD, 2025) and 1.34 in the EU (Eurostat, 2026), which is well below the level that ensures population replacement.

Population ageing and declining fertility rates represent significant structural demographic changes, placing mounting pressure on labour markets, pension systems, and healthcare services. Empirical evidence suggests that the old-age dependency ratio negatively affects economic growth by reducing productivity and limiting the accumulation of human and physical capital, as a growing share of resources is transferred to the elderly (Emerson et al., 2024). This conclusion is reinforced by studies on France, Germany, Italy, and the United Kingdom (Cooley et al., 2024), as well as Finland (Kotamäki and Lehtimäki, 2025). Together, these studies show that population ageing weakens productive capacity through labour force contraction, shifts economic activity towards lower-productivity sectors, and intensifies fiscal pressures through higher pension and healthcare expenditure. Population ageing can therefore be regarded as one of the drivers of long-term economic stagnation.

Against this backdrop, extending working lives and retaining older workers in the labour market increasingly becomes an economic necessity (Emerson et al., 2024). However, the feasibility of this response depends not only on demographic and institutional conditions, but also on the health and functional capacity of older individuals. Longer life expectancy does not necessarily imply a proportionally longer period of good health or a longer working life. According to Eurostat (2025), healthy life expectancy (HLE) in most European countries remains substantially below overall life expectancy (LE). In 2023, HLE in the EU stood at 63.1 years, approximately 18 years below average life expectancy. Moreover, evidence suggests that the gap between LE and HLE has widened over time, increasing from 8.62 to 9.72 years, and is expected to widen further, while both LE and HLE have generally remained higher in Europe (Cao, 2020). Taken together, these findings indicate that gains in longevity are not matched by equivalent gains in healthy years of life, which may limit the ability of older individuals to remain economically active.

In this context, long-term health conditions, functional limitations, mental health, and cognitive functioning continue to shape older people's participation in the labour market (Seeberg et al., 2022). Evidence on working life expectancy (WLE), based on three health dimensions - general health, physical strength, and cognitive ability - shows that the expected number of years spent in good physical health has remained relatively stable over time across European countries and has consistently exceeded the corresponding estimates for the other health dimensions. By contrast, the number of remaining years with good cognitive functioning has increased significantly over time in most European countries, particularly among

individuals aged 60-69 (Weber and Loichinger, 2022). This improvement has been attributed, at least in part, to rising educational attainment within this age group. LE with good cognitive function is also increasing among 70+-year-olds (Nielsen et al., 2022). More generally, individuals with higher levels of education not only live longer, but also spend more years both in employment and in good health (Weber and Loichinger, 2022). These findings suggest that healthy ageing may partly mitigate the adverse economic effects of population ageing, as improvements in the health of older individuals – particularly in cognitive capacities – are associated with higher labour force participation, longer working hours, greater productivity, and higher annual earnings (Gruss et al., 2025).

At the same time, these findings indicate that an ageing workforce should not be viewed exclusively through the lens of decline. Although some components of fluid intelligence tend to weaken with age, crystallised intelligence – accumulated knowledge, domain-specific expertise and judgement – is more stable and may continue to develop into later life, partly compensating for slower processing speed in many work contexts (Wong and Tetrick, 2017). Furthermore, scientific evidence indicates that lifestyle-related activities may mitigate the association between brain markers and cognitive performance, highlighting the potential of tailored health policies to reduce cognitive decline and delay the onset of dementia (Song et al., 2022). Thus, public health measures that encourage consistent physical activity, healthy eating, mental well-being, and social engagement are crucial for preventing chronic diseases and postponing functional decline among older adults (Huang et al., 2023; Lai and Woo, 2023).

The fact that accumulated knowledge, expertise, and judgement may continue to develop into later life, is especially relevant in knowledge-intensive and analytical occupations, where performance depends not only on speed but also on experience-based reasoning, problem framing, and the integration of complex information. Consistent with this perspective, meta-analytic evidence shows that older workers and employees with longer tenure are no less likely to engage in innovation-related behaviour than their younger counterparts (Ng and Feldman, 2013), while firm-level evidence suggests that age diversity can raise productivity in companies engaged in innovative and creative tasks (Backes-Gellner and Veen, 2013). This interpretation is also broadly consistent with more recent inventor-level evidence from Italy showing that, in the transition from independent to organisational inventorship, the role of age is negligible (Caviggioli, 2026), suggesting that age alone need not be regarded as a major constraint on innovative career development.

From a policy perspective, this implies that strategies for responding to demographic ageing should aim not only to extend working lives, but also to unlock the innovation potential of older workers through lifelong learning, age-inclusive management, healthy working conditions, and intergenerational knowledge exchange. This view is also consistent with more recent evidence indicating that younger employees' expressions of gratitude can encourage knowledge sharing by older employees, pointing to the importance of relational and age-inclusive workplace practices in supporting intergenerational knowledge exchange (Huang and Li, 2026). This interpretation is reinforced by recent OECD analyses (2025; 2026), which suggest that effective responses to demographic ageing should combine longer working lives with lifelong skill development, age-inclusive labour market practices, and healthy, age-friendly working environments to sustain productivity and better mobilise the contribution of older workers. This argument can be extended to the digital transformation of work, as broader research on sustainable human resource management suggests that organisations need to develop appropriate capabilities and work arrangements to minimise the harmful effects of digitalisation on workers (Dabić et al., 2023).

From a demographic perspective, the notion of population ageing, first introduced by Sauvy (1928), refers to structural shifts in the age composition of the population resulting from declining fertility and increasing life expectancy. In contemporary Europe, these shifts are closely linked to labour market dynamics, as older individuals – particularly those aged 55–64 – constitute a growing share of the workforce (Egdell et al., 2021). At the same time, the literature uses a range of related terms, including population ageing, ageing workforce, older workers, and older adults, which reflect different disciplinary perspectives and contribute to conceptual fragmentation in the field. The terminology used to describe older populations is not conceptually neutral and often reflects different theoretical and disciplinary perspectives. Terms such as "old" or "elderly" have frequently been associated with deficit-oriented interpretations of ageing

(Iversen et al., 2009; Langmann and Weßel, 2023), whereas "older adults" is generally considered more neutral and better suited to reflect the heterogeneity of this population, including differences in health status, economic activity, and social participation (Fields et al., 2018; Ivic et al., 2021; 2023).

Although a substantial body of research has examined population ageing, its economic implications, healthy ageing, healthy life expectancy, working life expectancy, and labour market participation in later life, this literature remains fragmented across economics, public health, demography, and social policy. In the European context, this fragmentation is particularly important, as Europe combines advanced population ageing, persistently low fertility, and substantial cross-country differences in labour market institutions, pension systems, health outcomes, and older workers' employment patterns. As a result, there is still limited systematic understanding of how research on the ageing workforce and its economic implications in Europe has evolved over time, which authors, journals, and countries have shaped the field most strongly, and which thematic clusters and emerging research directions currently define it. In this context, bibliometric analysis provides a suitable approach for mapping the intellectual, conceptual, and geographical structure of the literature. Therefore, this study aims to provide a comprehensive bibliometric overview of research on the ageing workforce and its economic implications in Europe by analysing publication dynamics, influential contributors, collaboration patterns, and thematic developments, while also identifying research gaps and future research avenues.

1. DATA AND METHODOLOGY

This study employs bibliometric analysis, a vital research area in the social sciences that applies quantitative and statistical tools to systematically examine a wide variety of academic literature (Xu et al., 2025). This method is crucial for going beyond qualitative descriptions and systematically analysing and comprehending the inherent dynamics, patterns, and general structure of a particular topic of study (Shahid et al., 2024). The primary objective of conducting a bibliometric analysis is to gain a broad perspective on key concepts, identify core intellectual structures, and capture emerging research trends and trajectories, which are difficult for traditional systematic literature reviews to accomplish when working with large, rapidly changing datasets (Hoerler et al., 2025). Fundamentally, bibliometrics consists of two main processes: science mapping, which uses methods like co-citation and co-word analysis to graphically depict the conceptual structure and relationships among various scientific elements, and performance analysis, which measures the influence and productivity of authors, institutions, and journals (Babajic et al., 2022). This methodology facilitates a thorough assessment of the current body of information about the ageing workforce and economic performance by offering these objective, measurable insights, which aid in identifying possible research gaps and future opportunities.

1.1 Data source

The requisite dataset for this bibliometric analysis was systematically retrieved from the Web of Science (WoS) Core Collection. The Web of Science Core Collection represents one of the most widely used and reputable databases for bibliometric research, providing high-quality citation indexing and standardised metadata suitable for large-scale quantitative analysis. This platform was specifically selected to guarantee that the analysis is based on reliable, well-respected, peer-reviewed scientific data (Dote-Pardo et al., 2025). The publications included in the Social Sciences Citation Index Expanded (SSCI) category were the specific focus of this investigation. This index is well-known throughout the world for including academic journal articles in the social sciences that go through a rigorous peer review process, ensuring reliable and high-quality content. Additionally, publications that were obtained from this database show a significant level of academic influence, which is often demonstrated by citations from other researchers (Xu et al., 2025). WoS is very useful for quantitative analysis since it offers organised metadata. Complex bibliometric methodologies require this structured data, which includes unique identifiers (IDs), Digital Object IDs (DOIs), publishing journal information, publication years, reference lists, and author information (Hoerler et al., 2025).

The search strategy was applied to the **Topic (TS)** field, which includes titles, abstracts, and author keywords. This approach ensures that all retrieved publications explicitly address the core themes of the study.

The precise search string used was:

```
TS = ((ageing OR aging OR "ageing workforce" OR "aging workforce" OR "older workers" OR "population ageing" OR "population aging")
AND
("economic growth" OR productivity OR "labour market" OR "labor market" OR "economic performance" OR employment)
AND
(Europe OR "European Union" OR EU OR "EU countries" OR "Euro area" OR "Western Europe"))
```

To guarantee the scientific rigour and relevance of the retrieved dataset, several filters and categorical restrictions were applied. Due to the inherent focus of the study on socio-economic and policy discussions, the search results were strictly limited to documents indexed in the Social Sciences Citation Index Expanded (SSCI) category. Additionally, the document types were restricted to only include Article or Review Article to focus exclusively on original research contributions and thorough scholarly overviews. Finally, the language criterion was limited to English for standardisation and efficient analysis.

1.2 Methodology

The data retrieved from the Web of Science Core Collection were subjected to a two-fold bibliometric methodology: Performance Analysis and Science Mapping. Performance analysis focuses on evaluating the productivity and impact of research constituents (authors, journals, and countries), while science mapping delineates the intellectual and conceptual structure of the field (Babajic et al., 2022).

Before selecting the analytical tools, a comparison between the two most widely adopted bibliometric software - VOSviewer and Bibliometrix – was conducted to ensure methodological robustness. Bibliometric analysis can integrate both tools: Bibliometrix, an R-based package accessible via the Biblioshiny interface, and VOSviewer, a standalone software specialising in visualisation (Oyewola and Dada, 2022). VOSviewer is highly valued for its graphical intuitiveness and advanced visualisation capabilities, making it particularly effective for constructing and examining bibliometric networks (Mondal, 2025). However, its functionality is limited exclusively to science mapping visualisations. In contrast, Bibliometrix offers a more comprehensive analytical environment, enabling both performance analysis and science mapping. Although it is generally less intuitive and requires greater technical familiarity than VOSviewer, Bibliometrix provides a complete and reproducible workflow for large-scale bibliometric investigations (Lim et al., 2024). Accordingly, this study employs Bibliometrix as the primary analytical tool due to its comprehensive capacity to conduct both performance analysis and science mapping within a single, reproducible framework.

To ensure methodological transparency and replicability, the bibliometric analysis followed a structured multi-stage workflow, as illustrated in Fig. 1. The process consisted of five consecutive steps, beginning with data retrieval and culminating in interpretation of the analytical results.

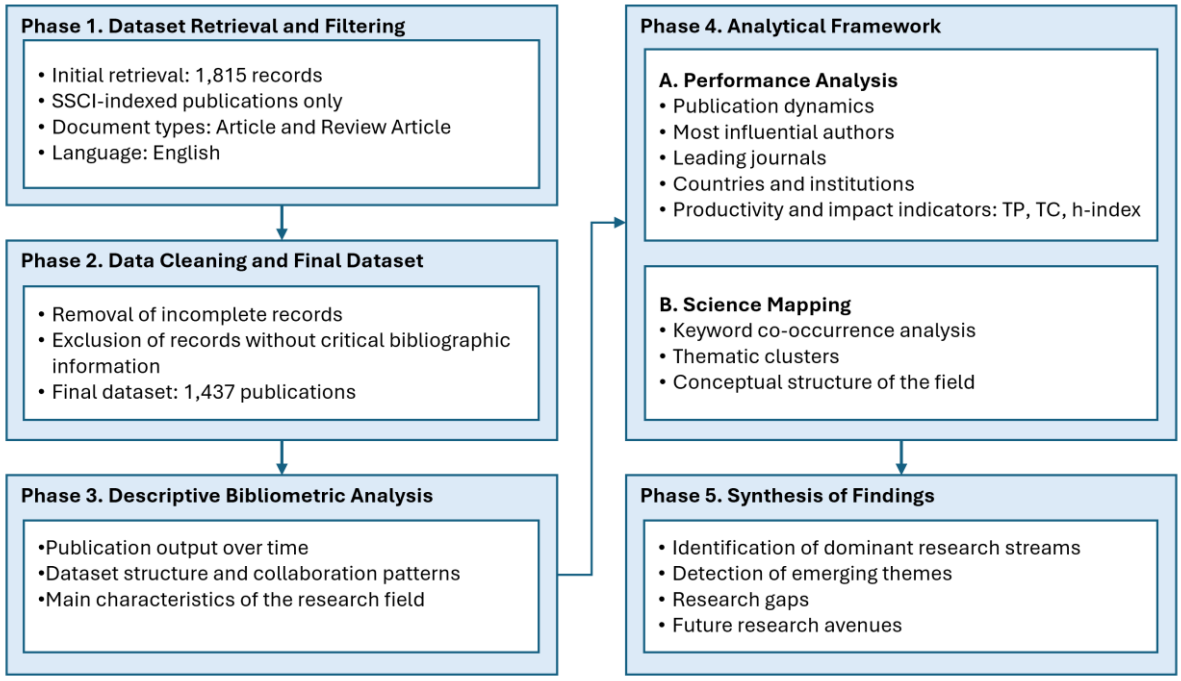

Figure 1. Analytical framework and workflow
Source: Compiled by the authors

The workflow began with the retrieval of 1,815 publications from the Web of Science Core Collection. The dataset subsequently went through a data cleaning process, during which records missing critical bibliographic details, such as DOIs or author keywords, were eliminated. After refinement, 1,437 publications remained and were used as the final analytical dataset. Then, a descriptive analysis was conducted to identify the primary bibliometric indicators and to describe the initial features of the research environment. These initial procedures provided the foundation for the two-stage analytical approach consisting of Performance Analysis and Science Mapping.

Performance Analysis employs established quantitative and statistical techniques to evaluate the scientific output and impact of contributors within the research field. This analysis focuses on measuring the productivity and influence of authors, journals, institutions, and countries. This involves calculating key bibliometric metrics, such as the Total Number of Publications (TP), Total Citations (TC), and the h-index, to provide objective data on academic relevance (Yamaguchi et al., 2022). Specifically, the study first analyses Publication Dynamics by charting the annual growth to identify phases of emergence and acceleration, thereby establishing the temporal evolution of the field. Subsequently, the Key Authors and Journals are identified using these productivity and impact metrics. Finally, the Country/Region Distribution is evaluated by mapping the concentration of research activity, citation strength, and collaborative networks across geographical regions, using Bibliometrix for structural feature visualization.

The second analytical phase involves Science Mapping, which is designed to graphically depict the intellectual structure and underlying conceptual relationships within the research field (Shahid et al., 2024). This quantitative approach relies heavily on network analysis functionalities provided by the Bibliometrix package in R, which facilitates rigorous visual and statistical analysis of textual data. To determine the conceptual structure and identify the field's main research hotspots, co-word analysis (keyword co-occurrence) is performed. This technique maps significant keywords appearing together in the literature, subsequently grouping them into thematic clusters. Furthermore, the chronological evolution of research themes over time is tracked using methodologies like keyword timeline analysis or burst detection (Aggarwal and Karwasra, 2023). This temporal analysis is crucial for identifying established and nascent research fronts, thus illustrating the dynamic trajectory of academic inquiry related to the ageing workforce and economic performance.

By combining these performance and mapping techniques, the study aims to provide a comprehensive and quantitative overview of the research landscape concerning the ageing workforce and economic performance in Europe, thereby identifying potential knowledge gaps and outlining future research avenues. Similar analytical approaches, combining performance metrics and clustering using Bibliometrix, have been effectively utilised in studies mapping research frontiers in diverse fields.

2. EMPIRICAL RESULTS

2.1 Descriptive analysis

The descriptive analysis provides an initial overview of the structure and development of the scientific literature on the relationship between the ageing workforce and economic performance in Europe. The final dataset comprises 1,437 publications by 4,178 distinct authors. The documents are distributed across 548 sources, indicating a wide dispersion of research activity across journals and academic platforms. Fig. 2 summarises the main characteristics of the dataset. The results reveal a highly collaborative research field, with over 83% of publications resulting from co-authorship. This pattern suggests that research on the ageing workforce and economic performance increasingly relies on interdisciplinary cooperation involving economists, sociologists, demographers, and public health researchers. Furthermore, the average annual growth rate of 15.95% indicates a rapidly expanding academic interest in the relationship between population ageing and economic performance.

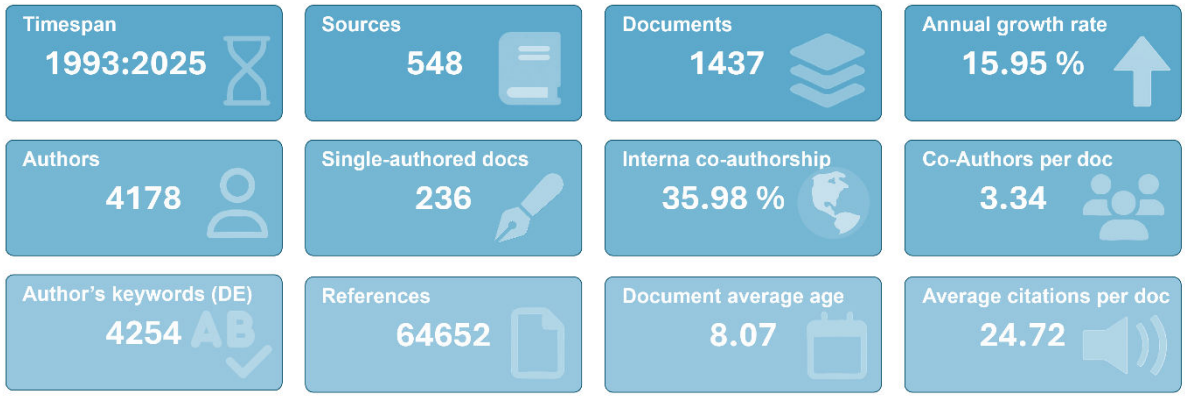

Figure 2. Dataset Overview
Source: Authors' elaboration based on Web of Science Core Collection data using Bibliometrix

Fig. 3 shows the evolution of scientific production between 1993 and 2025. The number of publications remained relatively modest during the 1990s and early 2000s but began to increase markedly after the global financial crisis. This acceleration reflects growing policy concerns related to demographic ageing, labour shortages, and the sustainability of pension systems across Europe. However, in 2023, the number of publications decreased and has not yet reached its peak in recent years. The slight decline may be attributed to delays in database indexing rather than a structural reduction in research activity.

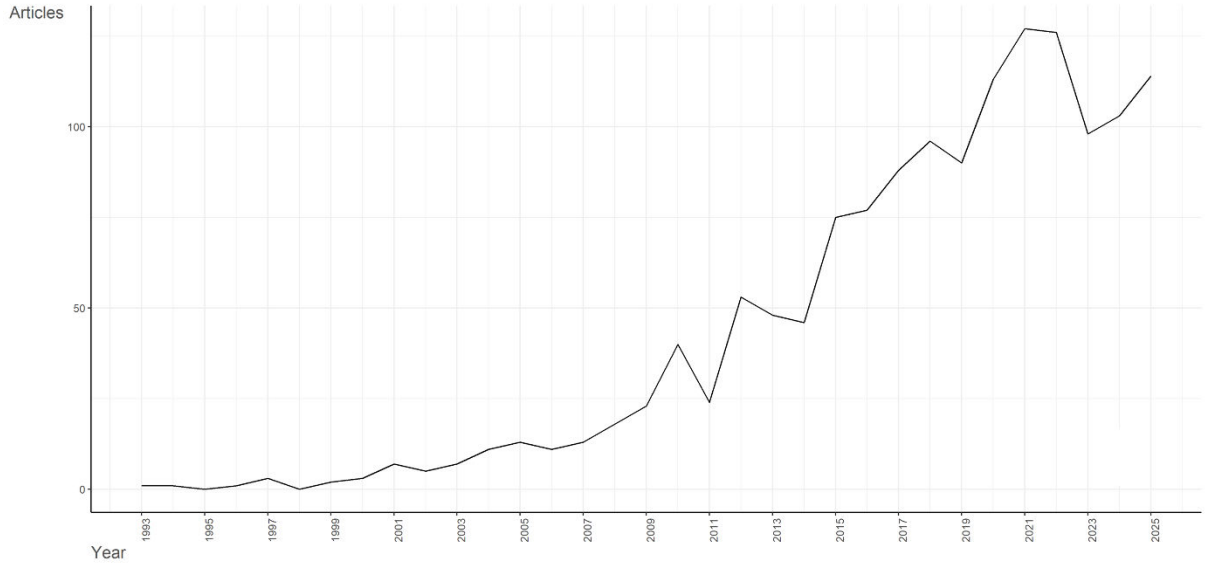

Figure 3. Annual scientific production
Source: Authors' elaboration based on Web of Science Core Collection data using Bibliometrix

Overall, the descriptive statistics reveal that the academic literature on the ageing workforce and economic performance has evolved into a dynamic and rapidly growing field characterised by strong collaboration and increasing interdisciplinary engagement.

2.2 Performance analysis

2.2.1 Authors

Table 1 presents the Top 50 authors in the dataset, ranked by total citations (TC), along with their number of publications (NP), citations per article (CA), and h-index. The table highlights the twelve highest values within each indicator, providing a consolidated view of both productivity and scientific impact in the field.

In terms of productivity, Burdorf A. and Henkens K. emerge as the most relevant authors, each contributing 13 publications, followed by Wahrendorf M. with 10 publications. In contrast, when citation impact is considered, clear differences emerge among these leading contributors. Burdorf A. ranks first in total citations (TC = 729), indicating the strongest overall scholarly influence in the dataset. Henkens K., despite an equal publication output, records a lower total citation count (TC = 504), while authors such as Foster L. (TC = 516) and Robroek SJW (TC = 395) achieve comparatively high citation impact with fewer publications. At the same time, while Burdorf A. and Henkens K. demonstrate the highest publication output, Foster L. exhibits a particularly high citation intensity, indicating that a smaller number of publications can still achieve significant scholarly influence. This is further reflected in citations per article (CA), where Foster L. shows the highest average impact (CA = 172), highlighting that fewer publications can achieve substantial scholarly influence.

Table 1. Top 50 authors by total citations, number of publications, citations per article and h-index

No.	Author	TC	NP	CA	h-index
1	BURDORF A	729	13	56	9
2	FOSTER L	516	3	172	3
3	HENKENS K	504	13	39	10

No.	Author	TC	NP	CA	h-index
26	BOOT CRL	127	3	42	3
27	BUFFEL V	125	4	31	4
28	ALONSO J	123	3	41	3

4	ROBROEK SJW	395	8	49	6	29	DINGEMANS E	117	4	29	4
5	WAHRENDORF M	387	10	39	8	30	BENAVIDES FG	114	5	23	4
6	DE WITTE H	302	3	101	3	31	HELGESSON M	110	4	28	4
7	VAN DALEN HP	300	5	60	5	32	BLOOM DE	98	3	33	3
8	AVENDANO M	296	6	49	6	33	DE BEER J	94	3	31	3
9	LEVECQUE K	276	4	69	4	34	JENSEN PH	82	4	21	4
10	SCHIPPERS J	269	5	54	5	35	MITTENDORFER-RUTZ E	78	4	20	4
11	SCHURING M	269	6	45	4	36	RUGULIES R	68	4	17	4
12	SIEGRIST J	255	4	64	4	37	ANDERSEN LL	63	4	16	3
13	GIANNAKIS E	203	3	68	3	38	BURSTRÖM B	55	4	14	4
14	VAN DER BEEK AJ	201	4	50	4	39	RIEKHOFF AJ	51	6	9	4
15	BRACKE P	200	8	25	7	40	ALEXANDERSON K	51	5	10	4
16	MÖHRING K	185	6	31	5	41	DOORLEY K	51	3	17	3
17	RADL J	181	4	45	4	42	FLORES M	41	3	14	3
18	HARO JM	179	7	26	7	43	FLEK V	36	4	9	3
19	DRAGANO N	173	6	29	5	44	CUARESMA JC	36	3	12	3
20	CRISTEA M	173	3	58	3	45	TUR-SINAI A	34	5	7	4
21	ARTAZCOZ L	169	7	24	5	46	AXELRAD H	34	3	11	3
22	BAMBRA C	158	3	53	3	47	BERTOGG A	32	3	11	3
23	BATEN J	150	3	50	3	48	DRESLEROVÁ D	31	3	10	3
24	BRUGIAVINI A	135	4	34	3	49	CARMICHAEL F	30	3	10	3
25	PRSKAWETZ A	131	4	33	4	50	DE ALMEIDA JMC	28	3	9	3

Note: TC – total citations; NP – number of publications; CA – citations per article.
Source: Authors' compilation based on Web of Science Core Collection data

In order to quantify the cumulative impact and relevance of an individual's scientific research output, the h-index was chosen as a particularly simple and useful single metric for characterization. This index provides an estimate of a scientist's broad impact by reflecting the maximum number (h) of published papers that have each garnered at least h citations (Hirsch, 2005). Table 1 shows that Henkens K. exhibits the highest impact (h = 10), indicating a consistently strong citation performance across his publications. Burdorf A. is ranked second with an h-index of 9, indicating significant scholarly importance, however, his relative effect is slightly lower despite comparable publication volume. Wahrendorf M. (h = 8), Bracke P. (h = 7) and Haro JM. (h = 7) also demonstrate notable and sustained influence within the field. The other authors have moderate influence levels, with h-indices ranging from 3 to 6, demonstrating a research landscape dominated by a small number of extremely significant contributions and a larger group of moderately influential authors.

Beyond differences in scholarly impact, publication activity also varies over time. The majority of articles were published by Burdorf A. in 2015, and Henkens K. in 2012, as illustrated in Fig. 4. The main authors published most of their articles between 2013 and 2015.

Fig. 4 further illustrates the temporal distribution of publication activity among the most productive authors. The majority of influential contributions were published between 2013 and 2015, suggesting that this period represented an important phase of consolidation within the field.

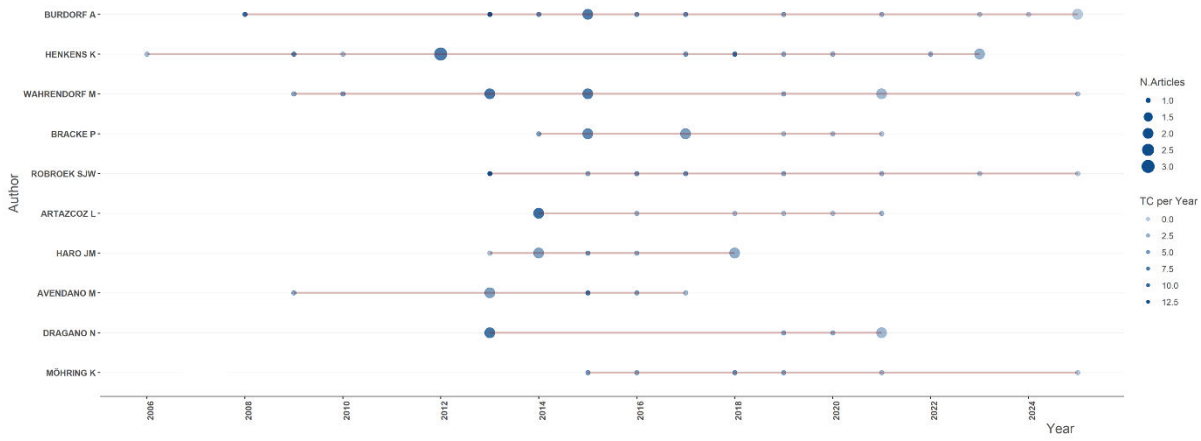

Figure 4. Authors' production over time
Source: Authors' elaboration based on Web of Science Core Collection data using Bibliometrix

To explain how frequently authors publish, we use Lotka's law, which says that authors who publish a large number of articles become less frequent as the number of publications rises (Lotka, 1926). Fig. 5 shows that the empirical authorship distribution (solid line) closely follows Lotka's theoretical pattern (dashed line), indicating that the field is dominated by single-publication authors, while highly productive authors constitute only a very small proportion of contributors.

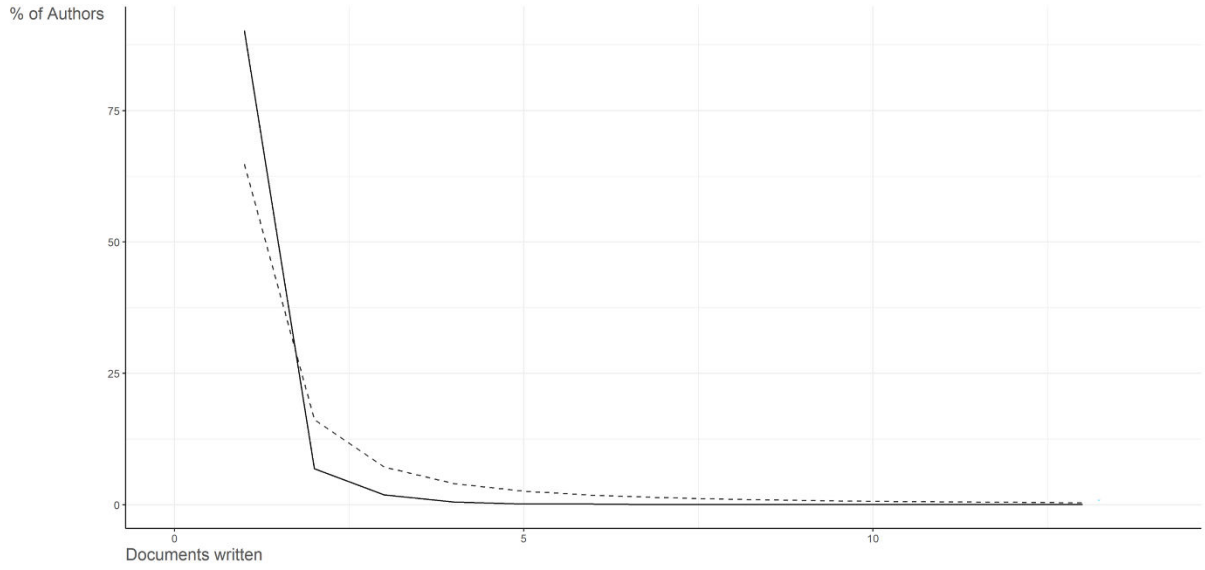

Figure 5. Lotka's law
Source: Authors' elaboration based on Web of Science Core Collection data using Bibliometrix

This distribution pattern suggests that the research field is characterised by a relatively small core group of specialised scholars who contribute consistently to the literature, while a much larger group of researchers participate only occasionally. Such a structure is typical of interdisciplinary research areas that attract contributors from multiple academic disciplines. The presence of numerous single-publication authors further indicates the expanding academic interest in the economic implications of population ageing.

2.2.2 Sources

Among the journal productivity, Fig. 6 shows the most productive journals. The leading journals in this field are *Ageing & Society* and *Sustainability* with 43 publications for each. However, Fig. 7 shows that *Social Science & Medicine* is the top-cited journal with 798 citations, significantly outperforming others.

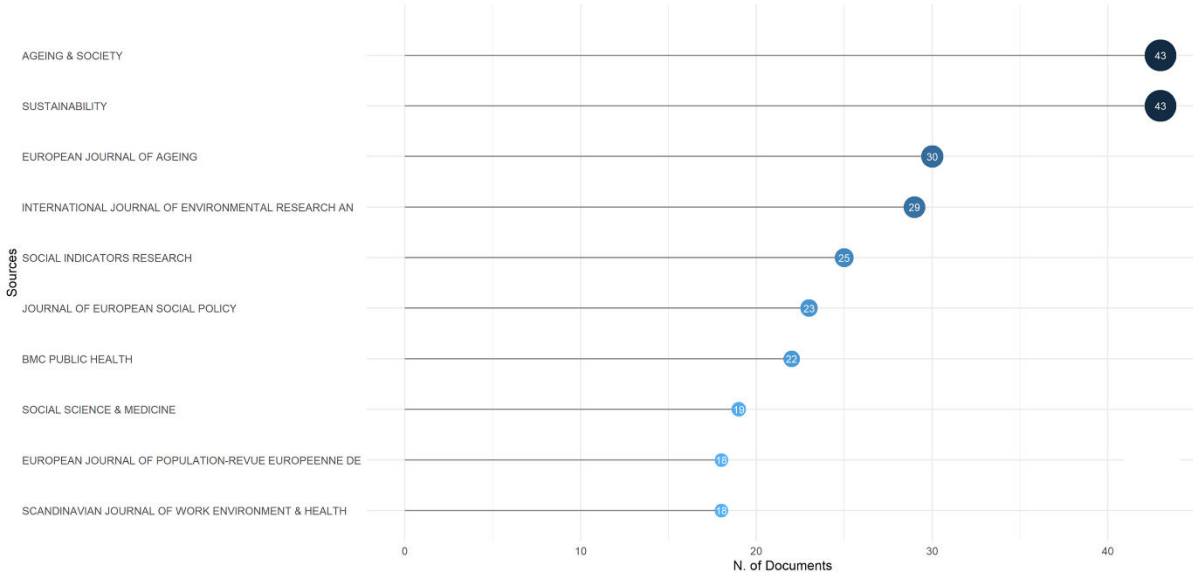

Figure 6. Top 10 Most Productive Journals
Source: Authors' elaboration based on Web of Science Core Collection data using Bibliometrix

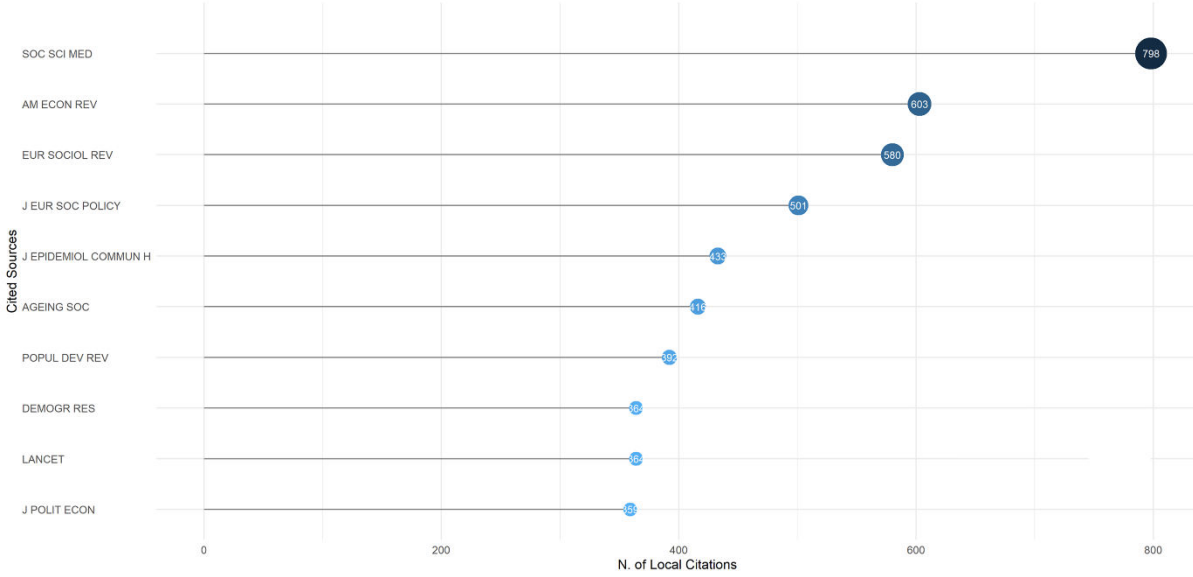

Figure 7. Top 10 most local cited sources
Source: Authors' elaboration based on Web of Science Core Collection data using Bibliometrix

Fig. 8 illustrates the cumulative production of the most relevant journals over time, highlighting how their contribution to the field has evolved since 2005. *Ageing & Society* shows the most sustained and consistent growth, with a steady increase beginning around 2006 and accelerating particularly after 2016. *Sustainability*, in contrast, exhibits a sharper and more sudden rise starting around 2017, indicating its rapid emergence as a key outlet in this research area. *The European Journal of Ageing* and the International *Journal of Environmental Research and Public Health* show moderate but continuous growth patterns, demonstrating stable and ongoing engagement with topics related to ageing workforce and economic performance. *Social Indicators Research* grows more slowly, but becomes more noticeable after 2019. Overall, the cumulative trajectories reveal that journal productivity in this field has increased primarily over the previous decade, with a notable expansion of publication activity across several major outlets.

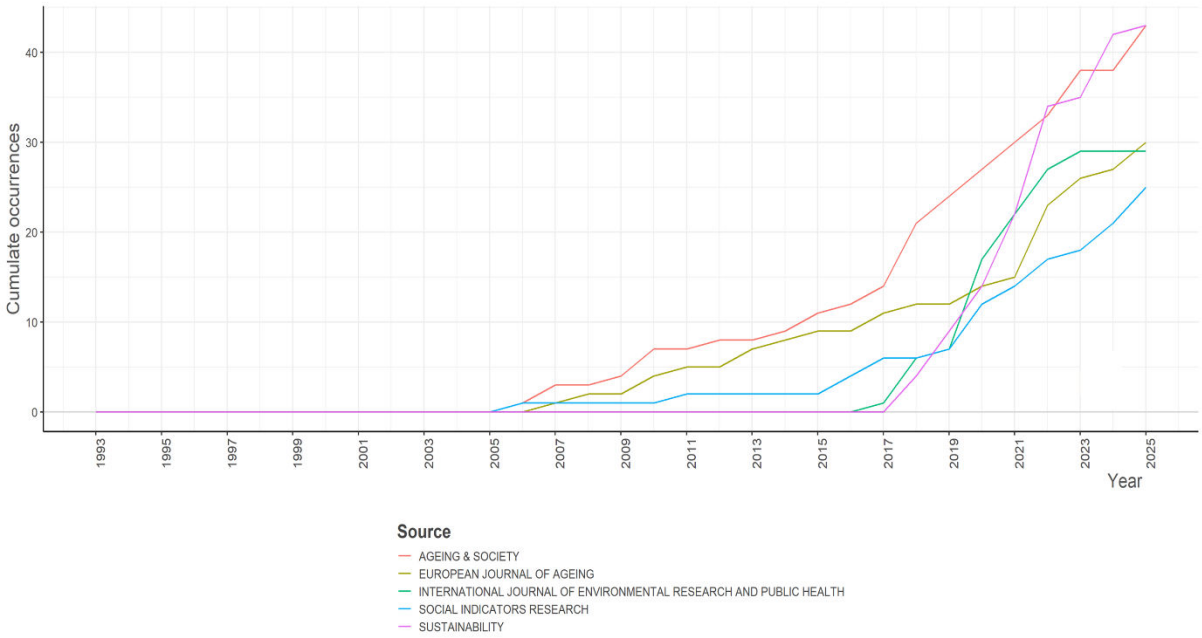

Figure 8. Top 5 sources' production over time
Source: Authors' elaboration based on Web of Science Core Collection data using Bibliometrix

Fig. 9 shows the journals with the highest local impact measured by the h-index. The h-index here reflects the number of articles published in each source that have received at least h citations within the dataset. *Ageing & Society* demonstrates the highest local impact (h = 16), indicating that it hosts the largest number of consistently and highly cited papers in this research field. It is followed by the *European Journal of Population* and *Social Science & Medicine* (h = 15), both of which also serve as central outlets for influential scientific work.

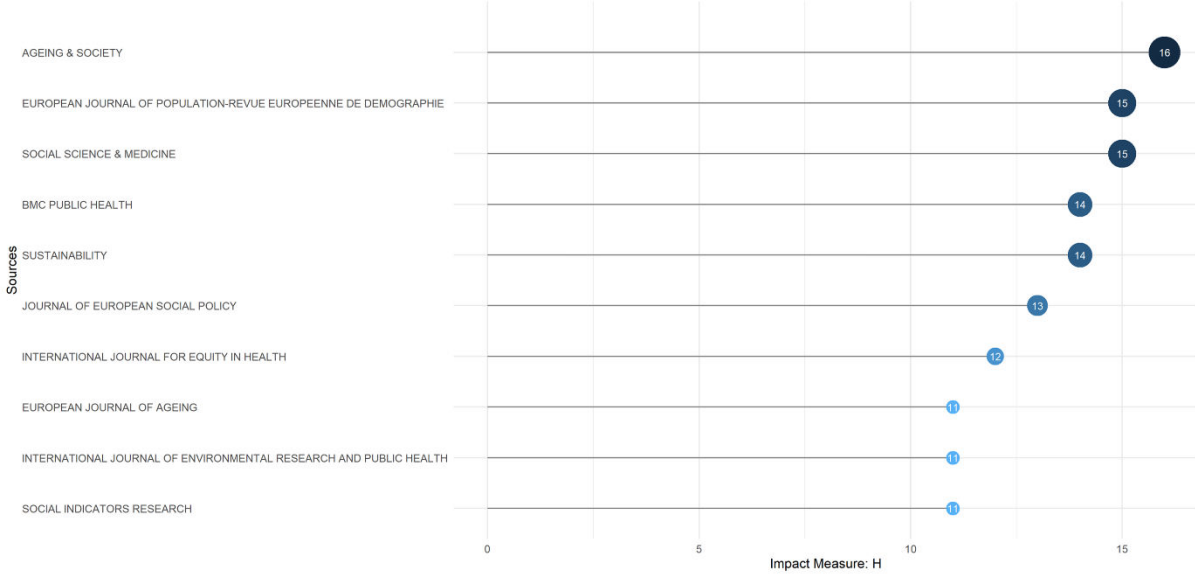

Figure 9. Sources' local impact
Source: Authors' elaboration based on Web of Science Core Collection data using Bibliometrix

Taken together, these findings indicate that while publication output has expanded across multiple journals, a relatively small group of core sources continues to concentrate on the most influential research within the field.

2.2.3 Countries and Institutions

Fig. 10 illustrates the global distribution of scientific production related to the ageing workforce and economic performance. The map shows that the United Kingdom stands out as the most productive country, followed by Germany, Spain, the Netherlands, the United States, and Italy. Most contributions originate from Europe and North America, while countries in Africa, the Middle East, and parts of Asia show substantially lower publication activity. Overall, the figure reflects a strong concentration of research output in high-income and research-intensive regions.

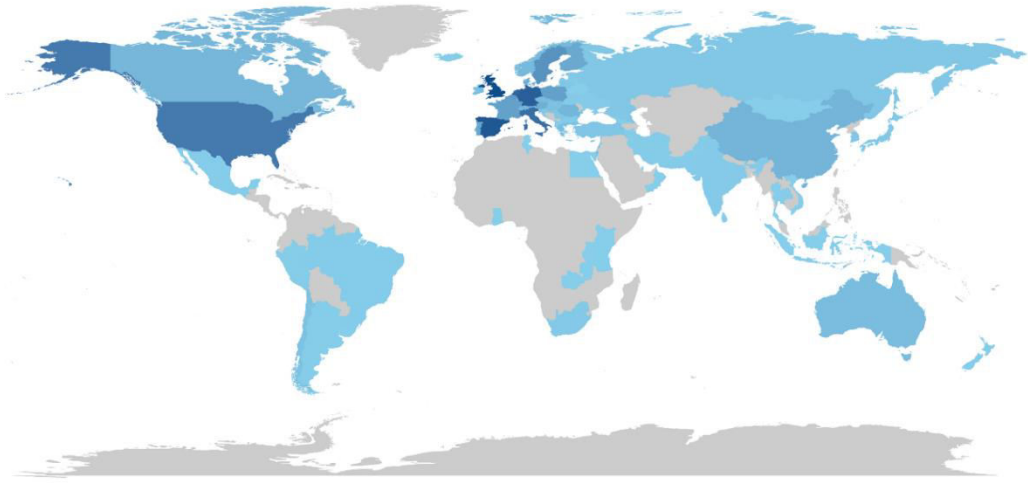

Figure 10. Countries' scientific production
Source: Authors' elaboration based on Web of Science Core Collection data using Bibliometrix

In terms of citations, the United Kingdom ranked first with 6010 total citations, followed by the Netherlands with 3612 and Germany with 3227 (Fig. 11). However, when looking at average citations per article, Fig. 12 shows that the United Kingdom drops to fourth place (40.9 citations per article). Turkey shows the highest citation impact, with an average of 54.4 citations per article, followed by Iran (52.5) and Cyprus (45), indicating that while these countries produce fewer publications overall, their individual articles tend to achieve higher citation impact.

Figure 11. Top 10 most cited countries Total Citations
Source: Authors' elaboration based on Web of Science Core Collection data using Bibliometrix

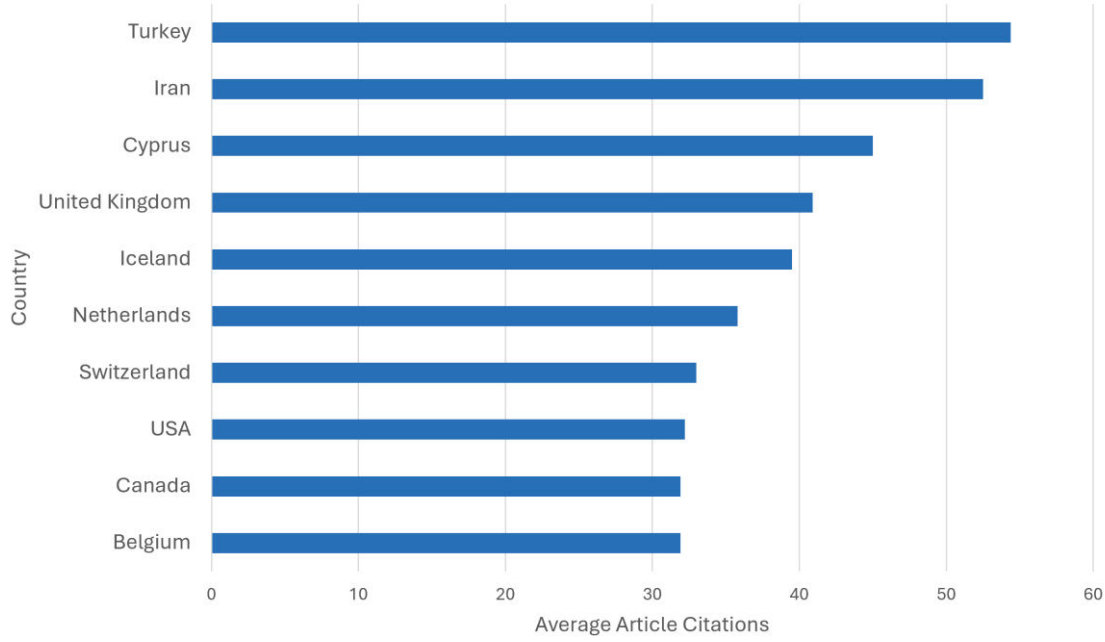

Figure 12. Top 10 most cited countries Average Article Citations
Source: Authors' elaboration based on Web of Science Core Collection data using Bibliometrix

Analysing the affiliations of publications helps understand the core institutions involved in the research of the ageing workforce and economic performance. Fig. 13 demonstrates that the University of London stands out with a significantly higher number of articles than other institutions, highlighting the United Kingdom's robust research capabilities in this field. At the same time, four of the Top 10 contributing institutions are located in the Netherlands, indicating a particularly high level of institutional involvement and intellectual commitment within the country.

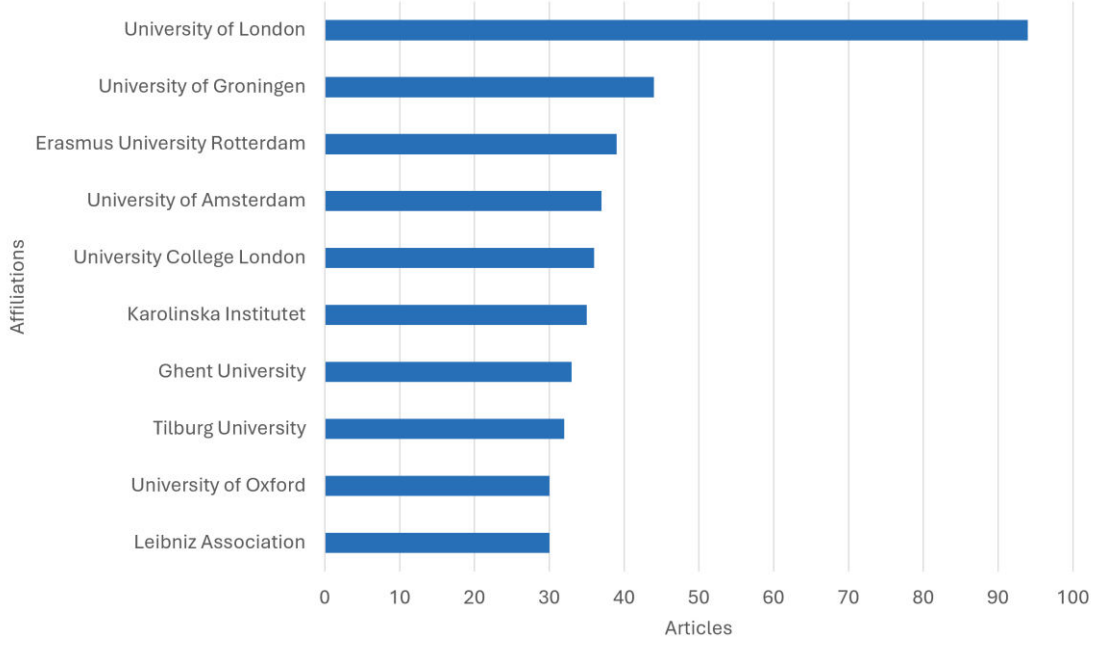

Fig. 13. Top 10 most relevant affiliations
Source: Authors' elaboration based on Web of Science Core Collection data using Bibliometrix

Overall, these findings reveal a geographically concentrated yet structurally differentiated research landscape, where high-output countries dominate in volume, while smaller contributors achieve notable impact through highly cited individual publications.

2.3 Science Mapping: keyword co-occurrence

Fig. 14 presents the co-occurrence of the author keywords in publications on the ageing workforce and economic performance. The nodes represent keywords, and the connections between them imply that these words appear in the same publications. The size of the nodes is determined by keyword frequency, while the thickness of the lines connecting them represents the intensity of the relationship.

The triangular core of the network is formed by three highly interrelated concepts: ageing, migration, and economic growth. Their close proximity and rich interlinkages indicate that these topics constitute the field's core analytical frameworks. They address the core research question of how demographic ageing interacts with labour mobility and larger macroeconomic dynamics to impact workforce participation and economic performance. Around this centre are several distinct themes, each representing a different aspect of the larger study environment. The ageing cluster includes terms like older workers, retirement, and pensions, indicating a heavy emphasis on later-life labour participation, retirement transitions, structural demographic change, and the sustainability of retirement systems.

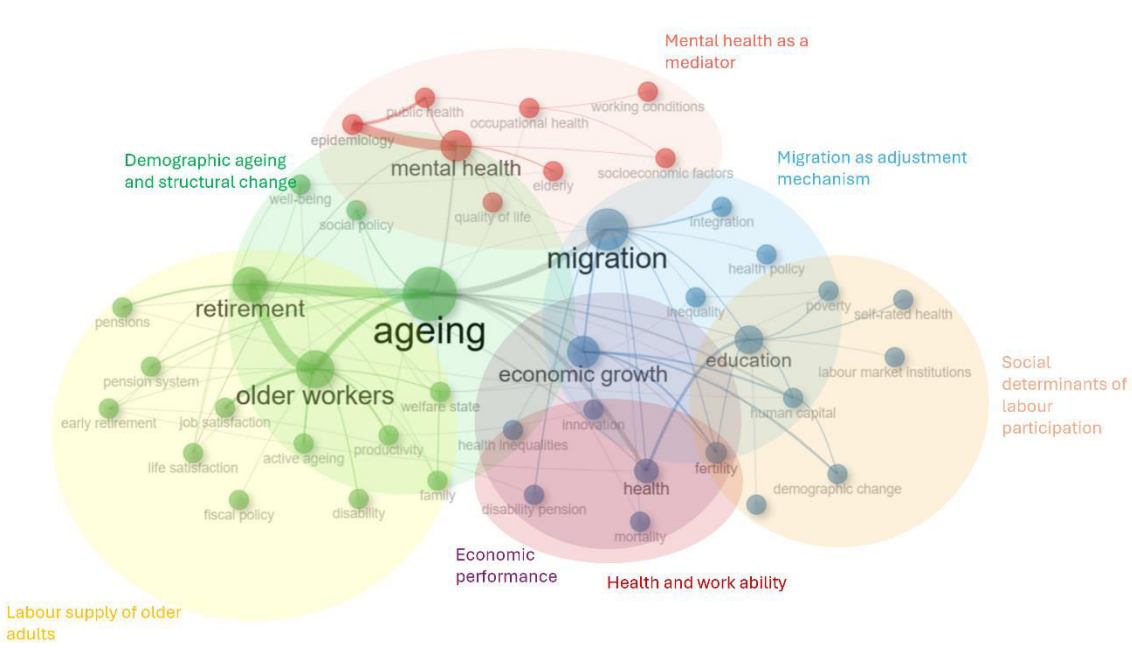

Figure 14. Co-occurrence of keywords
Source: Authors' elaboration based on Web of Science Core Collection data using Bibliometrix

The migration cluster focuses on topics such as education, health, inequality, and integration, demonstrating how migration is considered both as an adjustment mechanism and as a factor impacting labour supply, skill composition, and social integration.

The economic growth cluster links keywords such as innovation, fertility, human capital, and demographic change, suggesting that this cluster's study focuses on the macroeconomic consequences of demographic ageing, including its impact on productivity growth, labour supply, and long-term economic performance.

The mental health cluster emphasises psychological and social aspects, using terms such as epidemiology, quality of life, working conditions, and public health. This suggests that mental health is commonly researched as both an outcome and a moderating factor in the relationship between ageing, employment conditions, and labour market involvement.

Each thematic area is represented by a colour oval that groups keywords that are closely related. The labels for these thematic domains are placed around the outside edge of the map, indicating the broader conceptual divisions into which the keywords have been organised. These coloured categories have an essential interpretative function: they identify major paths of investigation within the subject and demonstrate how frequently these areas intersect. The clustering illustrates that, while the topics are separate, they remain interconnected. For example, mental health is closely linked to ageing and labour-market involvement, migration intersects with education, inequality, and demographic dynamics, and economic performance connects human capital, population change, and health-related aspects. Overall, the conceptual map depicts a diversified and well-integrated research landscape.

The bibliometric analysis conducted shows that, in addition to traditional topics such as population ageing, labour market participation, and economic growth, new interdisciplinary research fields are becoming increasingly prominent. The interaction between migration and ageing is becoming increasingly important, and it is being analysed in the literature as a potential mechanism for addressing labour shortages. There is also an increasing importance of mental health, quality of life, and working conditions, which are seen as key factors influencing older adults' participation in the labour market. In addition, there is a rising interest in how human capital, education, and innovation might help mitigate the negative effects of demographic changes on economic growth.

Despite the growing number of studies, significant research gaps remain. The literature lacks integrated studies that analyse demographic, economic, and health aspects simultaneously, even though their interplay is critical to understanding the impact of an ageing workforce on the economy. Furthermore, although mental health is becoming an increasingly important topic, it remains notably isolated from traditional economic analysis, suggesting that this dimension is only partially integrated into research on productivity and the labour market. Also, while migration is an important issue, it is frequently treated as a distinct process, with limited relation to the active participation of older workers and the structure of the labour market.

Based on the findings, several potential directions for future research can be identified. Future research should focus on deepening multidisciplinary approaches, such as combining economic, demographic, and public health evaluations or analysing the relationships between healthy ageing and labour market participation. In addition, research examining the interplay among migration, technological change, and population ageing has significant potential, particularly for assessing their long-term impact on labour supply and productivity. Greater attention should also be paid to the conditions under which older workers contribute to innovation, knowledge transfer, and productivity in age-diverse teams and knowledge-intensive sectors.

CONCLUSION

The study set out to map research on the ageing workforce and economic performance in Europe and shows that the field has developed into a rapidly expanding, highly collaborative, and multidisciplinary area of inquiry. Based on 1,437 publications indexed in the Social Sciences Citation Index and published between 1993 and 2025, the analysis identified an average annual growth rate of 15.95% and a high prevalence of co-authorship, indicating sustained interdisciplinary engagement across economics, demography, sociology, public health, and related fields.

The performance analysis further shows that the field is dynamic but structurally concentrated. Author productivity and influence are unevenly distributed, with a relatively small core of recurrent contributors and a much larger group of occasional authors. At the journal level, Ageing & Society and Sustainability emerged as the leading publication outlets, while Social Science & Medicine demonstrated the strongest

citation impact. Geographically, the United Kingdom occupies the central position in both publication output and total citations, while the institutional landscape is led by the University of London and marked by particularly strong representation of Dutch institutions.

The science mapping results indicate that the literature is structured around several interconnected core themes, the most important of which are population ageing, migration, and economic growth. Around this core, the field extends to retirement, pensions, labour market participation, inequality, mental health, human capital, public health, and innovation. Taken together, these patterns suggest that research is moving beyond fragmented disciplinary perspectives towards a more integrated understanding of how demographic change interacts with labour markets, health, and broader socio-economic conditions.

At the same time, the analysis identifies several important gaps. Studies that jointly examine demographic, economic, and health dimensions remain limited; mental health is still only partially integrated into mainstream economic analysis; and migration is often treated separately from the active participation of older workers and the structure of the labour market. Future research would therefore benefit from longitudinal, comparative, and multi-level approaches capable of linking macroeconomic processes with micro-level health, employment, and organisational behaviour.

From a policy perspective, the findings indicate that demographic ageing should be approached not only as a challenge to labour supply and fiscal sustainability, but also as a question of how to better mobilise the capabilities of older workers. The literature highlights the importance of integrated policy frameworks that link labour market participation, lifelong learning, healthy ageing, migration, pension reform, and public health. It also suggests that, in knowledge-intensive and age-diverse settings, older workers may represent an underutilised source of experience-based knowledge, analytical capability, and innovation. Accordingly, age-inclusive management, healthy working conditions, digital inclusion, flexible work arrangements, and intergenerational knowledge exchange should be treated not as ancillary measures, but as central components of a productive response to demographic ageing.

REFERENCES

Aggarwal, V., Karwasra, N. (2023), "A bibliometric analysis on trade openness and economic growth: Current Dynamics and future direction", Competitiveness Review: An International Business Journal, Vol. 34, No. 2, pp. 446–467, available at: https://doi.org/10.1108/cr-11-2022-0177

Babajic, A., Suljic, M., Halilbegović, S. (2022), "Economic growth, economic development, and poverty: A Bibliometric analysis", Journal of Economic and Social Studies, Vol. 8, No. 1, available at: https://doi.org/10.14706/jecoss21814

Backes-Gellner, U., Veen, S. (2013), "Positive effects of ageing and age diversity in innovative companies–large-scale empirical evidence on company productivity", Human Resource Management Journal, Vol. 23, No. 3, pp. 279-295, available at: https://doi.org/10.1111/1748-8583.12011

Caviggioli, F. (2026), "Independent Inventors in Italy: The role of sex and age in career development", Journal of Innovation & Knowledge, Vol. 13, available at: https://doi.org/10.1016/j.jik.2025.100929

Cao, X., Hou, Y., Zhang, X., Xu, C., Jia, P., Sun, X., Sun, L., Gao, Y., Yang, H., Cui, Z., Wang, Y., Wang, Y. (2020), "A comparative, correlate analysis and projection of global and regional life expectancy, healthy life expectancy, and their gap: 1995-2025", Journal of Global Health, Vol. 10, No. 2, available at: https://doi.org/10.7189/jogh.10.020407

Cooley, T. F., Henriksen, E., Nusbaum, C. (2024), "Demographic obstacles to European growth", European Economic Review, Vol. 169, available at: https://doi.org/10.1016/j.euroecorev.2024.104829

Dabić, M., Maley, J. F., Švarc, J., Poček, J. (2023), "Future of digital work: Challenges for sustainable human resources management", Journal of Innovation & Knowledge, Vol. 8, No. 2, available at: https://doi.org/10.1016/j.jik.2023.100353

Dote-Pardo, J., Ortiz-Cea, V., Peña-Acuña, V., Severino-González, P., Contreras-Henríquez, J. M., Ramírez-Molina, R. I. (2025), "Innovative Entrepreneurship and Sustainability: A bibliometric analysis in emerging countries", Sustainability, Vol. 17, No. 2, available at:

https://doi.org/10.3390/su17020658
Egdell, V., Maclean, G., Raeside, R., Chen, T. (2021), "Workplace preparedness for an ageing workforce: A case study", International Journal of Sociology and Social Policy, Vol. 42, No. 9/10, pp. 890–907, available at: https://doi.org/10.1108/ijssp-07-2021-0175
Emerson, P., Knabb, S., Sirbu, A.-I. (2024), "Does the old-age dependency ratio place a drag on secular growth?", Economic Analysis and Policy, Vol. 82, pp. 1056-1070, available at: https://doi.org/10.1016/j.eap.2024.04.026
Eurostat (2023), "Mortality and life expectancy statistics", available at: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Mortality_and_life_expectancy_statistics (accessed 28 November 2025)
Eurostat (2025), "Healthy life years statistics", available at: https://ec.europa.eu/eurostat/databrowser/view/hlth_hlye$defaultview/default/table (accessed 28 November 2025)
Eurostat (2026), "Fertility indicators (demo_find)", European Commission, available at: https://ec.europa.eu/eurostat/databrowser/product/view/DEMO_FIND (accessed November 28, 2025)
Fields, N. L., Adorno, G., Felderhoff, B., Parekh, R., Miller, V., Magruder, K., Rogers, K. (2018), "The social construction of "Emerging elders": Implications for age-friendly community assessments", Gerontology and Geriatric Medicine, Vol. 4, available at: https://doi.org/10.1177/2333721418784844
Gruss, B., Huang, E., Lagerborg, A., Noureldin, D., Ozhan, G. K. (2025), "The Labor Market Implications of Healthy Aging", working paper, No. WP/25/229, International Monetary Fund
Hirsch, J. E. (2005), "An index to quantify an individual's scientific research output", Proceedings of the National Academy of Sciences, Vol. 102, No. 46, pp. 16569–16572, available at: https://doi.org/10.1073/pnas.0507655102
Hoerler, R., Stein, F., Bayrle, N., Angerer, M., Kordsachia, O. (2025), "A bibliometric review of the EU Sustainable Finance Initiative: Evolving Research Dynamics", Sustainability Accounting, Management and Policy Journal, available at: https://doi.org/10.1108/sampj-01-2025-0135
Huang, H., Li, C., Mei, M. (2026), "How younger employees' gratitude expression impacts older employees' knowledge sharing: An emotions-as-social-information perspective", Journal of Innovation & Knowledge, Vol. 16, available at: https://doi.org/10.1016/j.jik.2026.101011
Huang, T.-Y., Chou, M.-Y., Liang, C.-K., Lin, Y.-T., Chen, R.-Y., Wu, P.-F. (2023), "Physical activity plays a crucial role in multidomain intervention for frailty prevention", Aging Clinical and Experimental Research, Vol. 35, No. 6, pp. 1283–1292, available at: https://doi.org/10.1007/s40520-023-02412-z
Iversen, T. N., Larsen, L., Solem, P. E. (2009), "A conceptual analysis of ageism", Nordic Psychology, Vol. 61, No. 3, pp. 4–22, available at: https://doi.org/10.1027/1901-2276.61.3.4
Ivic, S., Nikolic, G., Igrutinovic, M. (2021), "Recognition of older adults as a heterogeneous social group", Trans/Form/Ação, Vol. 44, No. 4, pp. 357–374, available at: https://doi.org/10.1590/0101-3173.2021.v44n4.29.p357
Kotamäki, M., Lehtimäki, J. (2025), "Getting too old for this: Population ageing and its economic consequences in Finland", Economic Analysis and Policy, Vol. 88, pp. 1720-1750, available at: https://doi.org/10.1016/j.eap.2025.10.040
Lai, E. T., Ho, S. C., Woo, J. (2022), "Social isolation, socioeconomic status, and development of functional impairments in Chinese older adults aged 70 years and over: A cohort study", Aging Clinical and Experimental Research, Vol. 35, No. 1, pp. 155–165, available at: https://doi.org/10.1007/s40520-022-02259-w
Langmann, E., Weßel, M. (2023), "Leaving no one behind: Successful ageing at the intersection of ageism and ableism", Philosophy, Ethics, and Humanities in Medicine, Vol. 18 No. 1, available at: https://doi.org/10.1186/s13010-023-00150-8
Lim, W. M., Kumar, S., Donthu, N. (2024), "How to combine and clean bibliometric data and use bibliometric tools synergistically: Guidelines using metaverse research", Journal of Business Research, Vol. 182, available at: https://doi.org/10.1016/j.jbusres.2024.114760
Lotka, A. J. (1926), "The frequency distribution of scientific productivity", Journal of the Washington Academy of Sciences, Vol. 16, No. 12, pp. 317–323, available at:

http://www.jstor.org/stable/24529203
Mondal, H. (2025), "A technical note on bibliometric analysis by Biblioshiny and Vosviewer", Indian Journal of Radiology and Imaging, available at: https://doi.org/10.1055/s-0045-1810060
Ng, T. W. H., Feldman, D. C. (2013), "A meta-analysis of the relationships of age and tenure with innovation-related behaviour", Journal of Occupational and Organizational Psychology, Vol. 86, No. 4, pp. 585–616, available at: https://doi.org/10.1111/joop.12031
Nielsen, C. R., Ahrenfeldt, L. J., Jeune, B., Christensen, K., Lindahl-Jacobsen, R. (2022), "Development in life expectancy with good and poor cognitive function in the elderly European population from 2004-05 to 2015", European Journal of Epidemiology, Vol. 37, No. 5, pp. 495–502, available at: https://doi.org/10.1007/s10654-022-00860-x
OECD (2020), Promoting an Age-Inclusive Workforce: Living, Learning and Earning Longer, OECD Publishing, Paris, available at: https://doi.org/10.1787/59752153-en
OECD (2025), Pensions at a Glance 2025: OECD and G20 Indicators, OECD Publishing, Paris, available at: https://doi.org/10.1787/e40274c1-en
OECD (2025), OECD Employment Outlook 2025: Can we get through the demographic crunch? OECD Publishing, available at: https://doi.org/10.1787/194a947b-en
OECD (2026), Building healthy, productive workforces for our 21st century: Accompanying issues note for the joint OECD-GCOA workshop
Oyewola, D. O., Dada, E. G. (2022), "Exploring machine learning: A scientometrics approach using bibliometrix and VOSviewer", SN Applied Sciences, Vol. 4, No. 5, available at: https://doi.org/10.1007/s42452-022-05027-7
Sauvy, A. (1928), "La population française jusqu'en 1956. Essai de prévision démographique", Journal de la Société de statistique de Paris, available at: https://www.numdam.org/item/JSFS_1928__69__321_0/
Seeberg, K. G., Skovlund, S. V., Bláfoss, R., Thomassen, K., Malchow-Møller, L., Sundstrup, E., Andersen, L. L. (2022), "The interplay between multimorbidity, physical work demands and work ability: Cross-sectional study among 12,879 senior workers", International Journal of Environmental Research and Public Health, Vol. 19, No. 9, available at: https://doi.org/10.3390/ijerph19095023
Shahid, M. K., Khin, A. A., Seong, L. C., Shahbaz, M., Ahmad, F. (2024), "Mapping the relationship of research and development expenditures and economic growth through Bibliometric Analysis: A theoretical perspective", Journal of the Knowledge Economy, Vol. 15, No. 4, pp. 17529–17555, available at: https://doi.org/10.1007/s13132-024-01781-8
Song, S., Stern, Y., Gu, Y. (2022), "Modifiable lifestyle factors and Cognitive Reserve: A systematic review of current evidence", Ageing Research Reviews, Vol. 74, available at: https://doi.org/10.1016/j.arr.2021.101551
Tragaki, A. (2024), "From 'demographic bomb' to 'silver tsunami': Navigating global population shifts", European View, Vol. 23, No. 1, pp. 22–30, available at: https://doi.org/10.1177/17816858241240606
United Nations Department of Economic and Social Affairs (2023), World Social Report 2023: Leaving no one behind in an ageing world, United Nations
Weber, D., Loichinger, E. (2020), "Live longer, retire later? developments of healthy life expectancies and Working Life Expectancies between age 50–59 and age 60–69 in Europe", European Journal of Ageing, Vol. 19, No. 1, pp. 75–93, available at: https://doi.org/10.1007/s10433-020-00592-5
Wong, C. M., Tetrick, L. E. (2017), "Job crafting: Older workers' mechanism for maintaining person-job fit", Frontiers in Psychology, Vol. 8, available at: https://doi.org/10.3389/fpsyg.2017.01548
Xu, L., Gatto, A., Liu, X., Zhao, X., Rosak-Szyrocka, J. (2025), "Advancements in low-carbon economic growth research from an energy consumption perspective: A bibliometric analysis", Sustainable Futures, Vol. 9, available at: https://doi.org/10.1016/j.sftr.2025.100685
Yamaguchi, N. U., Bernardino, E. G., Ferreira, M. E., de Lima, B. P., Pascotini, M. R., Yamaguchi, M. U. (2022), "Sustainable development goals: A bibliometric analysis of literature reviews", Environmental Science and Pollution Research, Vol. 30, No. 3, pp. 5502–5515, available at: https://doi.org/10.1007/s11356-022-24379-6