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Main Research Trends in Older Adult Education from a Silver Economy Perspective: Analysis of Trends and Future Directions

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SUMMARY

From the silver economy perspective, the education of older adults is fundamental to maximize the potential of this population, promoting their active participation in society and, therefore, in the economy. While education can be seen as a facilitating agent, for older adults it is even more so, as it provides for their inclusion and well-being, increasing their ability to contribute economically and reduce inequalities in all areas. However, the focus on older adults and the silver economy is relatively new, and certain gaps in research have been identified, which invites us to analyze and propose frameworks of reference on the directions of study that can establish and strengthen both the theoretical framework and public policies. To this end, an analysis of the main currents of research in the education of older adults, focusing on the silver economy, is offered below, through the use of advanced bibliometric tools and methodologies. These identify and examine emerging trends in this field, which helps to understand the current dynamics in the education of older adults, but also provides a solid foundation for the development of educational programs that respond to the needs of this population, promoting their well-being and their contribution to the silver economy. Finally, this work underlines the crucial importance of education in the inclusion and use of the potential of older adults in an aging society, while proposing a framework that integrates the main lines of research identified, providing a guide for future studies that generate knowledge according to the needs of an age group that is growing every day and that will undoubtedly be included in the agendas of governments and international organizations.

Keywords: silver economy; public policies; older adults; adult education; strategic intelligence.

ABSTRACT

From the silver economy perspective, the education of older adults is fundamental to maximize the potential of this population, promoting their active participation in society and therefore in the economy. While education can be seen as a facilitating agent, for older adults it is even more so, as it provides for their inclusion and well-being, increasing their ability to contribute economically and reduce inequalities in all areas. However, the focus on older adults and the silver economy is relatively new, and certain gaps in research have been identified, which invites us to analyze and propose frameworks of reference on the directions of study that can establish and strengthen both the theoretical framework and public policies. To this end, an analysis of the main currents of research in the education of older adults, focusing on the silver economy, is offered below, through the use of advanced bibliometric tools and methodologies. These identify and examine emerging trends in this field, which helps to understand the current dynamics in the education of older adults, but also provides a solid foundation for the development of educational programs that respond to the needs of this population, promoting their well-being and their contribution to the silver economy. Finally, this paper highlights the



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crucial importance of education in the inclusion and use of the potential of older adults in an aging society, while proposing a framework that integrates the main lines of research identified, providing a guide for future studies that generate knowledge according to the needs of this age group that is growing every day and that will undoubtedly be included in the agendas of governments and international organizations.

Keywords: silver economy; public policies; older adults; adult education; strategic intelligence.

Introduction

The silver economy has emerged as a strategic response to the global aging phenomenon, one of the most significant demographic changes of our time. This phenomenon is characterized by a sustained increase in life expectancy and a decline in birth rates, resulting in a growing proportion of older people in the total population. According to projections by international agencies, by 2050, the number of people over the age of 60 is expected double, reaching 2.1 billion worldwide. This demographic shift poses considerable challenges but it also offers unprecedented economic and social opportunities, which the silver economy seeks to take advantage of (Lipp and Peine 2022; Robledo Marín et al. 2022; Tsalis et al. 2020).

The silver economy encompasses a broad spectrum of economic activities that respond to the specific needs and demands of the elderly. This concept includes sectors such as healthcare, wellness, assistive technology, adapted housing, specialized tourism, and some more. It also recognizes the significant purchasing power of this demographic group, which, in many countries, accounts for a considerable share of total consumption. Beyond consumption, the silver economy also underscores the value of the active participation of the elderly in the labor market, whether through continued employment, entrepreneurship, or volunteer work. This participation not only contributes to economic growth, but also promotes the psychological and social well-being of older adults, who feel more integrated and valued in society (McGuirk, Conway Lenihan, and Lenihan 2022; Eager, Maritz, and Millemann 2022).

The importance of the silver economy lies in its ability to transform a challenge into an opportunity. Rather than considering population aging as an economic burden, this perspective allows older people to be seen as a valuable resource. Policies and strategies within the silver economy framework seek not only to address the needs of this population, but also to capitalize on their experience, knowledge, and consumption capacity. In doing so, an inclusive and sustainable economic development model that benefits all of society is fostered (Lukyanets, Okhrimenko, and Egorova 2021; Buheji 2021).

In this context, the education of older adults emerges as a key factor to the success of the silver economy. Lifelong education and learning are essential to ensure that seniors can adapt to technological, economic, and social changes. In an era where digitization and automation are transforming all aspects of life, it is crucial that older adults are not left behind. Educational programs that facilitate the acquisition of new digital skills, financial literacy, and the development of competencies in emerging sectors enable older adults to remain competitive in the labor market and continue to contribute to economic growth (Jose et al. 2023; Zhao and Xie 2023).

Furthermore, education for older adults has a positive impact on their overall health and well-being. Active learning is associated with better cognitive health, a lower incidence of neurodegenerative diseases, and a greater sense of purpose and satisfaction in life. This, in turn, reduces the burden on healthcare systems and social services, creating a positive effect on the economy as a whole (Klimczuk 2021; Alvarez-Diez, Vega-Esparza, and Villegas-Santillán 2020).

Education also facilitates the social inclusion of older adults, enabling them to participate fully in community life and reducing the risk of isolation and loneliness, common issues at this stage of life. An educated and socially active older population can play a crucial role in social cohesion, acting as mentors for younger generations and contributing to the transmission of intergenerational values and knowledge.



In the future, the education of older adults will be a determining factor for the success of the silver economy and, by extension, for the sustainable development of global society. Investing in the continuing education of the elderly not only improves their quality of life but also strengthens the economic and social resilience of nations. In a rapidly aging world, a society's ability to integrate and value its older members will be key to its future prosperity.

However, from an academic perspective, the silver economy and the education of older adults represent a growing and consolidating field of research. Despite its emerging relevance, the study of these areas is still developing and lacks a fully structured framework that encompasses educational, technological, economic, and social implications. Therefore, it is essential to identify and analyze the main research currents in this field in order to better understand the dynamics and needs of this population.

In this sense, bibliometric tools and methodologies, and the study of current trends allow mapping the most relevant research, focusing on issues such as lifelong learning, adaptation to new technologies, digital inclusion, and the development of competencies related to active economic participation, among other aspects. These studies also explore the psychological, social, and cultural implications of keeping older adults integrated into the educational and productive system.

All this can facilitate the definition of effective strategies that promote the education of older adults, consolidating an interdisciplinary approach that includes both educational theories and technological and silver economy principles. Furthermore, it is expected that such strategies should focus on the creation of inclusive and accessible educational programs that are adapted to the particularities of the older population, encouraging their continuous learning, and promoting their ability to participate in the economy and society – aspects that can only be determined through the analysis of the current state and understanding of the efforts made at the local, regional and global levels.

In this sense, the present research aims to identify and analyze the main research currents in the field of education of older adults from the perspective of the silver economy, using advanced bibliometric tools and methodologies to map current and emerging trends. Additionally, it seeks to propose themes that serve as a source for the definition of a frame of reference, facilitating the understanding of the educational and economic dynamics that impact the silver generation. It also aims to explore the implications of continuing education for older adults in terms of their social inclusion, cognitive well-being, and active participation in the economy, highlighting how these factors contribute to the strengthening of the silver economy (R.C. Álvarez-Diez et al. 2023; Cobo et al. 2011; Guallar et al. 2020).

Finally, the research aspires to contribute to the development of public policies and educational programs aligned with the principles of the silver economy, ensuring that initiatives designed for older adults are sustainable, inclusive, and capable to maximize the potential of this population. Through these objectives, the research seeks not only to advance academic knowledge, but also to have a practical impact on improving the education and quality of life of older adults, strengthening their role in the economy and contemporary society.

Methodology

Bibliometric techniques and tools are considered by experts as one of the most effective methodologies to evaluate the effort and impact of a field of knowledge over time, as is the case of Silver Economy and Education in Older Adults. These tools allow measuring the academic, scientific, and productive quality, facilitating the identification of trends, the main agents of knowledge development and the evolution of the field of study (van-Raan 2003, 2014; López-Robles et al. 2019; Álvarez Diez et al. 2022).

The main lines of work in bibliometrics include performance analysis and scientific relationship maps. Performance analysis focuses on the impact of publications, evaluated through evolution and citations received.



On the other hand, scientific relationship maps represent spatially how documents, keywords and authors are interrelated. This tool is particularly useful to discover and understand hidden or difficult to visualize relationships between key concepts for scientific development (López-Robles et al. 2020; R. Álvarez-Diez and López-Robles 2022; Gamboa-Rosales 2023; Torres Cortés, Carmona, and Vega Esparza 2022; Robles 2022).

In this research, the Scopus database, recognized as one of the most extensive in scientific, academic and business terms, has been used to analyze the evolution of the Silver Economy and Education in Older Adults. As of the end of 2024, Scopus records 79 publications and 1,088 citations related to these topics. Although the volume of publications is not high, it allows, through the bibliometric methodology, the identification of the main research topics and other relevant aspects for the study. For this purpose, the following advanced search formula was used: *TITLE-ABS-KEY ("silver econom*" OR "silver generation*" OR "silver market*" OR "elderly econom*" OR "elderly generation*" OR "elderly market*" OR "elderly econom*" OR "ageing econom*" OR "ageing generatio*" OR "ageing market*" OR "senior econom*" OR "senior generation*" OR "senior market*" OR "third age econom*" OR "third age generation*" OR "third age market*" OR "grey econom*" OR "grey generation*" OR "grey market*" OR "grey generation*" OR "grey market*") AND TITLE-ABS-KEY ("educati*") AND PUBYEAR > 1998 AND PUBYEAR < 2025 AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "cp") OR LIMIT-TO (DOCTYPE , "cb") OR LIMIT-TO (DOCTYPE , "re")) AND (LIMIT-TO (LANGUAGE , "English"))*

As detailed in the following sections, bibliometric relationship maps, or scientific maps, are tools that facilitate the organization and analysis of scientific information. These maps are used to generate, visualize, structure, and classify complex topics within a field of study. For this purpose, all relevant topics have been selected, regardless of the total number of publications, and grouped according to their linkages, thus allowing the identification of application areas that are being developed in these lines of research. The groups identified have been organized according to their weight and connections, assigning them a specific category and color.

Finally, it is important to note that the connections between topics can be both internal and external to the groups themselves, reflecting how a specific topic can act as a driver of development or support for other groups. However, these relationships should be evaluated considering the frequency of their occurrence, since the balance between both aspects determines the relevance of a topic for the development of the research area.

Results. Bibliometric Analysis on the Silver Economy and Education of Older Adults.

This research was carried out using the Scopus database, with the purpose of analyzing the performance indicators most used in the bibliography and the impact of publications related to the Silver Economy and Education of Older Adults. Taking as a reference the first publication that mentions both topics, the period of analysis was defined as 1999 to 2024. A total of 79 publications were identified, accumulating a total of 1,088 citations with an h-index of 16 publications, a total set that was processed using VOSviewer.

Figure 1 shows the evolution of scientific production (measured in number of publications) and impact (measured in number of citations) related to the Silver Economy and the Education of Older Adults, according to data from the Scopus database, between 1999 and 2024.

In terms of output, it is notable that from 1999 to approximately 2008, output in this field was relatively low, with less than 3 publications per year and some years without any publications. This suggests that academic interest in Silver Economy and Older Adult Education was in its early stages of development.

It is from 2009 onwards, that a gradual increase in the number of publications is observed, with some notable peaks in 2013, 2020 and 2022, reaching up to 14 publications in 2022. This increase suggests a growing interest in the topic, possibly driven by the global aging of the population and the recognition of the relevance of the silver economy.



However, production is inconsistent, with some years of a drop in the number of publications, which could reflect variations in funding, the interest of the academic community, or the consolidation of specific lines of research, although in overall terms the trend is positive.

On the other hand, citations, which reflect the impact of publications, show a sustained growth trend from 2006, with significant increases after 2015. This indicates that, although the production in terms of publications has been modest, the research conducted has had a growing impact and is increasingly referenced in the academic literature.

The year 2022 stands out with the highest number of citations, exceeding 140, suggesting that publications from previous years have gained recognition and relevance within the field. It is important to note that, although 2023 and 2024 show a slight decrease in citations, this pattern is common due to the time it takes for new publications to accumulate significant citations.

Overall, the field in question shows a positive trend in both the production and impact of research related to the Silver Economy and the Education of Older Adults. This field has experienced remarkable growth, especially in recent years, reflecting a growing interest and recognition of its importance. However, the variability in the annual production of publications suggests the need to consolidate the lines of research and maintain the momentum in the generation of new knowledge in this crucial field.

Based on the growing interest of the academic, scientific and business communities, it is relevant to identify the most influential authors, as well as the institutions, countries, regions, sources of information and areas of knowledge where research on the Silver Economy and Education in Older Adults is being developed, which are detailed in Table 1.

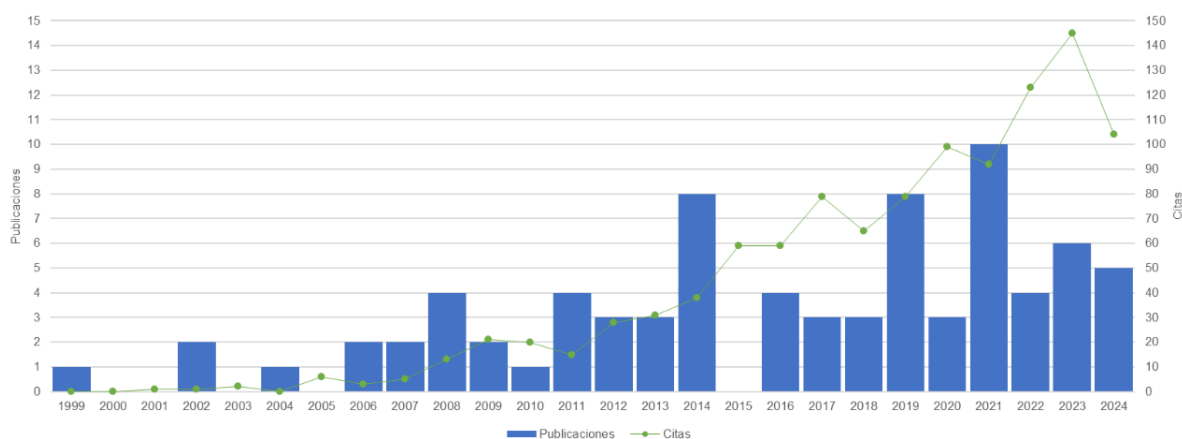


Figure 1. Production (publications) and Impact (citations) of the Silver Economy and Education of Older Adults according to the Scopus database. Source: Own elaboration

As for the most productive authors, a small group of researchers stand out, such as Hipp, C.; Pecchenino, R.A.; Schwarz, D.; Tullo, E.; and Wakeling, L., each with two publications. However, a relevant aspect is that there are a total of 250 additional authors who have contributed only one publication. This fact suggests that research in this field is quite dispersed, which could indicate that it is an emerging area with a growing interest, but still in the process of consolidation. The dispersion in academic production could also reflect the interdisciplinary nature of the subject, which attracts researchers from different fields.

Regarding the most cited authors, names such as Jang, S.; Bai, B.; Hu, C.; and Wu, C.-M.E., with 227 citations, reflect their significant influence on the literature on the Silver Economy and Older Adult Education. Other notable authors include Aidis, R. and van Praag, M. with 104 citations, and Pecchenino, R.A. with 83



citations. These figures suggest that, although the scientific output is spread across many researchers, some have achieved considerable impact, laying solid foundations for the future development of the field.

In terms of organizations, Michigan State University stands out as the most productive institution with three publications, underscoring its central role in research on this topic. It is followed by other major universities such as Pennsylvania State University, Newcastle University and Purdue University, each with two publications. This institutional diversity reinforces the idea that the interest in the Silver Economy and Older Adult Education is global and is being addressed by several renowned institutions at the international level.

In terms of the most productive countries and regions, the United States clearly leads with 19 publications, followed by the United Kingdom with 10 and China with 6. This dominance of the United States may be related to its robust research infrastructure and its traditional focus on issues related to aging and economics. The significant contribution of other countries such as Germany, Russia, Portugal, South Korea and Spain indicates that this field of study is of global relevance, with active research in various parts of the world.

On the other hand, the most productive sources in this field include journals such as the *Journal of Hospitality and Tourism Research* and *Modern Asian Studies*, each with two publications. This suggests that research on the Silver Economy and Older Adult Education is not confined to specialized journals in economics or gerontology, but extends to other areas such as tourism and regional studies, reflecting a truly multidisciplinary approach.

Finally, regarding research areas, Social Sciences dominate with 32 publications, underlining the importance of understanding Silver Economy from a social perspective. Areas such as Business, Management and Accounting, with 22 publications, and Economics, Econometrics and Finance together with Medicine, each with 15 publications, highlight the need for a comprehensive approach that considers both economic and health aspects in the study of the elderly population. The inclusion of Engineering and Computer Science as significant areas also highlights the crucial role of technology in improving the quality of life of older adults.

This analysis reflects an expanding field of research, with significant contributions from a wide range of authors, institutions, countries and disciplines. The geographic and thematic diversity suggests that the Silver Economy and the Education of Older Adults are topics of global interest, and that a multidisciplinary approach will be key to addressing the complex challenges associated with population aging. Although this field is still growing, it shows clear signs of consolidation and promises to have considerable impact.

In addition to the above, Table 2 lists the publications considered relevant according to the h-index offered by Scopus, in order to show their focus, as well as their positioning in time, sources and authors.

Figure 2 presents the main topics of research, development and innovation in the field of Silver Economy and Adult Education, according to data from the Scopus database. These topics were selected based on their presence at least once in the total literature, meaning that they include all currently researched areas within these two disciplines.

Table 1. Main authors, organizations, countries and areas of knowledge in the field of Silver Economy and Education of Older Adults according to the Scopus database. Note: Values



Description	(Publications Citations) Description
Most productive authors	(2) Hipp, C.; Pecchenino, R.A.; Schwarz, D.; Tullo, E.; Wakeling, L.
Most cited authors	(227) Jang, S.; Bai, B.; Hu, C.; Wu, C.-M.E. (104) Aidis, R.; van Praag, M. (83) Pecchenino, R.A. (78) Harrigan, P.; Hulbert, B. (73) Abad, L. (45) Pollard, P.S. (43) Mahadevan, R.; Jang, S.C.; Ham, S.; Hong, G.-S. (42) King, V.T.; Nguyen, P.A.; Minh, N.H. (38) Utendorf, K.R. (29) Spink, J.; Embarek, P.B.; Savelli, C.J.; Bradshaw, A. (25) Desfontaines, L.; Korchagina, E.; Varnaev, A.; Semenova, J. (24) Han, X.; Wei, C.; Cao, G.-Y. (23) Supiano, M.A.; Alessi, C.; Chernoff, R.; Goldberg, A.; Morley, J.E.; Schmader, K.E.; Shay, K. (19) Zsarnoczky, M.; David, L.; Mukayev, Z.; Baiburiev, R. (18) Hosseini, S.A.R.; Darbooy, S.; Tehrani Banihashemi, S.A.; Naseri, S.M.; Dinarvand, R. (17) de Mello, L.; Schotte, S.; Tiongson, E.R.; Winkler, H.; Tullo, E.; Wakeling, L.
More productive organizations	(3) Michigan State University (2) Pennsylvania State University; Newcastle University; Purdue University; Brandenburgische Technische Universität Cottbus; University College London; College of Health and Human Sciences
Most productive countries and regions	(19) United States (10) United Kingdom (6) China (5) Germany; Russian Federation (4) Portugal; South Korea; Spain (3) Australia; France; Hungary; Taiwan; Hungary; Taiwan (2) Austria; Canada; Finland; Greece; India; Japan; Philippines; Poland; Singapore
More productive sources	(2) Journal of Hospitality and Tourism Research; Modern Asian Studies



Main research areas	(32) Social Sciences (22) Business, Management and Accounting (15) Economics, Econometrics and Finance; Medicine (11) Engineering (9) Information technology (7) Arts and Humanities (3) Mathematics; Agricultural and Biological Sciences; Nursing; Psychology; (3) Mathematics; Agricultural and Biological Sciences; Nursing; Psychology. (2) Decision Sciences; Environmental Sciences
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In total, 542 topics have been identified, of which 58 turn out to be the most important (1,040 linkages), and these have been processed one by one in order to avoid duplications or empty topics, thus creating a knowledge base that serves as a frame of reference for future research, but, above all, establishes a clear and detailed framework on the main topics related to the Silver Economy and Education of Older Adults.

At the center of the network is the term "Silver Generation", which acts as a central node, reflecting its fundamental importance in Silver Economy and Older Adult Education research. This node is connected to a wide range of sub-themes, indicating that the "Silver Generation" is a widely explored concept in relation to various areas, such as behavior, education and active aging. Another central node highlighted is "Education and Training," which is closely linked to the "Silver Generation," suggesting that much of the research focuses on how education and training are essential for this population, especially in terms of maintaining their occupational relevance, improving quality of life, and promoting active and successful aging.

The "Aging Behavior" node is also prominent, highlighting the importance of understanding the behavioral patterns of older adults and how these impact their integration into the economy and society. Thematic connections reveal a strong relationship between "Active and Successful Aging" and other concepts such as "Education and Training", "Lifelong Learning" and "Employment". This indicates that research on Active and Successful Aging is not limited to physical health, but also encompasses continued participation in learning and work, essential elements for the development of the Silver Economy.

Table 2. Main publications in the field of Silver Economy and Education of Older Adults according to the Scopus database.

Description	(Quotations) Description
Publications h-index (APA)	(277) Jang, S., Bai, B., Hu, C., & Wu, C. M. E. (2009). Affect, travel motivation, and travel intention: A senior market. <i>Journal of Hospitality & Tourism Research</i> , 33(1), 51-73. (104) Aidis, R., & Van Praag, M. (2007). Illegal entrepreneurship experience: Does it make a difference for business performance and motivation?. <i>Journal of Business Venturing</i> , 22(2), 283-310. (78) Harrigan, P., & Hulbert, B. (2011). How can marketing academics serve marketing practice? The new marketing DNA as a model for marketing education. <i>Journal of marketing education</i> , 33(3), 253-272. (73) Abad-Alcalá, L. (2014). Media Literacy for Older People Facing the Digital Divide: The e-Inclusion Programs Design= Diseño de programas de e-inclusión para alfabetización mediática de personas mayores. <i>Comunicar</i> , 21(42), 173-180.



	<p>(45) Pecchenino, R. A., & Pollard, P. S. (2002). Dependent children and aged parents: funding education and social security in an aging economy. <i>Journal of Macroeconomics</i>, 24(2), 145-169.</p> <p>(43) Mahadevan, R. (2014). Understanding senior self-drive tourism in Australia using a contingency behavior model. <i>Journal of Travel Research</i>, 53(2), 252-259.</p> <p>(43) Jang, S., Ham, S., & Hong, G. S. (2007). Food-away-from-home expenditure of senior households in the United States: A double-hurdle approach. <i>Journal of Hospitality & Tourism Research</i>, 31(2), 147-167.</p> <p>(42) King, V. T., Nguyen, P. A., & Minh, N. H. (2008). Professional middle class youth in post-reform Vietnam: Identity, continuity and change. <i>Modern Asian Studies</i>, 42(4), 783-813.</p> <p>(38) Pecchenino, R. A., & Utendorf, K. R. (1999). Social security, social welfare and the aging population. <i>Journal of Population Economics</i>, 12, 607-623.</p> <p>(29) Spink, J., Embarek, P. B., Savelli, C. J., & Bradshaw, A. (2019). Global perspectives on food fraud: results from a WHO survey of members of the International Food Safety Authorities Network (INFOSAN). <i>npj Science of Food</i>, 3(1), 12.</p> <p>(25) Desfontaines, L., Korchagina, E., Varnaev, A., & Semenova, J. (2019, April). Organizational culture of trade enterprises in the context of modern demographic challenges and applying information technologies. In <i>IOP Conference Series: Materials Science and Engineering</i> (Vol. 497, p. 012117). IOP Publishing.</p> <p>(24) Han, X., Wei, C., & Cao, G. Y. (2022). Aging, generational shifts, and energy consumption in urban China. <i>Proceedings of the National Academy of Sciences</i>, 119(37), e2210853119.</p> <p>(23) Supiano, M. A., Alessi, C., Chernoff, R., Goldberg, A., Morley, J. E., Schmader, K. E., ... & Writing on behalf of the GRECC Directors Association. (2012). Department of Veterans Affairs Geriatric Research, Education and Clinical Centers: translating aging research into clinical geriatrics. <i>Journal of the American Geriatrics Society</i>, 60(7), 1347-1356.</p> <p>(19) Zsarnoczky, M., David, L., Mukayev, Z., & Baiburiev, R. (2016). Silver tourism in the European Union. <i>GeoJournal of Tourism and Geosites</i>, 18(2), 224-232.</p> <p>(18) Hosseini, S. A. R., Darbooy, S., Banihashemi, S. T., Naseri, S. M., & Dinarvand, R. (2011). Counterfeit medicines: report of a cross-sectional retrospective study in Iran. <i>Public Health</i>, 125(3), 165-171.</p> <p>(17) De Mello, L., Schotte, S., Tiongson, E. R., & Winkler, H. (2017). Greying the budget: Ageing and preferences over public policies. <i>Kyklos</i>, 70(1), 70-96.</p>
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Source: Own elaboration

Taking into account all of the above, and with the objective of effectively analyzing the growth of the Silver Economy and the Education of Older Adults, the next step is to identify the links between the main topics developed in recent years. For this purpose, we have chosen to use VOSviewer, a tool widely recognized in the academic, scientific and business communities for the construction and visualization of bibliometric networks.

Additionally, terms such as "Lifelong Learning" and "E-learning" are interrelated and linked to "Education and Training," suggesting a significant focus lifelong education and digital learning for older adults. This highlights the importance of lifelong learning to maintain the relevance and adaptability of this population in a



changing economic environment. On the other hand, terms such as "Socioeconomic Behavior" and "Employment" are connected to "Aging Behavior," indicating that research also explores how the socioeconomic behaviors of older adults influence their employability and economic participation, crucial aspects for the sustainability of the Silver Economy.

Emerging areas of interest such as "Digital Technologies" and "Engineering Education" also appear in the network, suggesting a growing interest in how digital technologies and engineering education can be integrated into the lives of older adults, likely to improve their quality of life and facilitate their inclusion in the digital economy. In addition, terms such as "Tourism Development" and "Silver Tourism" are linked to "Active and Successful Aging" and "Socioeconomic Behavior," suggesting that tourism targeting older adults is a growing area of research focused on how this activity can be a key component of active aging and contribute significantly to the economy.

In this sense, the figure shows that research on the Silver Economy and Older Adult Education is highly interconnected, with central themes such as the "Silver Generation", "Education and Training", and "Aging Behavior" acting as key axes. The importance of active aging, lifelong education, and socioeconomic behavior underscores the need for multidisciplinary approaches to address the challenges and seize the opportunities presented by an aging population. In addition, emerging areas such as tourism and digital technologies point to future research directions that could have a significant impact on the quality of life and economic integration of older adults.

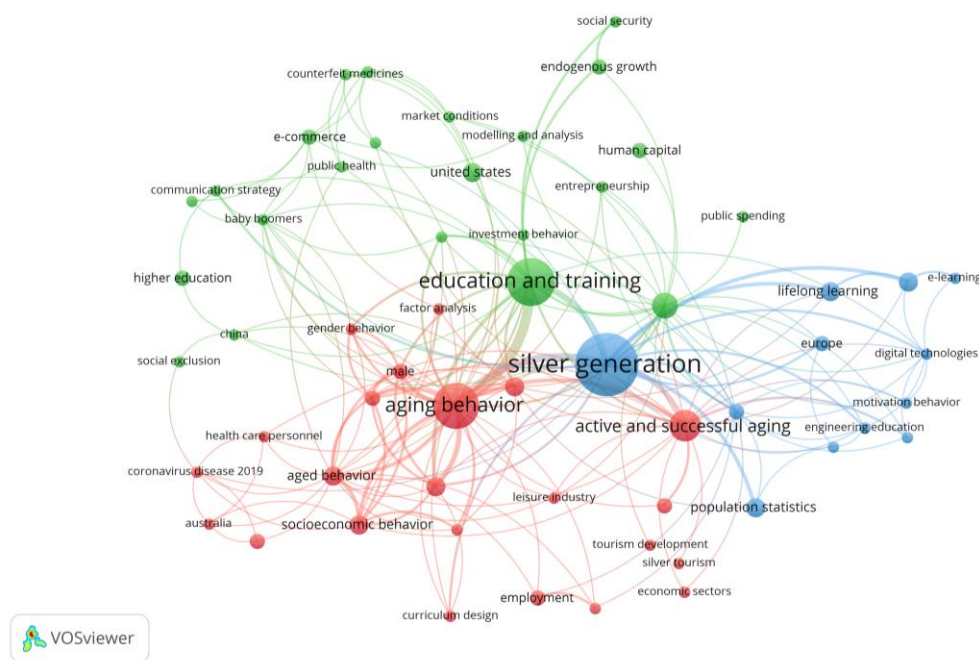


Figure 2. Main research, development and innovation topics in the field of Silver Economy and Education of Older Adults according to the Scopus database.

Source: Own elaboration

Based on the above, Table 3, Table 4 and Table 5 show the performance of each of the research, development and innovation topics in the field of Silver Economy and Education of Older Adults grouped into Aging Behavior (red, 23 topics, 76 occurrences and 367 links), Education and Training (green, 23 topics, 68 occurrences and 263 links), and Silver Generation (blue, 12 topics, 50 occurrences and 164 links), respectively. An analysis for each group is presented below.



Table 3 focusing on "Aging Behavior" within the context of the Silver Economy and Older Adult Education reveals the central importance of this topic in current research. With 13 occurrences, "Aging Behavior" is the most frequent theme, underscoring its relevance as a key concern in the literature on the older population. In addition, the theme has 59 links, indicating a high connectivity with other relevant themes, reflecting the interdependence of older adults' behavior with various economic, social, and health factors.

Among the main topics connected to "Aging Behavior" is "Active and Successful Aging," with 8 occurrences and 32 links. This relationship highlights the focus on how the behaviors of older adults directly influence their ability to age actively and successfully. Research in this area suggests that not only individual behaviors are studied, but also how these behaviors contribute to positive aging, which is essential in the Silver Economy framework.

Another strongly related theme is "Socioeconomic Behavior," with 4 occurrences and 28 links. This connection indicates that studies also focus on how the behavior of older adults is shaped by socioeconomic factors, and how these, in turn, affect their participation in the economy and society. In addition, "Aging Behavior" is linked to "Human Experiment" (4 occurrences and 24 links), suggesting that there is an empirical focus to the research, with studies designed to evaluate interventions that could improve the quality of life of older adults.

Other connected themes include "Employment" (3 occurrences and 11 links) and "Health Care Services" (3 occurrences and 8 links), reflecting interest in how older adults' behaviors influence their participation in the labor market and access to and use of health care services, both fundamental to the development of the Silver Economy. In addition, the relationship with themes such as "Demography" (4 occurrences and 16 links) and "Gender Behavior" (2 occurrences and 17 links) suggests that the research also considers demographic and gender factors, which is crucial for understanding variations in the behavior of older adults.

Thus, "Aging Behavior" emerges as a central and highly interconnected theme within Silver Economy and Older Adult Education research. Its high frequency and numerous linkages to other key topics such as active aging, socioeconomic behavior, and employment indicate that understanding the behavior of older adults is essential to addressing the challenges and opportunities presented by an aging population. The relationship with the Human Experiment also points to an empirical approach to research, which is critical to designing effective interventions to improve the quality of life of this population. Overall, Aging Behavior research encompasses multiple dimensions, reflecting its complexity and importance in the context of the Silver Economy.

Moreover, with 58 links, "Education and Training" shows high connectivity with other relevant topics, reflecting its central role in the interrelation of multiple factors within this field of study. Among the main connections is "Aging Population", which, with 6 occurrences and 27 links, is closely related to the education of older adults. This underscores the need to adapt educational systems to meet the demands of an aging population, highlighting the importance of designing programs that respond to the specific needs of this demographic.

Table 3. Main research, development and innovation topics around Aging Behavior (red, 23 topics, 76 occurrences and 367 links) within the field of Silver Economy and Education of Older Adults according to the Scopus database.



Subject	Occurrences Linkages
aging behavior	13 59
active and successful aging	8 32
aged behavior	4 27
demography	4 16
human experiment	4 24
socioeconomic behavior	4 28
employment	3 11
Female	3 26
health care services	3 8
Male	3 26
Vietnam	3 7
Australia	2 5

Subject	Occurrences Linkages
coronavirus disease 2019	2 7
curriculum design	2 5
economic sectors	2 7
factor analysis	2 11
gender behavior	2 17
health care personnel	2 10
labor market	2 9
leisure industry	2 11
silver tourism	2 4
socioeconomic factors	2 14
tourism development	2 3
coronavirus disease 2019	2 7

Source: Own elaboration

Another significant connection is with "United States," which has 4 occurrences and 14 links. This suggests that a considerable part of the research on education and training for older adults is focused on this country, reflecting both its leadership in educational innovation and the specific challenges it faces due to its rapidly aging population. The relationship with "Human Capital" (3 occurrences, 8 links) highlights the importance of education in valuing the human capital of older adults, suggesting that investment in lifelong education not only improves the quality of life of this population, but is also crucial to maximizing their economic contribution.

In addition, topics such as "E-commerce" and "Entrepreneurship" show how education and training are linked to new economic opportunities for older adults, enabling them to actively participate in areas such as e-commerce and entrepreneurship, provided they receive appropriate training. The relationship with "Public Health" and "Perception Behavior" underscores the connection between education, perception of aging and health outcomes, indicating that education also plays a role in promoting healthy behaviors and improving the perception of aging at both the individual and societal levels.

Finally, the connections to "Market Conditions" and "Marketing Strategy" reflect the importance of understanding market conditions and marketing strategies in the context of education for older adults. This suggests that education is key to preparing this population to participate effectively in the economy by adapting to the realities of an ever-changing marketplace.



Main research, development and innovation topics around Education and Training (green, 23 topics, 68 occurrences and 263 links) within the field of Silver Economy and Education of Older Adults according to the Scopus database.

Subject	Occurrences Linkages	Subject	Occurrences Linkages
education and training	14 58	entrepreneurship	2 8
aging population	6 27	government programs	2 9
united states	4 14	investment behavior	2 14
e-commerce	3 9	market conditions	2 11
endogenous growth	3 9	marketing strategy	2 5
higher education	3 6	modelling and analysis	2 7
human capital	3 8	perception behavior	2 15
baby boomers	2 12	public health	2 12
china	2 6	public spending	2 4
communication strategy	2 7	social exclusion	2 4
counterfeit medicines	2 7	social security	2 4
drug marketing	2 7	entrepreneurship	2 8

Source: Own elaboration

Thus, "Education and Training" emerges as a central and multifaceted aspect of Silver Economy and Older Adult Education research. Its high frequency and numerous connections to other key themes underscore its importance in maintaining the relevance and active participation of older adults in the economy and society. In addition, education is seen as an essential tool for improving the quality of life and social integration of this population, addressing both the challenges and opportunities presented by population aging.

Finally, Table 5, focusing on the theme "Silver Generation" in the context of the Silver Economy and Older Adult Education, highlights the central importance of this concept in current research. With 20 occurrences, "Silver Generation" is the most frequent theme, reflecting a significant focus on the study of this population of older adults who play a crucial role in society and the economy, especially within the framework of the Silver Economy. Moreover, with 61 links, this theme shows a high connectivity with other key aspects, evidencing its deep interrelationship with multiple dimensions of economic, social and technological life.

Among the top "Silver Generation" connections is "Lifelong Learning," with 4 occurrences and 8 links. This relationship suggests that lifelong learning is seen as an essential component for the "Silver Generation", underlining the importance of maintaining the relevance and capabilities of older adults through lifelong learning, which is crucial for their active integration into society and the economy. Likewise, topics such as "Population Statistics" and "Silver Citizen", both with 4 occurrences and 11 links, highlight the relevance of population statistics and the specific study of senior citizens in research on the "Silver Generation". This reflects an interest in understanding the demographic and behavioral characteristics of this generation, fundamental aspects for the development of appropriate policies and strategies in the context of the Silver Economy.

Other connected topics, such as "Commerce Behavior" with 3 occurrences and 18 links, highlight how the "Silver Generation" is involved in consumption and the economy. This link underlines that the consumption patterns and economic behavior of older adults are key areas of study, with direct implications for the economy



in general. In addition, the relationship with "Digital Technologies" and "Engineering Education," both with 2 occurrences and 11 links, indicates a focus on how emerging technologies and technical education can be integrated to improve the quality of life and economic participation of older adults. Themes such as "E-learning" and "Information and Communication Technologies" also stand out, reflecting the importance of these tools in facilitating access to education and improving the connectivity of the "Silver Generation", promoting their digital inclusion and their ability to take advantage of economic and social opportunities.

In summary, "Silver Generation" is positioned as a central and highly interconnected axis in Silver Economy and Older Adult Education research. Its high frequency and numerous connections to other key themes underscore the importance of this generation in today's society. The "Silver Generation" not only represents a significant demographic group, but also constitutes an economic force and a driver for the development of new technologies and educational methods. This analysis shows that research on the Silver Generation is complex and multifaceted, addressing both the challenges and opportunities presented by an aging population in an ever-changing economic and technological context.

Table 5. Main research, development and innovation topics around Silver Generation (blue, 12 topics, 50 occurrences and 164 links) within the field of Silver Economy and Education of Older Adults according to the Scopus database.

Subject	Occurrences Linkages	Subject	Occurrences Linkages
silver generation	20 61	decision making	2 4
lifelong learning	4 8	digital technologies	2 11
population statistics	4 11	e-learning	2 5
silver citizen	4 11	engineering education	2 11
commerce behavior	3 18	information and communication technologies	2 8
europa	3 9	motivation behavior	2 7

Fonte: Own elaboration

On the other hand, Figure 3 shows the evolution of the topics, providing a detailed view of the temporal evolution of the key topics in research on the Silver Economy and the Education of Older Adults, using data from the Scopus database. The colors in the figure indicate the period in which the terms have been most relevant, making it possible to identify how the areas of focus have changed over time.

First, the term "Silver Generation" stands out as a central node that has maintained its relevance over the past several decades. Its predominantly yellow color suggests that it has remained a central theme in recent research, with a consistent focus on aspects related to this population. Emerging connections around the "Silver Generation" include terms such as "Active and Successful Aging" and "Aging Behavior," indicating a growing interest in promoting active and healthy aging, as well as understanding the behaviors of this generation in different socioeconomic contexts.

The "Education and Training" node appears in green, indicating that it has gained prominence especially in the last decade. This increase in interest reflects a growing recognition of the importance of continuing education for older adults, particularly in the context of the Silver Economy, where training and lifelong learning are critical to maintaining employability and improving quality of life. Recent connections to topics such as "Lifelong Learning," "Digital Technologies," and "Motivation Behavior" suggest that research is exploring how to integrate new technologies and educational methods to support older adults in their active participation in the economy and society.



areas such as digital education and specialized tourism. Despite the broadening focus, the centrality of terms such as "Silver Generation" and "Education and Training" remains critical to understanding and supporting aging in a changing economic context. Recent trends indicate a growing interest in addressing the challenges and opportunities presented by population aging, using a multidisciplinary approach that combines social, economic, educational and technological aspects.

Discussion and conclusions

From the bibliometric analysis developed, several key conclusions can be drawn that reveal the research dynamics in the field of Silver Economy and Older Adult Education.

First, the "Silver Generation" emerges as a central and highly relevant theme, with the highest number of occurrences and linkages compared to other themes. This indicates that the older adult population, in the context of the "Silver Generation," is the main focus of studies related to the Silver Economy. This term is deeply interconnected with multiple areas, reflecting its importance both demographically and in its economic and social impact.

Similarly, "Education and Training" stands out as another central theme with a high frequency of occurrences and linkages, underscoring the importance of continuing education as a fundamental tool for maintaining the relevance and capacity of older adults to actively participate in the economy and society. Education is not only considered a means of social inclusion, but also a crucial factor in maximizing the human capital of the aging population.

The analysis also shows that research in these fields is multidimensional, with extensive interconnectedness with topics including health, technology, socioeconomic behavior, and active aging. This complexity suggests that population aging and the education of older adults are issues that require an interdisciplinary approach to be effectively addressed.

In addition, new areas of research are emerging, such as digital technologies and e-learning, which reflect a growing interest in how these tools can be used to improve the lives of older adults. These emerging areas indicate a trend towards the integration of technology in the education of older adults, which can facilitate their digital inclusion and improve their quality of life. Similarly, the connection to topics such as economic and business behavior underscores the importance of understanding how this population participates in the economy, suggesting that their consumption patterns and economic decisions are crucial areas of study with direct implications for the development of market strategies and economic policies tailored to an aging population.

In geographical terms, the high connectivity with terms such as "United States" and "Europe" indicates that a significant part of the research is focused on regions with aging populations and advanced economies. This suggests that strategies and policies developed in these regions can serve as models for other parts of the world facing similar challenges due to population aging.

On the other hand, the importance of behavior and health is manifested in topics such as "Aging Behavior", "Health Care Services", and "Public Health". These aspects underscore the need for a comprehensive approach that not only addresses education and economics, but also the health and wellness aspects that are fundamental to active and healthy aging.

Finally, the diversity of interrelated issues, such as "Socioeconomic Behavior", "Public Spending", and "Government Programs", highlights the need to develop specific policies and strategies that address the unique needs and challenges of the "Silver Generation". This involves careful planning and implementation of programs that integrate educational, economic, technological and health aspects.



Thus, the bibliometric analysis reveals that research on the Silver Economy and the Education of Older Adults is a growing field, characterized by its multidisciplinary approach and global relevance. Core topics such as the "Silver Generation" and "Education and Training" are central to understanding how societies can adapt to an aging population by harnessing their capabilities through continuing education, technological integration, and active participation in the economy. The emergence of new areas of research suggests that innovation and adaptation will be key to meeting the challenges of population aging in the coming decades.

On the other hand, the future of education in older adults as a line of research is emerging as an expanding and increasingly important field, driven by the global need to adapt to a rapidly aging population. This area is gaining prominence as an essential component in keeping older adults active, relevant and participatory in both society and the economy. Continuing education is seen not only as a means to improve quality of life, but also as a crucial tool for maintaining the employability and social integration of older adults. This suggests that future research will focus on developing adaptive, flexible and accessible educational models that respond to the specific needs of this population.

A significant trend in future research will be the integration of digital technologies and e-learning tools into educational programs for older adults. As technology continues to evolve, digital platforms offer new opportunities for lifelong learning, facilitating access to education and enabling older adults to stay connected and active. Future research will likely explore how these technologies can be designed and optimized to be inclusive, accessible, and effective for this population, opening up new fields of study at the intersection of technology, education, and aging.

In addition, the education of older adults is increasingly being approached from a multidisciplinary perspective, integrating social, economic, technological and health aspects. This approach reflects the complexity of the challenges associated with aging and the need for educational strategies that not only address formal learning, but also the holistic well-being of older adults. The future of this line of research is likely to involve collaborations between different disciplines, such as gerontology, psychology, economics, and educational technology, to develop integrated solutions that support healthy and active aging.

With the aging of the population, the demand for public policies that support the education of older adults will also increase. Future research will play a crucial role in informing and guiding the formulation of these policies, providing evidence on the effectiveness of different educational models, identifying best practices, and recommending interventions that promote the social and economic inclusion of older adults. This focus on applied research will involve a strong component of evaluation of existing programs and policies.

As education for older adults gains global relevance, future research will need to address the cultural diversity and different socioeconomic realities of older populations around the world. This will involve recognizing that there is no one-size-fits-all approach, and that educational models must be tailored to specific contexts, taking into account cultural, economic and political factors. A culturally sensitive approach will be essential to developing effective and equitable educational programs in a variety of international contexts.

Finally, innovation in educational methods will be a key area of research. The future of education for older adults will likely focus on innovating in adaptive pedagogical techniques, personalized learning approaches, and the integration of intergenerational methods that promote knowledge sharing between generations. Innovation will be critical to creating learning environments that are stimulating, inclusive, and tailored to the needs of this population.



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