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PhD in Economic Sc.

Taras Shevchenko National University of Kyiv

Приймак В.М.

кандидат економічних наук

Київський національний університет ім. Тараса Шевченка

<https://orcid.org/0000-0002-6525-7988>**Tymchenko Inna**

PhD in Economic Sc.

Taras Shevchenko National University of Kyiv

Тимченко І.П.

кандидат економічних наук

Київський національний університет ім. Тараса Шевченка

<https://orcid.org/0000-0003-1535-5309>

BIBLIOMETRIC ANALYSIS OF THE DEVELOPMENT OF AI STRATEGIES RESEARCH IN SMALL AND MEDIUM-SIZED ENTERPRISES (BASED ON SCOPUS DATA)

The growing integration of artificial intelligence into business processes has intensified scholarly interest in the strategic use of AI in small and medium-sized enterprises. This study aims to analyze the development of academic research on AI strategies in SMEs through a bibliometric approach. The research is based on publications indexed in the SCOPUS database and applies bibliometric methods using the VOSviewer. The results presents four primary research directions: the role of artificial intelligence as a driver of innovation and economic growth; the integration of AI technologies into strategic management systems; the relationship between digital transformation and the development of dynamic capabilities of SMEs; and the emerging research stream related to generative artificial intelligence and its implications for entrepreneurship and business education.

Keywords: AI strategy; artificial intelligence; SMEs; strategic management; bibliometric analysis; digital transformation.

JEL classification: O31, L26, M15, O33.

БІБЛІОМЕТРИЧНИЙ АНАЛІЗ РОЗВИТКУ ДОСЛІДЖЕНЬ АІ-СТРАТЕГІЙ У МАЛИХ І СЕРЕДНІХ ПІДПРИЄМСТВАХ (ЗА ДАНИМИ SCOPUS)

Проведено бібліометричний аналіз розвитку наукових досліджень у сфері формування АІ-стратегій малих і середніх підприємств (МСП) на основі даних міжнародної наукометричної бази SCOPUS. Актуальність дослідження зумовлена трансформацією ролі штучного інтелекту від інструмента автоматизації до стратегічного ресурсу забезпечення конкурентоспроможності підприємств, а також необхідністю систематизації фрагментарного наукового доробку у цій сфері. Встановлено, що впродовж останніх років спостерігається експоненційне зростання кількості публікацій, присвячених проблематиці АІ-стратегій МСП, що свідчить про активну фазу інституціоналізації відповідного наукового напрямку. Методологічною основою дослідження є бібліометричний аналіз із використанням інструментів візуалізації VOSviewer. У межах дослідження проаналізовано динаміку публікаційної активності, галузеву структуру досліджень, типи документів, географію наукових центрів, джерела публікацій, фінансування досліджень та структуру афіліацій. Особливу увагу приділено аналізу співзвучності ключових слів, що дозволило виявити кластерну структуру наукового дискурсу. У результаті кластеризації ідентифіковано чотири концептуальні напрями розвитку досліджень: АІ як драйвер інноваційного та економічного розвитку МСП; формування АІ-стратегій у системі стратегічного управління; цифрова трансформація та розвиток динамічних здібностей малих і середніх підприємств; освітньо-генеративний вимір розвитку штучного інтелекту. Доведено, що сучасний етап характеризується зміщенням акценту з технологічних аспектів на стратегічні, економічні та управлінські виміри інтеграції АІ. Отримані результати підтверджують гіпотезу про структурований та еволюційний характер

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розвитку наукового поля у сфері AI-стратегій МСП. Практичне значення дослідження полягає у формуванні системного уявлення про інтелектуальну структуру напряму та визначенні перспектив подальших теоретичних і прикладних досліджень у сфері стратегічного управління цифровою трансформацією малого і середнього бізнесу.

Ключові слова: AI-стратегія; штучний інтелект; МСП; стратегічне управління; бібліометричний аналіз; цифрова трансформація.

Statement of the problem. The digital transformation of the economy is changing approaches to enterprise management, the creation of competitive advantage, and the generation of value. Artificial Intelligence (AI) is increasingly moving from a technological tool to a strategic resource for business development. If earlier AI was mainly used to automate individual processes, today the development of comprehensive AI strategies integrated into the strategic management system is relevant.

This issue is significant for small and medium-sized enterprises (SMEs), which combine innovative potential with resource constraints. The integration of AI into SME activities requires a strategic vision, risk assessment, and consideration of competitive and institutional factors.

In recent years, the number of publications on digital transformation and AI has increased. At the same time, research on AI strategies of SMEs remains thematically fragmented, scattered across entrepreneurship, innovation, competitive advantage, digitalization, and dynamic capabilities. The lack of a systematic, generalized picture of the development of this scientific direction complicates the formation of a holistic theoretical basis.

Under such conditions, there is a need to generalize bibliometrically an array of scientific publications to systematize research, identify their structural connections, and determine dominant thematic areas. Bibliometric analysis enables the objective assessment of publication dynamics, the geography of research, and the structure of scientific discourse.

Therefore, the study's relevance stems from the need for a comprehensive structural assessment of the development of AI-strategy research in the small and medium-sized enterprise sector.

The study hypothesizes that the development of scientific research on AI strategy in small and medium-sized enterprises has a structured, clustered nature, which can be identified through bibliometric analysis of SCOPUS data and scientific visualization tools.

The bibliometric approach will allow us to identify dominant thematic clusters, trace the evolution of a scientific direction, and identify key countries and scientific centers.

Analysis of recent research and publications. The use of artificial intelligence in enterprise management is actively developing within the context of research on digital transformation, innovation management, and strategic business development. Modern research on artificial intelligence (AI) demonstrates a transition from an instrumental to a strategic understanding of its role in enterprise development. Several works emphasize that integrating AI into business processes increases productivity, innovation, and competitiveness [1, 2, 3]. In particular, the impact of AI on SME performance has been empirically confirmed in

countries with economies in transition [1; 4] and in the context of increasing resilience and strategic foresight [2, 31].

A separate direction focuses on AI adoption and the digital transformation of SMEs. Research shows that the level of AI implementation is determined by a combination of technological and organizational orientations [6], entrepreneurial orientation [7], and the development of dynamic capabilities [8, 9, 10]. At the same time, digital transformation is considered a systemic process that provides sustainable competitive advantages [11].

An important component of the modern discourse is the emergence of generative AI and the development of competencies in prompt engineering and in the use of ChatGPT [12, 13]. The educational dimension of AI strategies is revealed through the transformation of entrepreneurial education and training platforms [14, 15, 16], which represent a new research direction at the intersection of technology and human capital development.

In addition, the literature presents industry and functional aspects of AI integration: marketing [1, 17], logistics and supply chains [18], risk management and cybersecurity [19], sustainable development and green innovation [20, 21, 22]. This indicates an expansion of AI applications in SMEs and the interdisciplinary nature of research.

However, despite a significant number of empirical and conceptual works, the scientific body remains thematically fragmented. There is no generalized structural map of the development of research on AI strategies of SMEs, which justifies the feasibility of using a bibliometric approach to systematize scientific discourse and identify its cluster structure. The available reviews are primarily conceptual analyses or systematic literature reviews, without using quantitative scientometric tools. Thus, the systematization of scientific research on AI strategies in the small- and medium-sized enterprise sector, based on objective bibliometric indicators, remains an unresolved part of the general problem. The lack of a structured map of scientific discourse makes it difficult to determine the logic of its evolution and the prospects for further research. This is precisely what determines the feasibility of using a bibliometric approach, which allows for a quantitative and structural assessment of the development of scientific views and the identification of thematic clusters.

The purpose of the article is to conduct a bibliometric analysis of the development of scientific research on AI strategies for small and medium-sized enterprises using data from the SCOPUS database and scientific visualization tools to identify the dynamics of publications, thematic clusters, and key centers of scientific activity.

The methodological basis of the study is a bibliometric approach, which allows for a quantitative and structural assessment of the development of scientific publications in the field of AI strategies for small and medium-sized

enterprises. Bibliometric analysis was used to identify the dynamics of scientific interest, determine thematic research clusters, identify the most influential authors and countries, and outline the prospects for the further development of scientific discourse.

The empirical basis of the study was a bibliometric analysis of SCOPUS publications. The sample was formed using the terms «artificial intelligence strategy», «AI strategy», «small and medium enterprises», «SME», and «small business». The search was carried out using the fields Title, Abstract, and Keywords, with a time frame limited to the period 1985-2025. The types of documents were defined as scientific articles and review publications.

The research algorithm included the following stages:

1. Formation of a search query and selection of relevant publications in the SCOPUS database.
2. Export of bibliographic data in CSV format.
3. Processing of the data set and performing bibliometric analysis.
3. Construction of visualizations using VOSviewer software.
4. Interpretation of the obtained results and formation of generalizations.

Analysis of the obtained results was carried out based on the following methods: analysis of publication dynamics (determination of the number of articles by year); citation analysis (identification of the most influential works and authors); analysis of keyword co-occurrence (co-occurrence analysis) to identify thematic clusters; analysis of scientific cooperation (by countries and authors); methods of system analysis and logical generalization.

Visualization of scientific connections was carried out using the VOSviewer software, which allows the creation of keyword co-occurrence maps, co-authorship networks, and citation maps. Clustering was performed using the modularity optimization algorithm, which selects research groups with the closest internal connections.

The applied methodological approach enabled the systematization of scientific publications by main thematic

areas, the assessment of the evolution of AI-strategy research in the SME sector, and the establishment of an analytical basis for further scientific developments.

Presentation of the main research material. Theoretical and methodological basis. The search query was formed from the fields: Article title, Abstract, Keywords: "AI strategy" OR "artificial intelligence strategy" OR "artificial intelligence" AND "strategy" AND "SME" OR "small and medium enterprise" OR "entrepreneurship" OR "small business" – 578 results. Time period 1985-2025, document type only Journal and Book chapter, subject areas only: Business, Management and Accounting (170), Computer Science (117), Economics, Econometrics and Finance (101), Social Sciences (90), Engineering (52), Decision Sciences (31), Environmental Science (30). In total, we received 306 documents. Access key: TITLE-ABS-KEY ("AI strategy" OR "artificial intelligence strategy" OR "artificial intelligence" AND "strategy") AND TITLE-ABS-KEY ("SME" OR "small and medium enterprise" OR "entrepreneurship" OR "small business")) AND PUBYEAR > 1985 AND PUBYEAR < 2026 AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "ch")) AND (LIMIT-TO (SUBJAREA , "BUSI") OR LIMIT-TO (SUBJAREA , "COMP") OR LIMIT-TO (SUBJAREA , "ECON") OR LIMIT-TO (SUBJAREA , "SOCI") OR LIMIT-TO (SUBJAREA , "ENGI") OR LIMIT-TO (SUBJAREA , "DECI") OR LIMIT-TO (SUBJAREA , "ENVI") OR LIMIT-TO (SUBJAREA , "ENER") OR LIMIT-TO (SUBJAREA , "MULT") OR LIMIT-TO (SUBJAREA , "AGRI"))

Analysis of publication dynamics in the SCOPUS database shows a gradual increase in scientific interest in AI strategies in the small and medium-sized enterprise sector since 2013. During 2013–2019, the number of publications remained insignificant and episodic (2-4 per year), indicating the initial stage of the formation of the scientific direction (fig. 1).

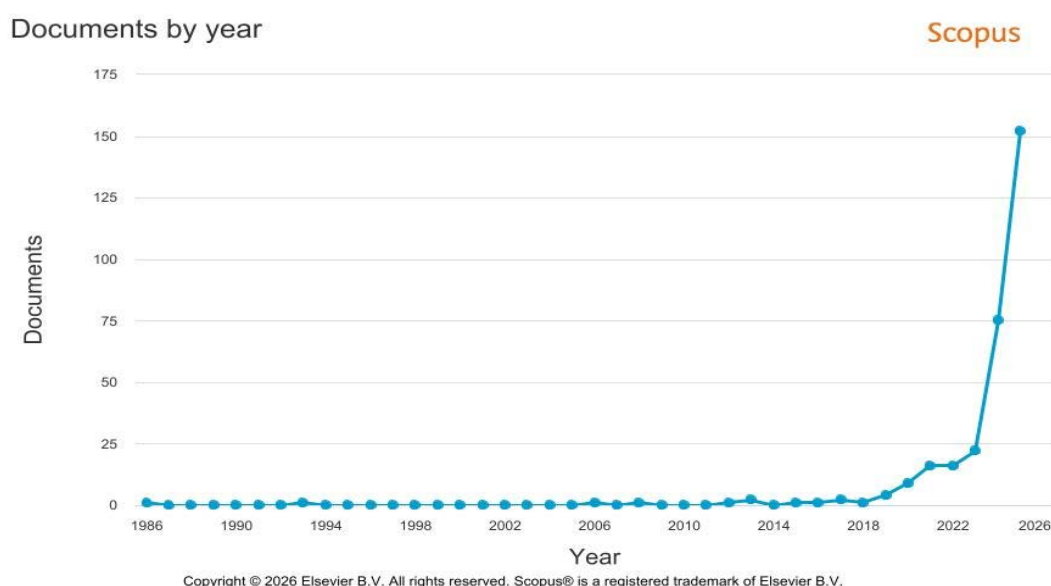


Figure 1. Number of articles per year.

Source: Scopus.

Since 2020, there has been a clear trend of increasing publication activity: the number of documents increased to 9 in 2020, 16 in 2021-2022, and 22 in 2023. The most intensive growth was recorded in 2024-2025, when the number of publications increased to 75 and 152 documents, respectively.

The results indicate a transition in research on AI strategies for SMEs from the formation phase to the active development phase. Such dynamics may be associated with: the acceleration of digital transformation following the COVID-19 pandemic [23.]; the active deployment of generative artificial intelligence; the growth of interest in the strategic integration of AI into business processes; and the strengthening of state and international programs to support the digitalization of SMEs.

Thus, the results confirm the hypothesis of the structured, rapidly growing nature of the scientific discourse in the field of AI strategies for small and medium-sized enterprises.

The analysis of publication distribution by field of

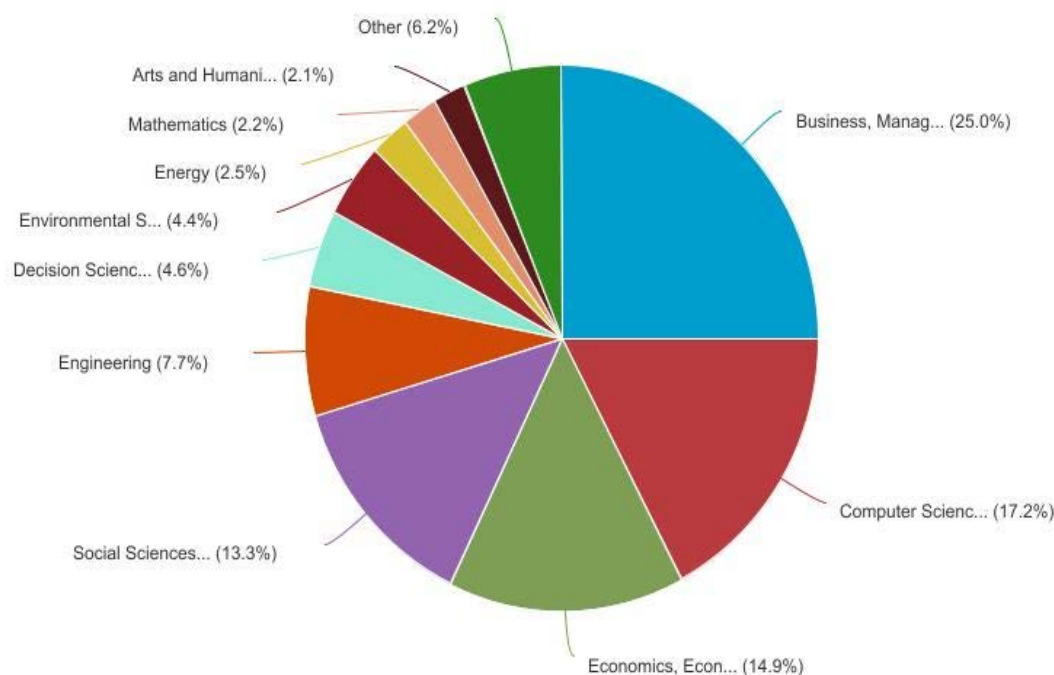
knowledge has shown the interdisciplinary nature of research on AI strategies in the SME sector. According to SCOPUS data, the largest share of documents falls in the field of Business, Management and Accounting (25.0%), which confirms the strategic and managerial nature of the research issues (fig. 2).

The second place is occupied by Computer Science (17.2%), reflecting the technological nature of artificial intelligence and the significant role of algorithmic and digital solutions in shaping AI strategies. The share of publications in Economics, Econometrics, and Finance (14.9%) indicates growing interest in assessing the economic efficiency of AI implementation and its impact on the productivity and competitiveness of SMEs.

The share of research in the field of Social Sciences (13.3%) is also significant, indicating the social and institutional dimensions of digital transformation, including issues of entrepreneurial behavior, organizational changes, and the adaptation of business models.

Documents by subject area

Scopus



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Figure 2. Documents by subject area.

Source: Scopus.

The results obtained demonstrate that the issue of AI strategies for SMEs arises at the intersection of managerial, economic, and technological research. The dominance of managerial and economic components (altogether almost 40%) indicates a gradual transition from a purely technical understanding of AI to its strategic integration into the enterprise management system.

Thus, the sectoral distribution of publications confirms

the hypothesis of the structured, interdisciplinary nature of the development of AI strategy research in the SME sector.

Analysis of document distribution by type indicates that articles predominate in the overall research on AI strategies for SMEs. Of the total number of publications, 221 documents (72.2%) are scientific articles, while 85 documents (27.8%) are presented in the format of monograph sections (Book Chapter) (fig. 3).

Documents by type

Scopus

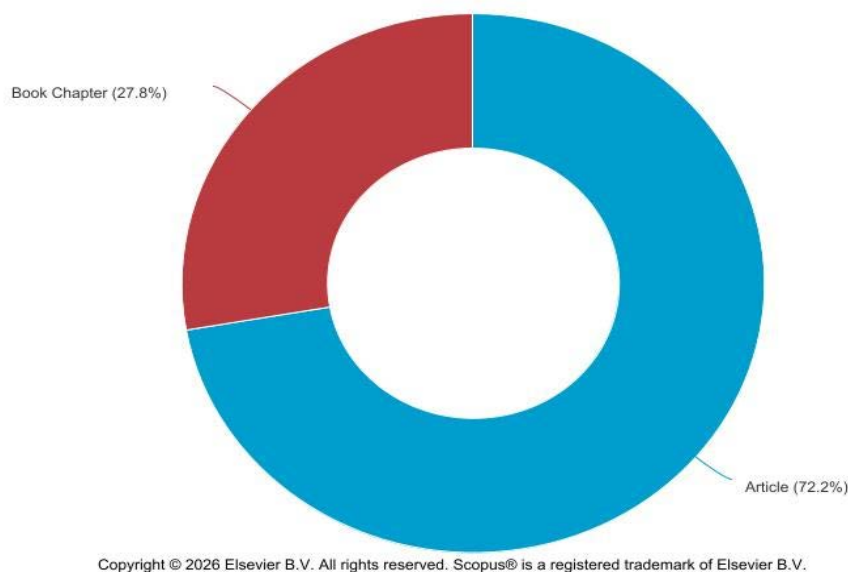


Figure 3. Documents by type.

Source: Scopus.

The dominance of articles as the main format of scientific communication confirms the institutionalization of the research area in peer-reviewed publications. A high proportion of articles indicates the formation of stable academic interest, the development of a theoretical and methodological base, and active discussion of the issue in scientific journals.

The presence of a significant proportion of monograph chapters (more than a quarter of the collection) demonstrates the interdisciplinary nature of the field and its inclusion in broader research collections on digital transformation, innovation, and strategic management.

The results obtained confirm that research on AI strategies of SMEs is in an active phase of scientific development and transitioning from fragmentary publications to a systematic theoretical understanding.

Analysis of publication distribution by country showed a significant concentration of scientific activity in Asia and North America. The leader in the number of publications is India (about 59 documents), which indicates a high level of research activity in the field of digital transformation and the development of AI solutions for small and medium-sized businesses (fig. 4).

Documents by country or territory

Scopus

Compare the document counts for up to 15 countries/territories.

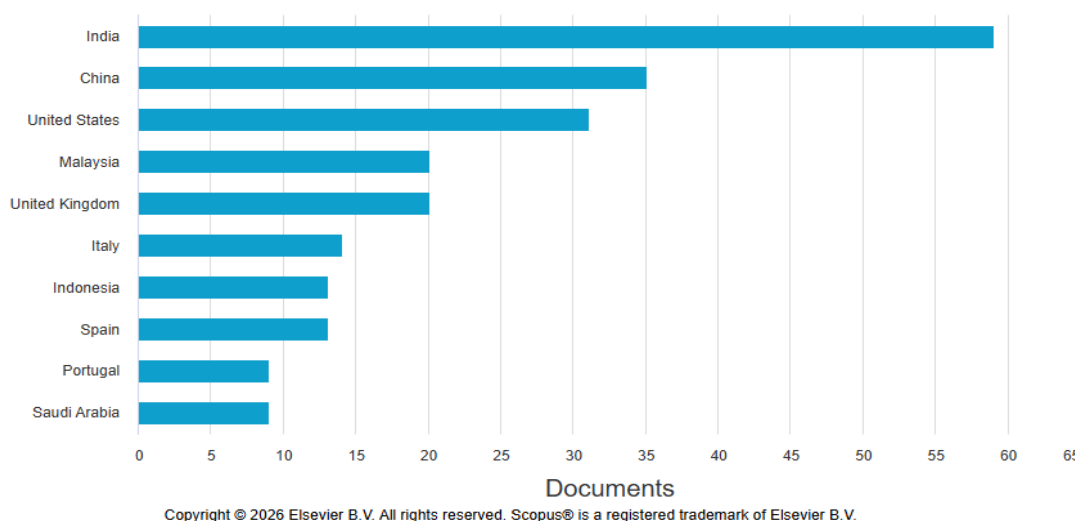


Figure 4. Documents by country.

Source: Scopus.

The second position is occupied by China (approximately 35 documents), reflecting the country's strategic orientation towards the development of artificial intelligence as a priority area of state policy and innovative development. The USA also accounts for a significant share of publications (approximately 31 documents), which is traditionally one of the global centers of research in technology and strategic management.

Among European countries, the United Kingdom and Italy are the most active, while Southeast Asian countries (Malaysia, Indonesia) maintain a stable presence in the studied area. Spain, Portugal, and Saudi Arabia are also represented in the sample.

Thus, research on AI strategies of SMEs has a pronounced global character; the phenomenon of concentration of publications is observed in countries with active

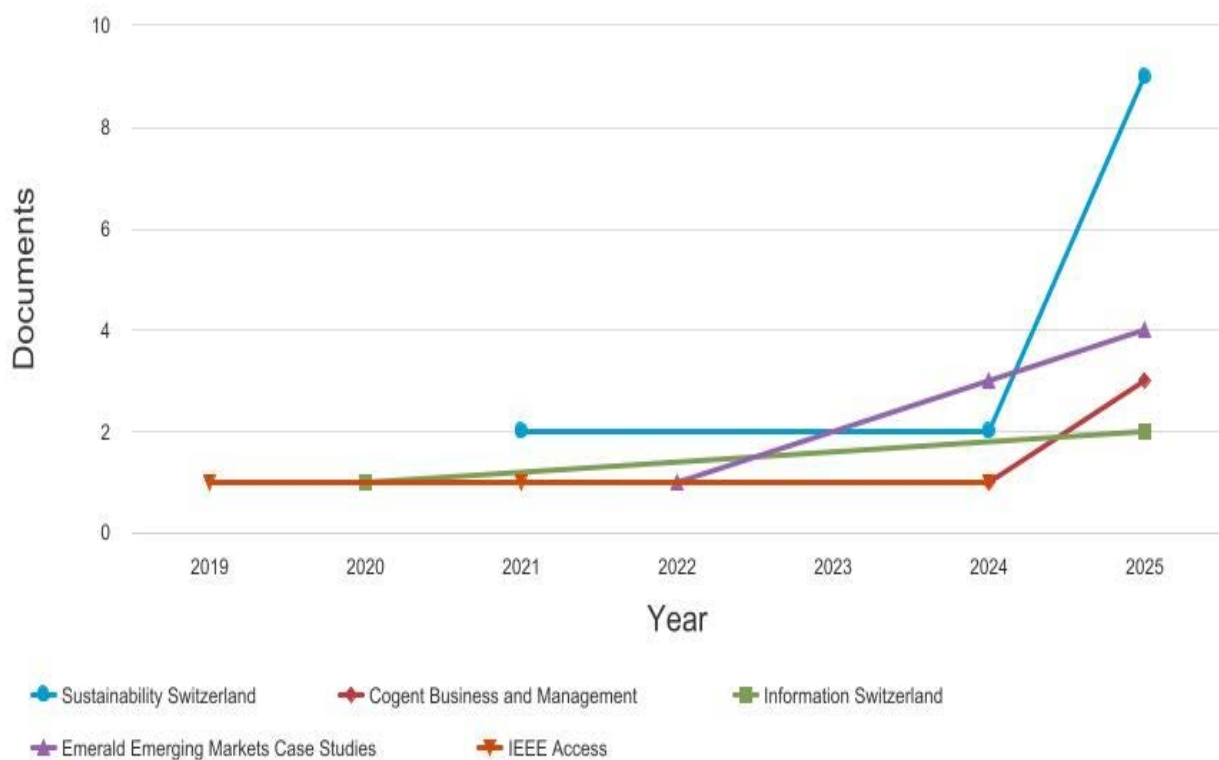
state support for digital transformation, and the formation of scientific discourse in the field of AI strategies of SMEs is associated with economies that actively invest in the development of innovative ecosystems. Geographical distribution confirms the hypothesis of a structured development of the scientific field and the presence of regional research centers.

Analysis of publication distribution by source showed a concentration of research on SME AI strategies across multiple international peer-reviewed publications. The journal Sustainability (Switzerland) shows the most pronounced growth dynamics, with the number of publications reaching 9 in 2025, indicating an active discussion of AI and digital transformation in the context of the sustainable development of enterprises (fig. 5).

Documents per year by source

Scopus

Compare the document counts for up to 10 sources. Compare sources and view CiteScore, SJR, and SNIP data



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Figure 5. Documents per year by source.

Source: Scopus.

A stable presence is also demonstrated by Emerald Emerging Markets Case Studies, Cogent Business and Management, Information (Switzerland), and IEEE Access. The growth of publications in 2024-2025 is particularly significant, correlating with the general trend of exponential growth in research on AI strategies.

Analysis of publication distribution by financial sponsors showed that research on AI strategies for small and

medium-sized enterprises receives institutional support from national and international scientific foundations.

The most significant number of publications is associated with funding from the National Natural Science Foundation of China, confirming China's active role in shaping the scientific discourse in the fields of artificial intelligence and strategic management of digital transformations (fig. 6).

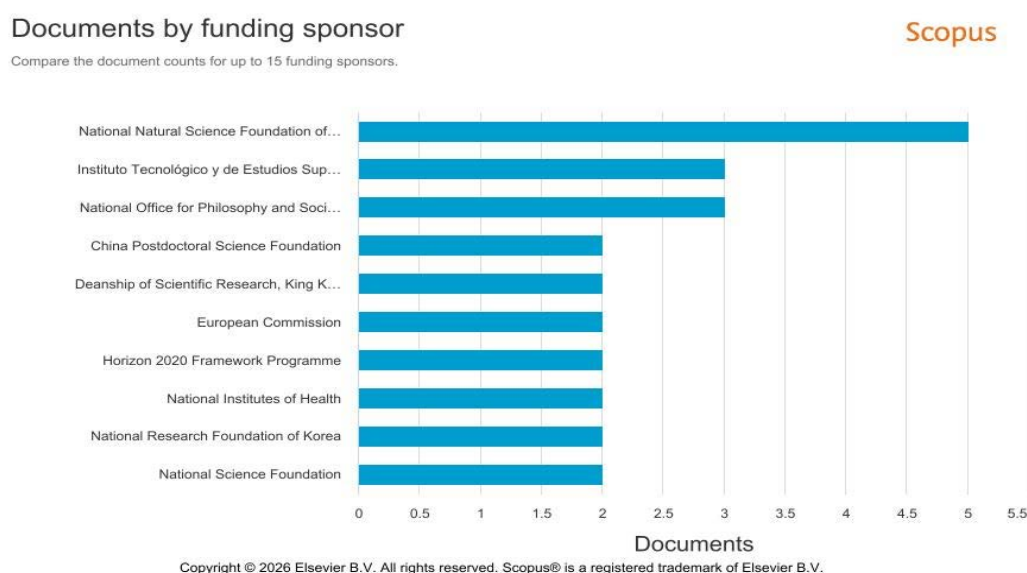


Figure 6. Documents per year by source.
Source: Scopus.

The presence of the European Commission and the Horizon 2020 program on the list of financial donors indicates the integration of AI strategies for SMEs into the priority areas of European innovation policy.

Conclusions: research on SME AI strategies is supported by state science funds; the main concentration of funding is in countries with an active state digitalization policy; and institutional support contributes to the formation of sustainable AI research centers. Thus, the analysis of funding sources confirms the institutional determinants of the development of AI strategy research and its alignment with the strategic directions of the scientific and technological policies of leading countries worldwide.

To identify the structure of the scientific discourse, a co-occurrence analysis of keywords was conducted using VOSviewer. The constructed map enabled the identification of several thematic clusters that reflect the main directions of AI strategy research in the small- and medium-sized enterprise sector.

The central node of the network is the concept of "artificial intelligence", which has the most connections and the highest frequency of co-occurrence with other terms. This confirms its role as the conceptual core of the research area.

As a result of clustering, four main thematic clusters were identified (fig. 7).

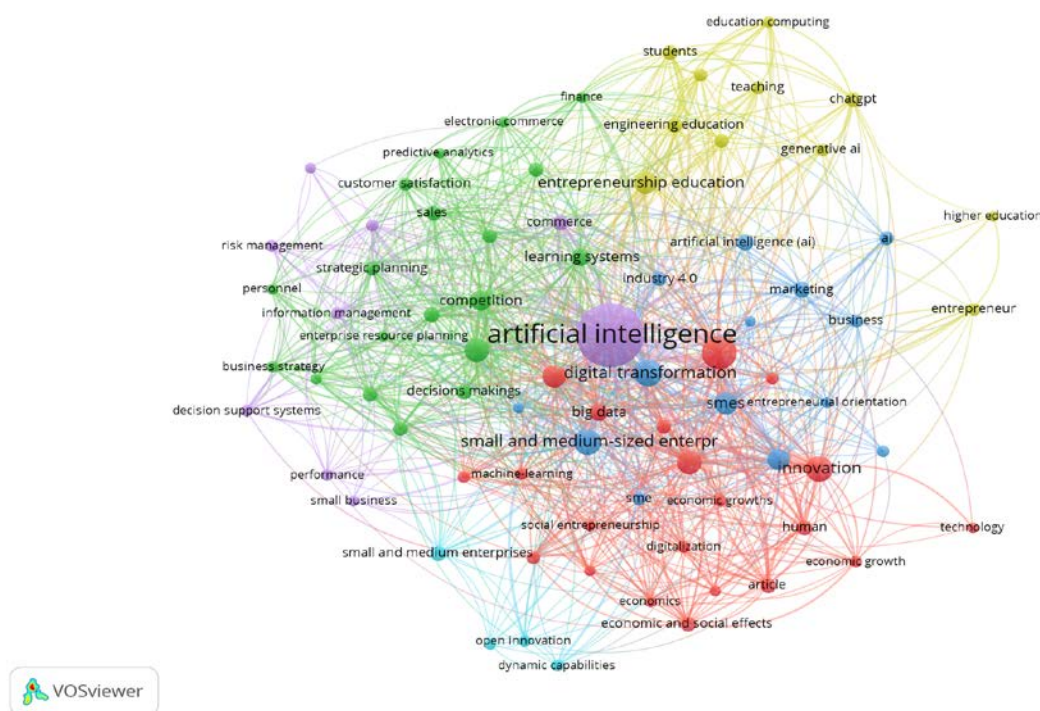


Figure 7. Keyword co-occurrence
Source: VOSviewer.

Cluster 1: Area 1. AI as a driver of innovative and economic development of SMEs

This cluster includes the following key terms: innovation, digitalization, economic growth, economic development, sustainable development, entrepreneurship, machine learning, technology, and investments.

This area focuses on macro- and meso-level aspects of AI's impact on enterprise development and the broader economy. A significant proportion of publications examine the relationship between AI implementation, SME innovation, and economic growth indicators.

Cluster 2: Direction 2. Formation of AI strategies in the strategic management system

Key terms: business strategy, strategic planning, competitive advantage, decision support systems, risk management, enterprise resource planning, performance, predictive analytics.

This cluster reflects the managerial and entrepreneurial dimension of research. The focus is on developing digital transformation strategies, the competitive advantages of SMEs, and adapting business models for AI use.

Cluster 3: Direction 3. Digital transformation of SMEs and entrepreneurial orientation

Key terms: digital transformation, SMEs, entrepreneurial orientation, dynamic capabilities, open innovation, technology adoption, Industry 4.0. This cluster focuses on the applied aspects of integrating AI into an enterprise's strategic management system. Research in this direction focuses on improving the efficiency of management decisions, optimizing business processes, and using analytical tools.

Cluster 4: Educational-Generative Dimension of AI Development

Key terms: generative AI, ChatGPT, entrepreneurship education, e-learning, higher education, education computing, virtual reality.

This cluster is the newest and demonstrates the integration of generative artificial intelligence into the field of education and training of entrepreneurs. Its activation coincides with a sharp increase in publications after 2022.

Interpretation of results

The obtained results allow us to draw several conceptual conclusions:

Research on AI strategies for SMEs is interdisciplinary.

There is a shift in focus from technological aspects to strategic and economic ones.

Since 2023, a new direction in generative AI has been actively emerging.

The concept of AI strategy is gradually being integrated into the classical theory of strategic management.

Thus, cluster analysis confirms the hypothesis of the structuredness and evolutionary nature of the development of scientific discourse in the field of AI strategies of small and medium-sized enterprises.

Conclusions. The bibliometric analysis of the development of AI strategy research in small and medium-sized enterprises, based on data from the SCOPUS database, allowed us to form a holistic picture of the evolution of scientific discourse in this area, identify its structural features, and outline the prospects for further research.

First, it was established that research on AI strategies of SMEs is in an active growth phase. Starting in 2020, an exponential increase in publications has been observed, and in 2024-2025, a sharp acceleration of scientific activity was recorded. This indicates the transformation of artificial intelligence from a technological tool into a strategic factor in enterprise development.

Secondly, the sectoral distribution of publications confirmed the interdisciplinary nature of the research. The dominance of the directions of Business, Management and Accounting, Computer Science, and Economics demonstrates the combination of managerial, technological, and economic components in the formation of AI strategies of SMEs. Thus, the direction under study is shaped by the intersection of strategic management, the innovative economy, and digital technologies.

Thirdly, the geographical analysis confirmed the presence of regional research centers, in particular in India, China, and the USA, as well as the active participation of countries in Southeast Asia. This indicates the global nature of the problem's development and its connection to national digital transformation strategies.

Fourth, the cluster analysis of keywords allowed us to systematize the scientific discourse and aggregate it into four conceptual areas:

1. AI as a driver of innovative and economic development of SMEs;
2. Formation of AI strategies in the strategic management system;
3. Digital transformation of SMEs and development of dynamic capabilities;
4. Educational and generative dimension of AI development.

It was found that, in the early stages of research, focus was mainly on technological aspects, whereas the current stage is characterized by a strengthening of the strategic and economic dimensions. It is worth noting the formation of a new cluster associated with generative AI, which became more active after 2022.

Thus, the results of the study confirm the hypothesis regarding the structured and evolutionary nature of the development of scientific research on AI strategies in the small and medium-sized enterprise sector. The bibliometric approach allowed us to identify the internal logic of the formation of research directions and determine the dominant thematic fields.

The practical significance of the results lies in the possibility of using the developed classification of directions to further empirical research on AI strategies of SMEs, particularly in countries with transition economies.

The prospects for further research include conducting a comparative analysis of regional models of AI strategy formation, assessing the impact of generative artificial intelligence on SME business models, and integrating bibliometric results with empirical data from enterprises.

Thus, the analysis provides a theoretical and analytical basis for further development of research on AI strategies of small and medium-sized enterprises and their integration into the system of strategic management of digital transformation.

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