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Bibliometrics Analysis of Bankruptcy Prediction Trends in MSMEs: Global Insights from (2020–2025)

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Abstract. The purpose of this study is to map the development of research on bankruptcy prediction in Micro, Small, and Medium Enterprises (MSMEs) during 2020–2025 and to identify major scientific trends, influential authors, and dominant methodological approaches. Using a bibliometric method, data were collected from the Scopus database, producing 144 initial documents that were filtered into 23 final publications based on relevance and open-access availability. Performance analysis and science mapping were carried out using VOSviewer through co-authorship, co-citation, and keyword co-occurrence networks. The findings reveal four main research clusters: (1) financial-ratio-based distress models, (2) machine-learning approaches for SME risk prediction, (3) post-pandemic MSME resilience, and (4) credit scoring using non-financial indicators. Scientometrics is identified as the most influential journal, while Edward I. Altman and Alessandro Giannozzi emerge as central scholars. The United States, Italy, and the United Kingdom appear as the most collaborative and productive countries. The novelty of this research lies in its specific focus on MSME bankruptcy prediction during the post-pandemic era, the use of an open-access-filtered dataset, and the identification of emerging thematic clusters. However, this review is limited to Scopus-indexed, English-language, and open-access publications, which may exclude relevant studies from other sources.

Keywords: MSME Bankruptcy Prediction; Bibliometric Analysis; Science Mapping; Machine Learning; Co-citation Network.

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1. INTRODUCTION

Micro, Small, and Medium Enterprises (MSMEs) serve as the backbone of global economic resilience, accounting for the vast majority of businesses and providing a critical foundation for employment and GDP growth in both emerging and advanced economies [1]–[11]. However, this pivotal role is shadowed by an inherent fragility; MSMEs are disproportionately susceptible to financial distress, driven by internal resource constraints and a heightened sensitivity to systemic shocks [3], [4]. This vulnerability is compounded by a persistent "financing gap," where MSMEs struggle to secure capital due to information asymmetry, lack of robust financial documentation, and a high perceived risk of insolvency by institutional lenders [6], [9], [12]–[17].

The landscape of bankruptcy prediction has undergone a significant paradigm shift, transitioning from classical accounting-based models toward more sophisticated computational frameworks. While traditional ratios, such as the Altman Z-score, provided an early foundation for credit risk assessment, recent scholarship argues that these linear models often fail to capture the idiosyncratic risks of the MSME sector [10]–[12], [18]. Unlike large corporations, MSMEs operate under different structural dynamics, where qualitative factors—such as managerial experience and local market volatility—often carry more weight than formal balance sheets.

The period between 2020 and 2025 represents a unique "stress test" for global financial modeling, as the COVID-19 pandemic and subsequent inflationary pressures forced a re-evaluation of predictive accuracy. In response, the research community has pivoted toward high-dimensional techniques, including hazard models and Machine Learning (ML) algorithms, such as Random Forest and Support Vector Machines, which demonstrate superior performance in handling non-linear data [1], [7], [20]–[28]. These advanced approaches allow for the integration of non-financial indicators and real-time data, providing a more granular view of MSME health in a volatile global market.

Despite this surge in specialized literature, the rapid diversification of methodologies has created a fragmented and decentralized body of knowledge. As new techniques emerge—ranging from deep learning to hybrid qualitative-quantitative ensembles—there is an urgent need to synthesize these developments to understand the current state of the

art. There is currently a conspicuous absence of a systematic, bibliometric synthesis that captures the "post-pandemic pivot" in bankruptcy forecasting. Existing reviews often lack the temporal relevance to account for the most recent technological shifts and global economic restructuring occurring in the current 2020–2025 window.

This study addresses this gap by providing a rigorous science-mapping analysis of the domain's intellectual structure using bibliometric techniques. By analyzing the meta-data of thousands of scholarly contributions, this research aims to: (1) quantify the trajectory of publication trends during this period of extreme economic volatility; (2) deconstruct the collaborative networks of influential authors, institutions, and journals to identify the global epicenters of MSME research; and (3) employing co-word and thematic clustering to reveal the transition from traditional statistical models to the current frontier of AI-driven insolvency intelligence.

2. METHODS

2.1. Research Design

This study employs a quantitative bibliometric research design to systematically evaluate the evolution of MSME bankruptcy prediction literature. Bibliometric analysis was selected for its capacity to deconstruct large volumes of scientific data, allowing for the objective mapping of citation structures, influential scholarship, and the thematic progression of the field [29], [30]. By utilizing science-mapping techniques, this design transcends traditional literature reviews to reveal the hidden intellectual connections and collaborative networks that define the current 2020–2025 research epoch.

2.2. Data Acquisition and Search Strategy

Bibliographic data were harvested from the Scopus database, a premier repository favored for its rigorous indexing standards and extensive coverage of financial and computational research [29], [30]. The search was executed on April 28, 2025, using a curated query designed to capture the intersection of MSMEs and predictive analytics. The search string was meticulously formulated based on established terminology in financial distress literature and bibliometric best practices [31]–[43]:

TITLE-ABS-KEY (("SME" OR "MSME" OR "small and medium enterprises" OR "small business") AND ("bankruptcy" OR "default" OR "financial distress") AND ("prediction" OR "risk assessment" OR "probability of default"))

As illustrated in the comprehensive research workflow in Figure 1, the keywords were selected through a tripartite approach: (1) technical terms prevalent in MSME literature [31]–[38]; (2) synonyms identified via preliminary scoping of the domain [29], [39]; and (3) high-frequency terms aligned with Scopus indexing standards [40]–[43]. The search was temporally constrained to 2020–2025 to capture the post-pandemic research surge, restricted to English-language open-access articles and proceedings to ensure maximum transparency and replicability.

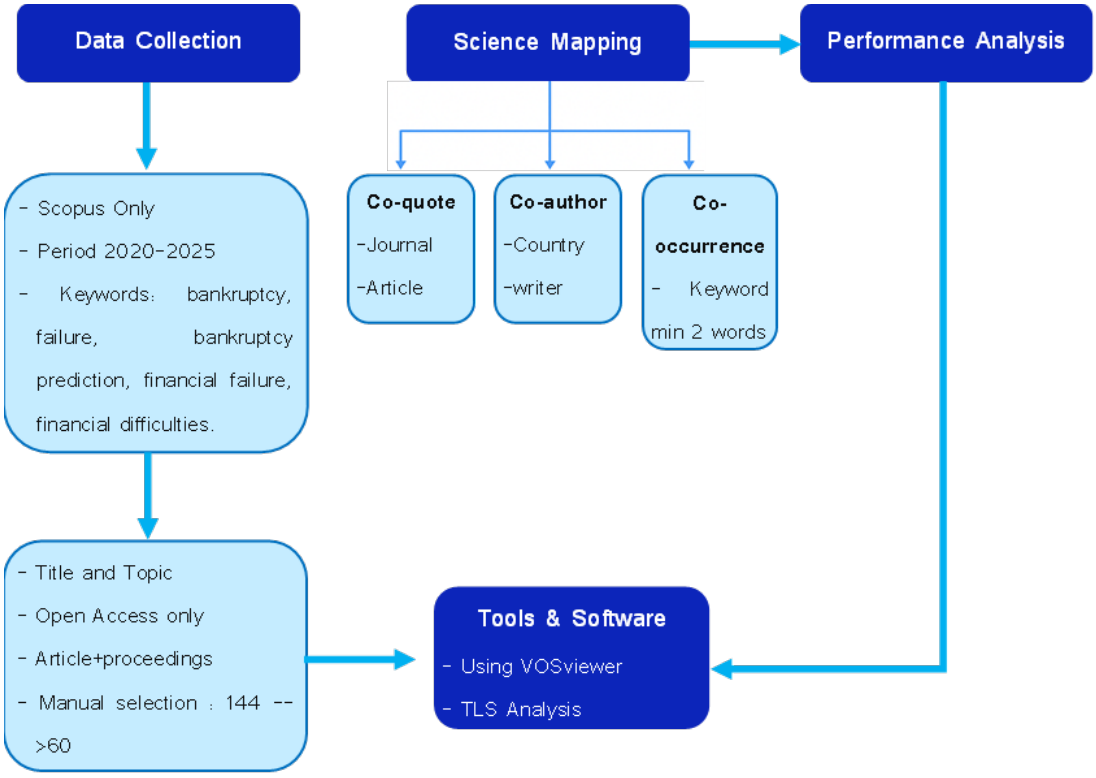

Figure 1. Bibliometrics Research Workflow

2.3. Screening and Eligibility Criteria

The refinement of the initial dataset followed a structured multistage screening process to ensure thematic alignment with the study's objectives. Initially, 144 documents were identified. During the Identification phase, non-research items such as editorials and notes were removed. This was followed by a rigorous Screening of titles and abstracts

to confirm that the studies specifically addressed MSME-scale enterprises and utilized predictive or risk assessment methodologies. Finally, the Eligibility phase ensured full-text availability, resulting in a finalized corpus of 23 high-impact articles. This rigorous filtering process, which guarantees the quality of the analyzed metadata, is visually summarized in the procedural flowchart in Figure 1.

2.4. Bibliometric Analysis Techniques

The analysis was bifurcated into two primary methodologies to provide a holistic view of the research landscape:

1) Performance Analysis: This evaluative technique was used to quantify the productivity and impact of various stakeholders. It identifies the most prolific journals, influential authors, and dominant contributing countries, thereby establishing the "who's who" in MSME bankruptcy research.
2) Science Mapping: This technique visualizes the structural and dynamic relationships between research constituents. Three specific mapping methods were applied:
    a) Co-citation Analysis: To uncover the theoretical foundations and "intellectual roots" of the field.
    b) Co-authorship Analysis: To map global research synergies and institutional collaborations.
    c) Co-occurrence Analysis: To examine keyword clusters, which reveal the shift from traditional financial ratios to AI-driven methodologies as discussed in the Introduction.

2.5. Analytical Software and Research Workflow

VOSviewer (Version 1.6.20) was utilized as the primary computational tool for generating network visualizations. It was selected for its robust capability in handling Scopus metadata and its sophisticated algorithms for distance-based mapping. The integrated research workflow—encompassing data retrieval, screening, clustering, and final visualization—is depicted in Figure 2. This figure serves as the methodological blueprint for the study, ensuring that each step from data collection to science mapping is conducted with high procedural integrity.

2.6. Validity and Reliability Procedures

To ensure the reproducibility of findings, the study maintained strict data integrity protocols. All metadata were exported in CSV and BIB format directly from Scopus without manual alteration. Software settings in VOSviewer, including the fractional counting method and minimum threshold occurrences for keywords, were kept consistent across all visualizations. Furthermore, the explicit documentation of the search query and the inclusion/exclusion criteria shown in Figure 2 ensures that the study meets the standards of transparency required for high-impact academic publication.

3. RESULTS AND DISCUSSION

The observation and assessment of publication trends concerning MSME bankruptcy prediction were conducted through a systematic bibliometric lens. This study utilizes VOSviewer to generate science maps that visualize the intellectual structure of the field [44]–[46]. In the initial phase of the analysis, the most influential publishing patterns, prominent journals, highly cited articles, and key researchers were identified to map the current state of knowledge regarding micro, small, and medium enterprise insolvency.

3.1. Most Productive Journal or Conference

Based on the Scopus dataset retrieved using the search strategy outlined in Figure 1, a total of 23 articles were identified, spanning 16 unique journals and conferences. By applying a threshold of at least one article and one citation, 13 key sources were isolated for further analysis, as detailed in Table 1.

Table 1. The most productive journal or conference with a lot of citations

Source	Number of Articles	Quotation	Total Link Strength
Scientometrics	1	88	7
Journal of Small Business Management	4	53	4
Journal of Small Business Strategy	1	27	1
Journal of the International Council for Small Business	3	1	1

Source	Number of Articles	Quotation	Total Link Strength
Managerial Science Review	1	8	1
Journal of Management of Central Europe	1	1	0
Design	1	10	0
Foresight and Governance of IMS	1	7	0
Journal of Risk Management and Finance	1	58	0
Journal of the Operational Research Society	1	18	0
Naukovyi Visnk Natsionalnoho Hirnychoco Universtetu	1	2	0
Risk	1	21	0
Sustainability (Switzerland)	2	70	0

The Journal of Small Business Management emerges as the most productive outlet with four publications, while Scientometrics demonstrates the highest scientific influence, commanding 88 citations from a single, high-impact study. These venues represent the primary intellectual conduits for MSME risk research. *Scientometrics* dominates in connectivity because it specializes in the bibliometric and methodological frameworks frequently cited across the bankruptcy prediction domain. Conversely, the *Journal of Small Business Management* leads in volume due to its targeted focus on SME financial management and risk exposure. Based on citation impact and centrality within the co-citation network, scholars aiming to contribute to this field should prioritize the following high-impact outlets:

1. Scientometrics (Methodological depth)
2. Journal of Small Business Management (Sectoral specialization)
3. Sustainability (Switzerland) (Interdisciplinary reach)
4. Journal of the Operational Research Society (Computational modeling)

As visualized in Figure 2, the VOSviewer analysis reveals four distinct clusters representing the relational strength between these publication venues. Scientometrics is positioned within Cluster 1, exhibiting the highest level of connectivity with a Total Link

Strength (TLS) of 7. This indicates its role as a "bridge" journal, connecting various methodological approaches within the global MSME bankruptcy research landscape.

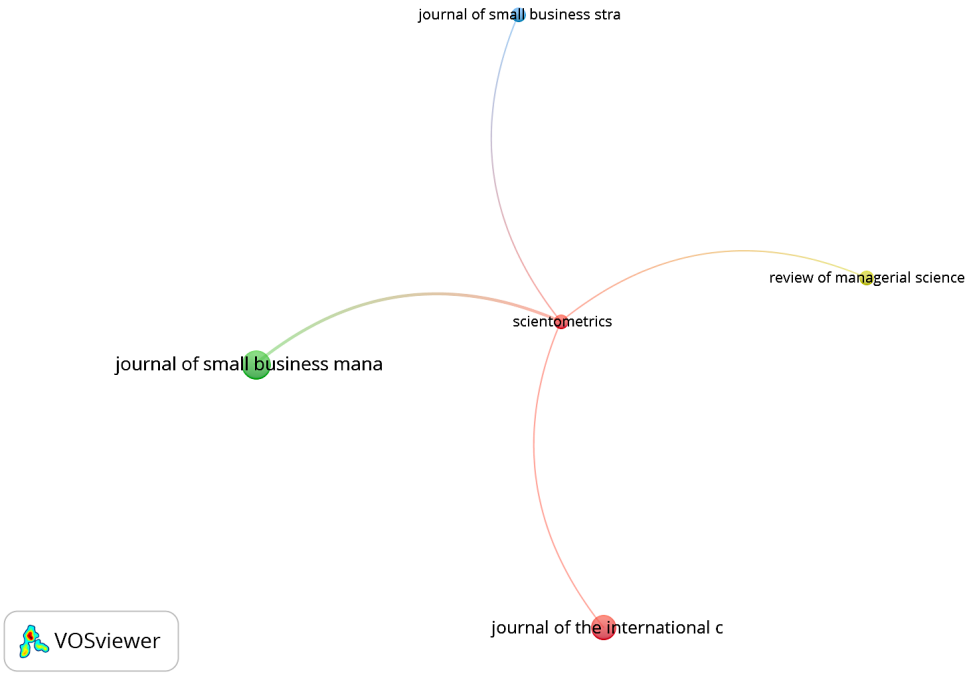

Figure 2. Map of Joint Citations of Journals or Conferences

3.2. Most Influential Articles

The citation analysis identifies the intellectual pillars that have shaped MSME bankruptcy research during the 2020–2025 period. According to the Scopus dataset, the article titled "Rethinking SME Default Prediction: A Systematic Literature Review and Future Perspectives" (published in Scientometrics) stands out as the most authoritative work. With 88 citations and a Total Link Strength (TLS) of 6, it functions as the primary central node in the co-citation network, bridging foundational theories with contemporary predictive challenges.

Other highly influential contributions include the empirical analysis of Slovakian SMEs (65 citations) and the exploration of Machine Learning (ML) techniques in bankruptcy forecasting (58 citations). These papers are pivotal because they address the specific structural limitations of traditional models when applied to small-scale enterprises. In contrast, several recent papers—focusing on cutting-edge themes such as COVID-19 impacts, hybrid ensemble models, and entrepreneurial resilience—have not yet

accumulated citations (see Table 2). This lack of citations is typical for the most recent 2024–2025 publications and represents the "emerging frontier" rather than a lack of relevance.

Table 2. Most Cited Articles

Title	Authors	Quotation	TLS
Rethinking SME default predictions: a systematic literature review and future perspectives	Ciampi, F., Giannozzi, A., Marzi, G., Altman, E.I.	88	6
Revisiting the default predictor of SMBs: Omega Score	Altman, E.I., Balzano, M., Giannozzi, A., Srhoj, S.	37	1
Predicting the survival of small businesses on the verge of failure	Dieperink, H., Adriaanse, J., Dechesne, M.	2	1
SME default prediction: Systematic method evaluation	Cheraghali, H., Molnár, P.	2	1
SME default predictions: A systematic review focused on methodology	Cheraghali, H., Molnár, P.	12	1
Predict company failure for small and medium enterprises and new ventures	Wang, W., Guedes, M.J.	8	1
Success factors of rural entrepreneurship: An empirical investigation in emerging markets	Gyimah, P. Lussier, R.N.	27	1
Bankruptcy Prediction for Micro and Small Enterprises Using Financial, Non-Financial, Business Sector and Macroeconomic Variables: The Case of the Lithuanian Construction Sector	Kanapickienė, R., Kanapickas, T., Nečiūnas, A.	10	0
Business failure predictions for Slovakia's small and medium-sized companies	Svabova, L., Michalkova, L., Durica, M., Nica, E.	65	0
Advanced assessment of bankruptcy prediction models focused on the core authors of the field: 2010–2022	Soukal, I., Marci, J., Trnkova, G., Svobodova, L., Hedvicakova, M., Hamplova, E., Maresova, P., Lefley, L.	1	0
Practical insights to predict defaults in small and medium-sized businesses	Cheraghali, H., Molnár, P.	1	0

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Title	Authors	Quotation	TLS
Does the quality of financial statements matter in default predictions? Proof of the Portuguese Construction Sector SMEs	Costa, M., Lisbon, I., Gameiro, A.	11	0
Bankruptcy Prediction Using Machine Learning Techniques	Shetty, S., Musa, M., Bredart, X.	58	0
The impact of solvency and business activities on the profitability of mining companies in Ukraine	Vyhovska, N.G., Polchanov, A.Y., Ostapchuk, T.P., Dovgaliuk, V.V.	2	0
Design for Manufacturing, Assembly, and Reliability: An Integrated Framework for Product Redesign and Innovation	Juniani, AI, Singgih, ML, Karningsih, PD	10	0
Employment contracts, wages and failure of SMEs	Dewaelheyns, N., Van Hulle, C., Van Landuyt, Y., Verreydt, M.	5	0
Textual analysis and corporate bankruptcy: A financial dictionary-based sentiment approach	Nguyen, B.-H., Huynh, V.-N.	18	0
The Impact of the First Year of the Pandemic on Czech Entrepreneurship	Dvoulety, O.	7	0
Does Size Matter? Analyzing the Financial Implications of COVID-19 on SMEs and Large Enterprises Using a Hybrid Methodology	Halteh, K	0	0
The Ensemble Method for Predicting Bankruptcy Resolution: A New Approach	SánchezMedina, A.J., Cerviño-Cortínez, D.L., BlázquezSantana, F., Pellejero, M.	0	0
Introducing entrepreneurial resilience in small business failure prediction	Dieperink, H., Adriaanse, J., Dechesne, M.	0	0
Accuracy in private company financial reporting for future cash flow prediction	Liu, S., Skerratt, L.	0	0
Improving the Accuracy of Company Failure Forecasting Using Non-	Kuvek, T., Pervan, I., Pervan, M.	0	0

Title	Authors	Quotation	TLS
Financial Variables: The Case of Croatian SMEs			

The dominance of these articles can be attributed to three strategic strengths:

1. Methodological Innovation: The integration of hybrid statistical–ML techniques to overcome the noise in MSME financial data [1], [2].
2. Systematic Synthesis: Providing structured evaluations that consolidate decades of fragmented SME failure models [3], [4].
3. Regional Granularity: Offering context-specific evidence (e.g., studies on the Lithuanian construction sector or Czech entrepreneurship) that provides practical utility for local policymakers [5], [6].

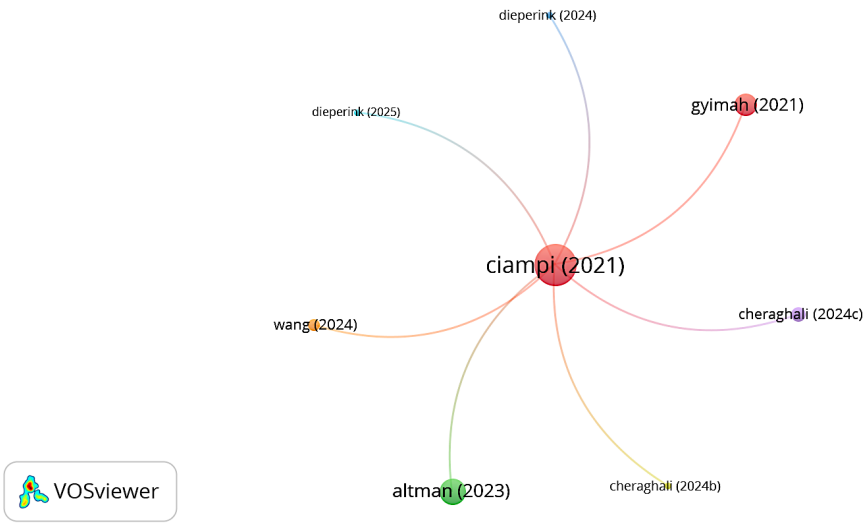

Figure 3. Most Cited Article Maps

As visualized in the co-citation map in Figure 3, the VOSviewer analysis reveals seven distinct clusters. These clusters illustrate the relational proximity between studies. Notably, Cluster 1 contains both the *"Rethinking SME Default Prediction"* paper and studies on *"Rural Entrepreneurship,"* indicating a strong thematic link between general default theory and specific environmental success factors. Despite the variance in TLS (ranging from 6 to 1), these articles form the collective backbone of the field. The central position of Ciampi et al. (2020) reinforces the conclusion that systematic reviews are currently the most influential drivers of citations in this research window.

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3.3. Scholarly Impact and Author Networks

To identify the primary intellectual drivers of the domain, an analysis of author productivity and citation impact was conducted. As evidenced in Table 3, Edward I. Altman and Alessandro Giannozzi emerge as the most influential figures, each contributing two high-impact articles that have amassed 125 citations and a Total Link Strength (TLS) of 12. Their dominance underscores the enduring relevance of foundational bankruptcy theories when adapted to modern MSME contexts.

Table 3. Most Influential Authors by Citation and Link Strength

Authors	Number of Articles	Quotation	Total Link Strength
Altman, E.I.	2	125	12
Giannozzi, A.	2	125	12
Cheraghali, H.	3	15	6
Molnár, P.	3	15	6
Adriaanse, J.	2	2	4
Dechesne, M.	2	2	4
Dieperink, H.	2	2	4

The VOSviewer mapping in Figure 4 reveals the collaborative structure of the field, categorized into three distinct clusters. Cluster 1 represents a high-impact research syndicate featuring Altman, Giannozzi, Adriaanse, and Dieperink. This group signifies the bridge between classical financial modeling and contemporary survival analysis. Cluster 2 is led by Hamid Cheraghali and Peter Molnár, whose three publications indicate a consistent output focused on methodological evaluation. Finally, Cluster 3 is centered around Mark Dechesne, representing specialized niche research.

The analysis suggests that cross-border and cross-institutional collaboration is a critical catalyst for the development of MSME bankruptcy research. Highly influential authors often serve as "knowledge brokers" between different regions, allowing for the integration of diverse datasets and varied methodological perspectives. This collaborative synergy leads to:

1) Enhanced Model Generalizability: By combining datasets from different economic jurisdictions, models become more robust against regional biases.

2) Methodological Acceleration: The fusion of accounting-based expertise with modern data science leads to faster innovation in prediction accuracy.
3) Global Scientific Visibility: Collaborative works tend to achieve higher citation trajectories, expanding the reach of MSME-specific research.

Strengthening international partnerships—particularly between established researchers in developed economies and scholars in emerging markets—is essential. Such collaboration would not only enhance methodological rigor but also address the "financing gap" in developing nations by providing more accurate, locally-relevant bankruptcy risk frameworks.

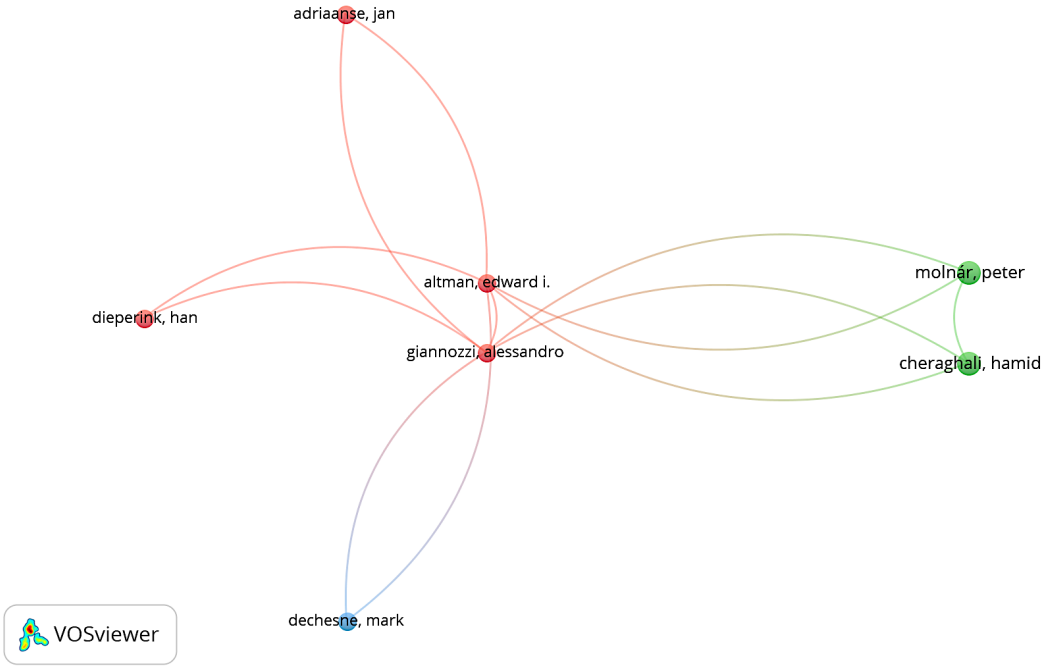

Figure 4. Most Influential Authors

3.4. Geographic Distribution and Global Collaboration Networks

The analysis of cross-country collaboration (Table 4 and Figure 5) reveals a significant concentration of research activity in Western economies. The United States, Italy, and the United Kingdom emerge as the primary global hubs for MSME bankruptcy research, recording the highest Total Link Strength (TLS) values of 16, 15, and 14, respectively. As shown in Table 4, these nations not only lead in citation counts but also serve as the central anchors for international co-authorship networks. This dominance is likely

attributed to their sophisticated financial reporting standards, access to granular longitudinal data, and well-funded academic ecosystems. Table. 4 Most Influential Countries.

Table 4. Most Influential Countries by Citation and Collaborative Strength

Country	Quotation	Total Link Strength
United States	210	16
Italy	125	15
English	106	14
Czech Republic	23	10
Norway	15	10
Poland	15	10
Netherlands	2	6
Croatia	37	3
Ghana	27	3
Portugal	19	3
Belgium	63	0
Indonesia	10	0
Japan	18	0
Kuwait	58	0
Lithuania	10	0
Romania	65	0
Slovakia	65	0
Ukraine	2	0

The science mapping presented in Figure 5 categorizes the global landscape into two primary collaborative clusters. Cluster 1 is a broad network led by the United States, Italy, and the United Kingdom, extending to the Netherlands, Croatia, Ghana, and Portugal. This cluster represents the "intellectual core" where the majority of cross-border methodological innovation occurs. Cluster 2 consists of the Czech Republic, Norway, and Poland, forming a robust European sub-network with moderate influence (TLS = 10).

A critical observation from the data is the "collaboration gap" affecting emerging economies. While countries such as Slovakia, Romania, and Indonesia have produced

significant research (with Slovakia recording a high citation count of 65), their TLS remains at zero. This indicates that their research is primarily localized, lacking the international synergies that drive global model robustness. As stated in the introduction, MSMEs in developing nations are particularly vulnerable to external shocks; therefore, bridging this gap is essential. International collaboration offers three vital benefits:

1) Enhanced Model Robustness: Integrating diverse economic datasets reduces over-fitting to specific national markets.
2) Knowledge Transfer: Facilitates the movement of advanced Machine Learning methodologies from high-resource hubs to emerging economies.
3) Standardization: Encourages the alignment of MSME risk assessment practices across different regulatory environments.

The results in Table 4 confirm that while developed countries currently dominate the scholarly output, the future of the field depends on diversifying these networks to include a broader range of socio-economic contexts.

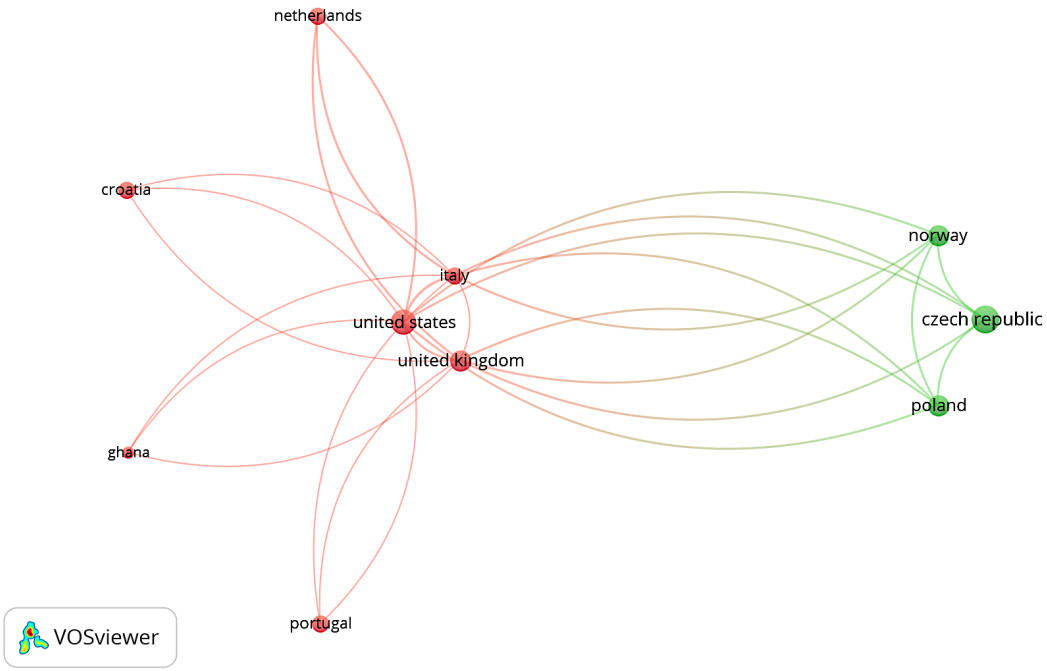

Figure 5. Most Influential Country Maps

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3.5. Keyword Co-Occurrence and Thematic Evolution

To uncover the conceptual structure and emerging trends in MSME bankruptcy research, a keyword co-occurrence analysis was performed using VOSviewer. Out of 125 unique keywords identified in the 2020–2025 corpus, 18 met the minimum threshold of two occurrences. As detailed in Table 5, the terms "SME," "Failure," and "Default" exhibit the highest frequency and Total Link Strength (TLS), serving as the foundational pillars of the domain.

Table 5. Keyword Co-Emergence

Keywords	Event	Total Link Strength
SME	6	17
Failure	5	12
Default	4	11
Predictions	3	11
Bankruptcy	5	10
Bankruptcy Prediction	3	10
Failure Prediction	2	8
Logistic Regression	2	8
Regression Analysis	2	8
Small and Medium Enterprises	2	8
Financial Difficulties	3	6
SME	3	6
Machine Learning	3	5
Credit Rating	2	4
Entrepreneurial Resilience	2	3
Non-Financial Variables	2	3
Small Business Failure	2	3
Covid-19	2	1

The mapping of these keywords, visualized in Figure 6, reveals four distinct thematic clusters that illustrate the transition from classical models to contemporary intelligence:

1) Cluster 1 (Traditional Modeling): This is the largest cluster (8 items), encompassing "SMEs," "Logistic Regression," and "Regression Analysis." It represents the conventional accounting-based approach to bankruptcy, which primarily relies on linear statistical methods to interpret financial ratios.

2) Cluster 2 (Credit Risk Assessment): Focused on "Default," "Failure," and "Credit Rating," this cluster links bankruptcy theory to the practical needs of financial institutions and lenders.
3) Cluster 3 (Socio-Economic Resilience): This cluster includes "Entrepreneurial Resilience" and "Small Business Failure." It signifies a critical shift in the literature—moving beyond balance sheets to examine the qualitative capacity of business owners to withstand crises.
4) Cluster 4 (The COVID-19 & AI Frontier): Notably, this cluster directly connects "Covid-19" with "Machine Learning." This suggests that the pandemic acted as a catalyst, forcing researchers to adopt non-linear, AI-driven methodologies to capture the extreme market volatility that traditional regression models failed to predict.

The integration of "Non-Financial Variables" in Cluster 1 and "Machine Learning" in Cluster 4 confirms the trend identified in the Introduction: the research community is increasingly moving toward "Insolvency Intelligence." By leveraging high-dimensional data and algorithmic flexibility, these emerging clusters provide a more robust framework for predicting MSME survival in a post-pandemic global economy.

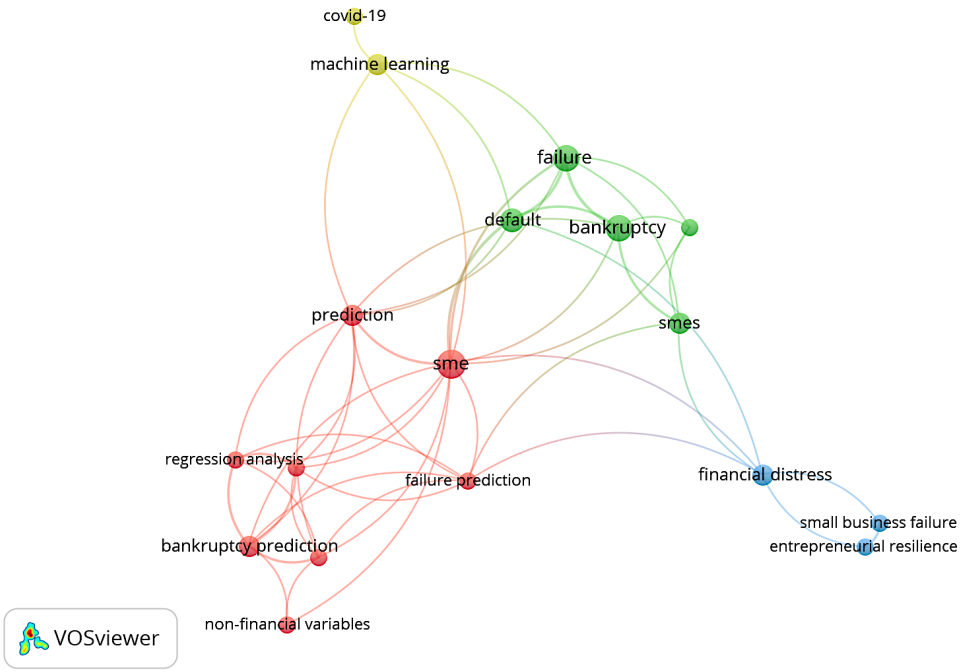

Figure 6. Map of the appearance of the combined keywords

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3.6. Discussion

The bibliometric analysis of MSME bankruptcy prediction from 2020 to 2025 reveals a research field in a state of rapid methodological and thematic transition. The publication ecosystem is currently anchored by the Journal of Small Business Management, which serves as the most productive outlet, indicating a high level of scholarly focus on MSME-specific financial risk. However, the conceptual trajectory of the field is primarily shaped by the work of Ciampi et al. in Scientometrics. Their systematic review acts as a central theoretical node, providing the necessary methodological rigor that has allowed subsequent researchers to move beyond fragmented studies and toward integrated, future-oriented predictive frameworks.

The social structure of the field reveals that authorship remains heavily influenced by foundational credit risk theories. Edward I. Altman, the pioneer of the Z-score model, remains the dominant intellectual figure, followed closely by contributors such as Alessandro Giannozzi. Together, their cumulative impact of 125 citations and a Total Link Strength (TLS) of 12 suggests that while new methods emerge, they are still fundamentally validated against classical benchmarks. Emerging authors such as Cheraghali and Molnár have introduced new methodological insights, particularly in systematic evaluations of machine learning–based prediction models. However, the collaboration network exposes a notable geographic disparity; while the United States, Italy, and the United Kingdom lead in citation impact and collaborative strength, participation from countries such as Indonesia remains limited. This identifies a critical cross-country research gap, as the unique socio-economic stressors facing MSMEs in developing nations require more collaborative attention to ensure global model generalizability.

The literature further reveals a decisive methodological pivot away from traditional, linear financial ratio-based approaches. This evolution is driven by the inherent limitations of Altman's original Z-score and standard logistic regression when applied to the inconsistent reporting structures of MSMEs. In response, the research community has moved toward more sophisticated, adaptive methods, including hazard models, random survival forests, and sentiment-based textual analysis. This shift reflects a maturing discipline that recognizes MSME bankruptcy as a multi-dimensional

phenomenon that requires non-financial variables and real-time data to achieve high predictive accuracy.

VOSviewer-based co-occurrence mapping identifies four dominant thematic clusters that define this research window. The first cluster continues to focus on technical foundations, such as logistic regression and non-financial variable analysis, while the second centers on core credit scoring topics like bankruptcy and failure. A significant development is seen in the third cluster, which highlights entrepreneurial resilience and financial stress, reflecting a shift toward psychosocial and contextual risk factors. Finally, the direct clustering of COVID-19 and Machine Learning in the fourth cluster proves that the pandemic was the primary catalyst for the widespread adoption of AI-based insolvency intelligence.

Collectively, these findings demonstrate that MSME bankruptcy research is moving toward a more holistic "Resilience and Intelligence" paradigm. The integration of advanced machine learning models is no longer an experimental luxury but a necessary response to global economic volatility. Future studies must bridge the existing geographic gaps by fostering international collaborations that apply these advanced AI-driven methodologies to the specific socio-economic contexts of MSMEs in emerging economies.

4. CONCLUSION

This study provides a comprehensive overview of the development and direction of MSME bankruptcy prediction research through a rigorous bibliometric approach. Based on the systematic analysis of publication trends, collaborative networks, and thematic clusters from 2020 to 2025, several critical conclusions are drawn: The research domain has experienced significant growth, with the topic of MSME bankruptcy prediction receiving increased attention from both academics and practitioners. This surge is primarily driven by the need for financial stability amidst global economic uncertainty and the post-pandemic crisis. Within the literature, the Journal of Small Business Management has emerged as a central productive source, while the systematic review by Ciampi et al. (2021) in Scientometrics reinforces its position as the leading reference and methodological foundation for contemporary studies.

Intellectual dominance in the field is characterized by the enduring influence of prominent authors such as Edward I. Altman and Alessandro Giannozzi. Geographically, the United States, Italy, and the United Kingdom serve as the primary global epicenters for research collaborations. However, a significant disparity remains evident as developing countries, including Indonesia, still have considerable room to strengthen their contributions and bridge existing research gaps in the global landscape. Methodologically, the field is undergoing a definitive paradigm shift from classical financial ratio-based techniques to more complex and dynamic approaches. The integration of machine learning, hazard models, and non-financial indicators has significantly improved the accuracy and reliability of bankruptcy forecasting for small enterprises. Furthermore, keyword mapping reveals a meaningful diversification of research directions; the current frontier now incorporates multidimensional variables, including psychological, institutional, and macro contexts—specifically addressing the profound impacts of COVID-19.

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