



Mapping Research Trends on Entrepreneurial Readiness in Vocational Education: Implications for Indonesia (2020–2025)

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ABSTRACT

Purpose - This study systematically maps global research trends on entrepreneurial readiness in vocational education from 2020 to 2025 and identifies implications for strengthening the Indonesian vocational education system (SMK). Entrepreneurial readiness is a strategic national priority amid ongoing graduate unemployment and policy reforms, including *Merdeka Belajar*.

Methodology - A bibliometric analysis was conducted using data from the Scopus database. After a multi-stage screening, 82 relevant publications were selected from an initial pool of 159 documents. Subsequently, the VOSviewer software generated keyword co-occurrence networks and temporal overlay visualizations, enabling the identification of thematic clusters and the evolution of research focus.

Findings - The analysis identified 29 key terms within five thematic clusters: (1) Entrepreneurial Readiness, (2) Work-Integrated Learning, (3) Entrepreneurial Self-Efficacy, (4) Entrepreneurial Intention, and (5) Entrepreneurial Education. Early studies (2020–2021) centered on employability skills, curriculum design, and work-integrated learning, while recent research (2022–2025) focused on digital competence, self-efficacy, leadership, and innovation. These thematic trends correspond to Indonesia's digital economic growth and national reforms in vocational education under the *Merdeka Belajar* framework. However, notable gaps persist in bibliometric studies tailored to the Indonesian vocational education context, specifically highlighting the need for targeted research.

Significance - This study maps the field of entrepreneurial readiness research in Indonesian vocational education, strengthens the integration of the Theory of Planned Behavior with work-integrated learning and digital competence, and offers actionable policy insights for redesigning SMK curricula under the *Merdeka Belajar* framework.

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INTRODUCTION

Entrepreneurial readiness has become an increasingly urgent issue in vocational education, given its role in preparing graduates not only to be employable workers but also to be individuals capable of creating business opportunities in a dynamic economic environment. Entrepreneurial readiness refers to the psychological state and individual capability that encompasses knowledge, skills, and motivation to face challenges in running a business (Yuliani, 2018).

Several factors influence entrepreneurial readiness, including self-efficacy, entrepreneurial knowledge, motivation, and industrial work practice experience (Yuliani, 2018). Furthermore, another study found that entrepreneurship learning positively contributes to students' entrepreneurial readiness (Ratumbusang & Rasyid, 2015).

Theoretically, research on entrepreneurial readiness is often grounded in the Theory of Planned Behavior (TPB). This theory explains that an individual's actions are influenced by three main factors: attitude toward the behavior, subjective norms, and perceived behavioral control (Ajzen, 2020; Maullah & Rofiuddin, 2021). In addition, practical experiences through work-integrated learning (WIL), such as internships, industrial training, and collaborative projects with businesses and industries, play an important role in strengthening entrepreneurial readiness. These experiences enhance students' knowledge and skills, including soft skills in entrepreneurship, and support their ability to successfully establish and sustain their own businesses (Hasmarini & Saputra, 2023).

Despite the growing recognition of entrepreneurial readiness in vocational education, the field remains fragmented across different theoretical perspectives and geographical contexts. While substantial research has been conducted on entrepreneurship education in general, there is a notable bibliometric gap: no systematic bibliometric study has mapped how entrepreneurial readiness is conceptualized, measured, and fostered specifically within vocational education systems – leaving intellectual structures, collaborative networks, and thematic evolution in this domain largely uncharted, particularly in relation to developing country contexts such as Indonesia. (Blimpo & Pugatch, 2019; Hamdan, 2018). Furthermore, the existing literature lacks a comprehensive bibliometric analysis that could reveal intellectual structures, collaborative networks, and emerging themes in this domain, particularly in relation to developing country contexts such as Indonesia.

In the Indonesian context, vocational education serves over 5.2 million students annually. Graduates face significant labor market challenges (Putra, 2021). Data from the Central Bureau of Statistics shows that vocational graduates often have higher unemployment rates than their peers with general education. This underscores the need to equip graduates with entrepreneurial skills (Putra, 2021). This gap exists between graduate competencies and the flexible, digital, and innovation-driven job market. Strengthening entrepreneurial readiness is, therefore, a strategic priority. Entrepreneurial readiness encompasses entrepreneurial intention, psychological readiness, cognitive competency, practical skills, and self-efficacy in identifying and seizing business opportunities (Purwianti et al., 2025; Suanpong et al., 2025). Conceptually, entrepreneurial readiness is rooted in Icek Ajzen's Theory of Planned Behavior (TPB)-based entrepreneurial intention theory and also in the concept of entrepreneurial self-efficacy, widely referenced in modern entrepreneurship literature (Simanihuruk et al., 2025).

The Government of Indonesia has recognized this challenge through various policies, including the Merdeka Belajar (Freedom to Learn) initiative and the incorporation of entrepreneurship education into the national curriculum (Aji & Putra, 2021; Defrizal et al., 2022; Pohan & Kisman, 2022). However, translating these policy intentions into effective pedagogical practices requires evidence-based insights drawn from both global research trends and local contextual realities. Despite the rapid growth of studies on entrepreneurship education, few have specifically mapped research trends in entrepreneurial readiness in vocational education using a bibliometric approach. Bibliometric analysis allows for comprehensive identification of intellectual structures, collaboration patterns, thematic clusters, and research evolution within a scientific field (Maulana et al., 2024).

Therefore, this article aims to map global research trends for the 2020–2025 period and formulate their

implications for strengthening vocational education in Indonesia. Despite the rapid growth of literature on entrepreneurship education, several key gaps remain: a lack of bibliometric studies that specifically examine entrepreneurial readiness in the context of vocational education; a lack of integration between global analysis and the national policy context of developing countries; and the dominance of quantitative survey-based approaches, while longitudinal and mixed-method explorations are still limited, and there is a paucity of research linking entrepreneurial readiness with digital transformation and Industry 4.0 in vocational education. Therefore, the purpose of this study is to determine the implications of these bibliometric findings for vocational education policies and practices in Indonesia, identify the intellectual structure and evolution of research themes on entrepreneurship readiness in vocational education, Map global collaborative networks based on co-authorship and co-citation analysis, and identify the dominant theories and methodological approaches used in the 2020–2025 period. This study will systematically map the current period (2020–2025), analyze intellectual structures based on co-citation and keyword co-occurrence, and formulate contextual policy implications for Indonesia.

METHODOLOGY

Research Design

This study used a bibliometric research design to systematically map and analyze the literature on entrepreneurial readiness in vocational education (Du et al., 2025; Karantali & Panagiotidis, 2025). In this context, entrepreneurial readiness refers to the preparedness of students or institutions within vocational education to engage in entrepreneurial activities. Bibliometric analysis, a method that uses quantitative approaches to study publications, identifies research trends, intellectual structures, and thematic evolutions in a field (Muskhir et al., 2024; Xuanyun et al., 2024). This study uses citation-based measures (metrics that track how often articles are cited) and keyword co-occurrence mapping (analyzing the frequency and links between keywords). It aims to uncover the knowledge base, emerging topics, and collaborative patterns from 2020 to 2025. The design follows established bibliometric procedures. The process involves data collection, screening, and visualization using VOSviewer, a bibliometric mapping software. These steps ensure both replicability and transparency.

Data Source and Collection

Scopus was chosen as the primary source for its broad, relevant coverage of peer-reviewed journals in education and social sciences. To capture recent developments in entrepreneurial readiness within vocational education, publications from 2020 to 2025 were searched. Specifically, the TITLE-ABS-KEY field search used: ("entrepreneurial readiness" OR "entrepreneurship readiness") AND ("vocational education" OR "TVET" OR "vocational school") AND ("self-efficacy" OR "internship" OR "work-integrated learning" OR "entrepreneurial intention"). Data was retrieved on March 15, 2025, yielding 159 documents for screening and analysis. This systematic approach ensured the dataset reflected a focused range of research on the intersection of entrepreneurship and vocational education.

Screening and Inclusion Criteria

The screening process was conducted in multiple stages to ensure only relevant, high-quality studies were included (Hassan & Duarte, 2024; Marzi et al., 2025; Mishra et al., 2024). First, document types were restricted to peer-reviewed journal articles, review articles, and conference papers, thereby excluding book chapters and non-peer-reviewed documents. Second, duplicate records were identified and removed using Scopus's built-in deduplication feature. Third, titles and abstracts were reviewed to exclude papers outside the scope of entrepreneurial readiness or unrelated to vocational education, reducing the dataset from 159 to 107 documents (52 were excluded at this stage). Fourth, the remaining documents were assessed against inclusion criteria, which required that papers be written in English and directly related to entrepreneurship readiness, self-efficacy, work-integrated learning, or entrepreneurial intention in the context of vocational or

higher education, further reducing the dataset from 107 to 82 documents (25 excluded at this stage). The final dataset of 82 documents provides a robust foundation for mapping research patterns and thematic clusters in entrepreneurial readiness.

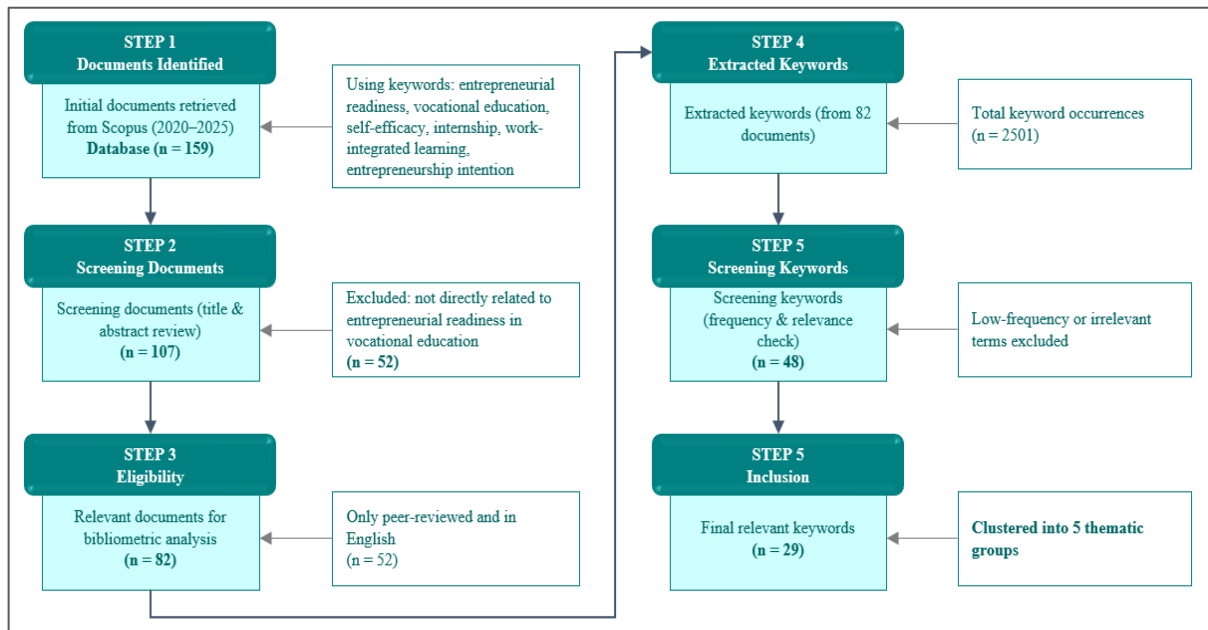


Figure 1. Flowchart for the Study

Data Visualization and Analysis

The data analysis in this study was conducted using VOSviewer, a widely used bibliometric mapping software designed for constructing and visualizing bibliometric networks (De Falco et al., 2024; Kumar et al., 2023; Rochman et al., 2024). The analysis included several stages, such as co-occurrence analysis, keyword co-network mapping, overlay visualization, and density mapping, in order to capture both the structural relationships and the temporal evolution of research on entrepreneurial readiness in vocational education. The process began with 2,501 raw keyword occurrences, which were then screened to 48, and finally narrowed down to 29 relevant keywords for in-depth analysis. Bibliometric mapping was chosen because it allows for a systematic exploration of the intellectual landscape, thematic linkages, and research frontiers in this field. Through these visualizations, the study was able to identify dominant research themes, temporal trends, and knowledge gaps that are crucial for advancing the discourse on entrepreneurship education, work-integrated learning, and readiness in vocational contexts.

FINDINGS

Main Information and Geographic Distribution

The bibliometric dataset from Scopus (2020–2025) yielded 159 initial documents. These were reduced to 107, then finalized at 82 relevant publications. The papers appeared in 65 journals, reflecting broad interest in entrepreneurial readiness within vocational and higher education. Collectively, they contained 4,920 cited references from 315 unique authors. Of these, 24 produced single-authored papers, and 19 produced single-authored documents. Most papers were collaborative, averaging 3.84 co-authors per article. The dataset showed a 22.5% international collaboration rate, suited to the global but regionally anchored nature of vocational education research. Citation performance was relatively strong, with 6.12 citations per document, suggesting studies in this domain are attracting scholarly attention. In terms of keywords, 2,501 terms were initially identified; 48 were screened and refined to 29, which served as the basis for clustering and network analysis.

Table 1. General Information regarding Sources, Documents, and Keywords

Description	Results
Database	Scopus
Period	2020–2025
Initial Documents Retrieved	159
Documents after Screening	107
Relevant Documents (final)	82
Sources (Journals)	65
Authors (unique)	315
Authors of single-authored docs	24
Co-Authors per Document (average)	3.84
Average citations per document	6.12
International co-authorships %	22.5%
Keywords (total occurrences)	2,501
Screening Keywords	48
Relevant Keywords (final)	29

The bibliometric analysis of 82 relevant Scopus-indexed documents (2020–2025) reveals a rich intellectual landscape concerning entrepreneurial readiness in vocational education. From 2,501 initial keyword occurrences, screening identified 48 relevant terms that clustered into thematic areas such as entrepreneurial readiness, self-efficacy, intention, work-integrated learning, and technopreneurship. Figure 2 shows that Entrepreneurial Readiness (occurrence = 64, total link strength = 748) and Entrepreneurial Intention (occurrence = 55, total link strength = 939) are the most dominant constructs, highlighting their centrality in the scholarly discourse. Other high-occurrence terms, such as Experience (32, 466), Entrepreneur (26, 447), Business (25, 386), and Work Readiness (16, 226), emphasize how readiness is conceptualized not only as a psychological outcome but also as a function of practical exposure, networking, and employability. This pattern indicates that the literature positions readiness as the culmination of multiple dimensions—knowledge, skills, intention, and contextual opportunities—making it a multidimensional construct in vocational education research.

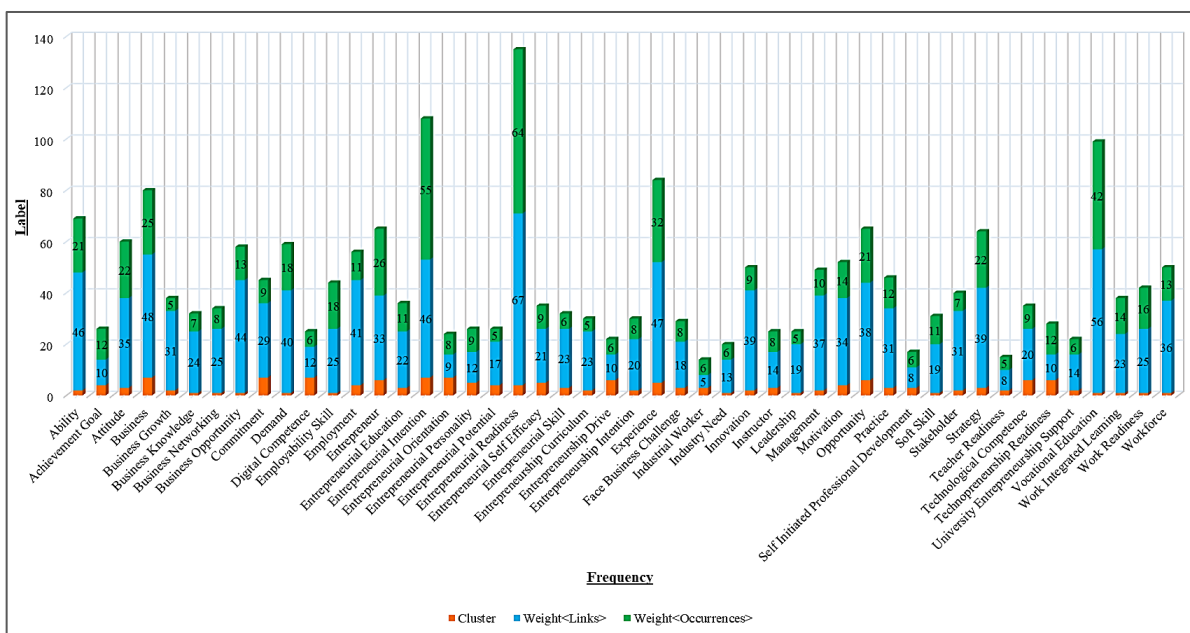


Figure 2. Keyword Co-occurrence Statistics and Cluster Distribution (2020–2025)

The visualization of keyword networks based on Total Link Strength (TLS) in Figure 2 highlights the degree of interconnectedness among terms in the field of entrepreneurial readiness within vocational education. Keywords such as Entrepreneurial Intention (TLS = 939), Entrepreneurial Readiness (TLS = 748),

Vocational Education (TLS = 550), and Experience (TLS = 466) emerge as the most strongly connected, reflecting their pivotal role as bridging concepts across multiple thematic clusters. This indicates that intention and readiness are consistently positioned as outcome variables in the literature, while practical exposure and experience function as essential pathways linking education with entrepreneurial outcomes. Furthermore, supporting terms such as Entrepreneur (TLS = 447), Business (TLS = 386), and Work Readiness (TLS = 226) show moderate but significant connections, reinforcing the idea that readiness cannot be isolated from broader employability and career-preparedness discourses. The dominance of these linkages suggests that current research trends converge toward understanding readiness as a nexus between psychological constructs (self-efficacy, intention), experiential learning (internships, work-integrated learning), and institutional contexts (curriculum, vocational training).

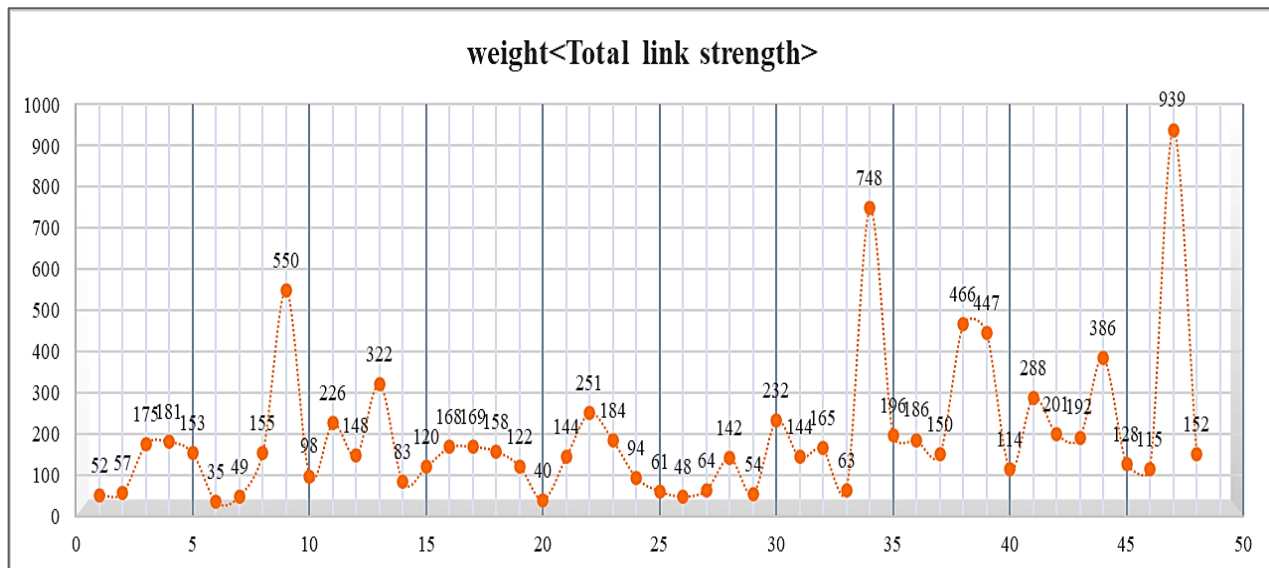


Figure 3. Total Link Strength in Entrepreneurial Readiness Research (2020–2025)

Table 1 groups the field into five clusters and 29 keywords. It shows that entrepreneurial readiness among vocational students stems from a mix of skills, experience, mindset, intentions, and support. Cluster 1 (Entrepreneurial Readiness) highlights outcome-based skills, business knowledge, networking, opportunity recognition, self-driven growth, and resilience. These traits define practical readiness. Cluster 2 (Work-Integrated Learning) covers employability skills, experience, practice, networking, and industry needs. It traces how vocational programs link classrooms with jobs. The repeated focus on “network” across clusters bridges exposure and opportunity. Cluster 3 (Entrepreneurial Self-Efficacy) covers motivation, self-management, soft skills, entrepreneurial personality, leadership, attitude, and tech competence. This mix turns experience into confidence. Cluster 4 (Entrepreneurial Intention) covers entrepreneurial orientation, potential, achievement goals, work readiness, commitment, and innovation. This is where confidence turns into purposeful plans that align with TPB logic. Cluster 5 (Entrepreneurial Education) includes digital skills, university support, curriculum, industry needs, and teacher readiness. This cluster shapes WIL quality and self-efficacy, both of which are crucial, given vocational schools' focus on hands-on learning and industry fit. Reducing 48 initial terms (7 clusters) to 29 keywords (5 clusters) shows thematic maturity. It also supports a clear progression: Education/WIL → Self-Efficacy → Intention → Readiness. This gives a simple way to design interventions in vocational entrepreneurship education.

Table 2. Final Distribution of 29 Keywords into Five Clusters on Entrepreneurial Readiness (2020–2025)

ID	Label	Cluster	Weight <Links>	Weight <Occurrences>	Weight <Total link strength>
Cluster 1 - Entrepreneurial Readiness					
1	Business Knowledge	1	24	7	52
2	Business Networking	1	25	8	57
3	Business Opportunity	1	44	13	175
4	Professional Development	3	8	6	54
5	Business Growth	2	31	5	83
6	Face Business Challenge	3	18	8	61
Cluster 2 - Work Integrated Learning					
7	Employability Skill	1	25	18	153
8	Experience	5	47	32	466
9	Practice	3	31	12	142
10	Network	6	38	21	288
11	Industry Need	1	13	6	35
Cluster 3 - Entrepreneurial Self Efficacy					
12	Motivation	4	34	14	196
13	Management	2	37	10	158
14	Soft Skill	1	19	11	155
15	Entrepreneurial Personality	5	12	9	186
16	Leadership	1	19	5	49
17	Attitude	3	35	22	251
18	Technological Competence	6	20	9	201
Cluster 4 - Entrepreneurial Intention					
19	Entrepreneurial Orientation	7	9	8	152
20	Entrepreneurial Potential	4	17	5	63
21	Achievement Goal	4	10	12	144
22	Work Readiness	1	25	16	226
23	Commitment	7	29	9	128
24	Innovation	2	39	9	169
Cluster 5 - Entrepreneurial Education					
25	Digital Competence University Entrepreneurship	7	12	6	115
26	Support Entrepreneurship	2	14	6	144
27	Curriculum	2	23	5	120
28	Industry Demand	1	40	18	181
29	Teacher Readiness	2	8	5	40

Research Focus Based on Co-Occurring Keywords

The bibliometric analysis revealed five interconnected clusters that collectively illustrate how entrepreneurial readiness among vocational students is shaped by a blend of individual competencies, experiential learning, motivational factors, and systemic support. Cluster 1 (Entrepreneurial Readiness) emphasizes the multidimensional nature of readiness, combining business knowledge, networking, and resilience in facing challenges, suggesting that readiness is both a cognitive and behavioral construct that prepares students for entrepreneurial realities. Cluster 2 (Work-Integrated Learning) highlights the pivotal role of internships and industry-aligned practices, showing that experiential learning strengthens employability skills, networks, and practical knowledge that directly contribute to entrepreneurial capacity-building.

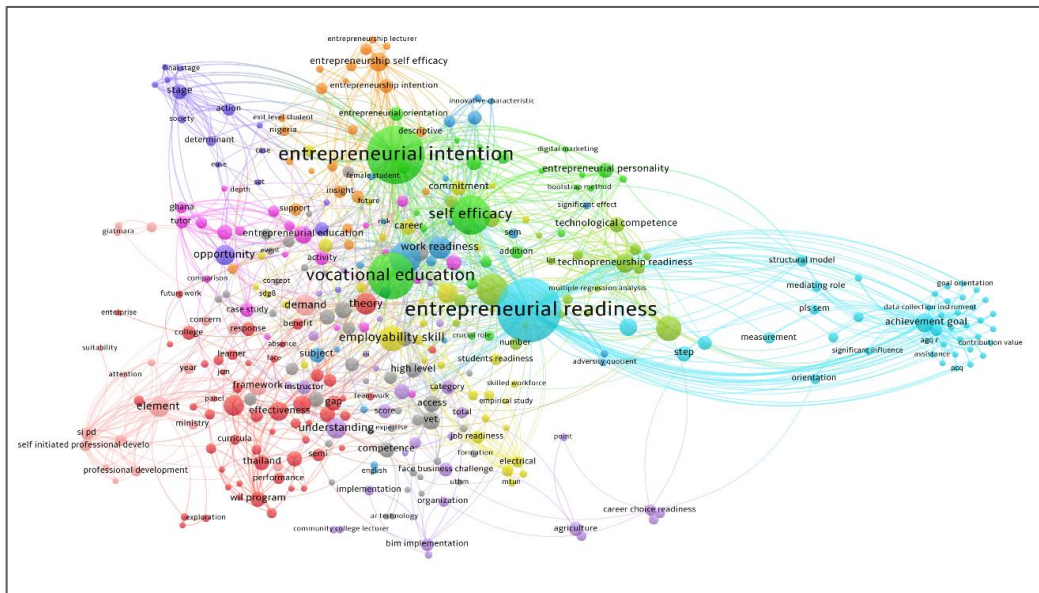


Figure 4. Co-occurrence Network of All Keywords.

Cluster 3 (Entrepreneurial Self-Efficacy) further underscores that confidence in one’s entrepreneurial abilities, including leadership, management, and technological competence, serves as a crucial mediator linking education and practice to intention and readiness. This aligns with the broader literature that identifies self-efficacy as one of the strongest predictors of entrepreneurial outcomes. Cluster 4 (Entrepreneurial Intention) reflects the motivational dimension, in which orientation, commitment, and innovation translate self-efficacy into a willingness to act, positioning intention as the cognitive bridge to readiness. Finally, Cluster 5 (Entrepreneurial Education) situates these processes within broader systemic and institutional frameworks, underscoring the importance of curriculum design, digital competence, and institutional-industry collaboration in sustaining entrepreneurial ecosystems.

Research Focus Based on Year of Publication

The overlay visualization map provides a temporal perspective on how research themes related to entrepreneurial readiness in vocational education have evolved between 2020 and 2025. In the early years (2020–2021), the dominant keywords clustered around entrepreneurship education, employability skills, experience, and industry demand. This reflects the initial concern of scholars with aligning vocational education to labor market expectations and building basic entrepreneurial competencies. These early studies often emphasized entrepreneurship curriculum and teacher readiness as foundational elements, underscoring the urgency of equipping educators and designing relevant programs during and immediately after the COVID-19 disruptions (Dhawan, 2020). The prevalence of terms like practice and work readiness in this period indicates that research was primarily focused on ensuring students could transition effectively from school to the world of work, with entrepreneurship framed as an employability strategy.

In contrast, the later years (2022–2025) show a shift toward advanced themes like digital competence, entrepreneurial self-efficacy, innovation, leadership, and business networking. This maturation of the research agenda marks a transition in focus: attention moves from basic curriculum foundations to psychological, technological, and systemic drivers of entrepreneurial readiness. Keywords such as entrepreneurial personality, commitment, technological competence, and entrepreneurial orientation signal broader interest in the internal capabilities and attitudes that sustain entrepreneurial intention and readiness in vocational contexts. Meanwhile, the recurring presence of networking and industry demand throughout 2020–2025 demonstrates that building strong connections between students, institutions, and industries remains a consistent research priority. Overall, the overlay map reveals a clear temporal trajectory: the focus transitions from foundational curriculum and employability to more nuanced constructs of self-efficacy, intention, and

readiness, reflecting the consolidation of vocational entrepreneurship research into a multidimensional ecosystem perspective.

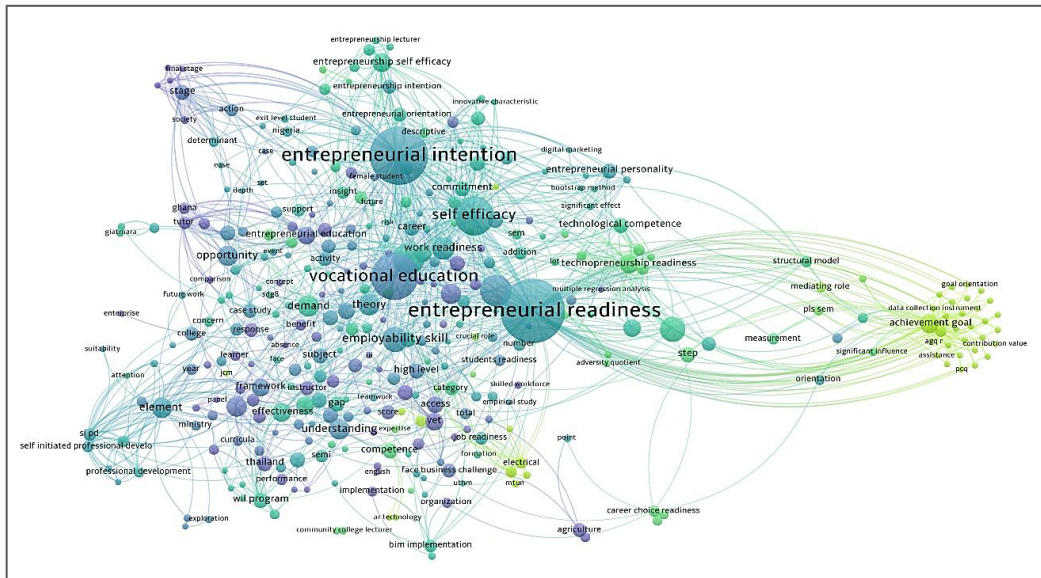


Figure 5. Overlay Visualisation Map for Co-occurring Keywords Over Time

Year-by-Year Evolution of Entrepreneurial Readiness (2020-2025)

The year-by-year analysis reveals a progressive deepening of conceptual understanding of entrepreneurial readiness within vocational education research. Notably, Table 2 shows key transitions, such as the 2021 shift from foundational constructs to applied frameworks and the 2023 focus on emerging conceptual phases. By systematically capturing these developmental markers, Table 2 traces dominant constructs, thematic shifts, and evolving phases from 2020 to 2025.

Table 3. Year-by-Year Conceptual Evolution of Entrepreneurial Readiness (2020–2025)

Year	Dominant Keywords	Thematic Emphasis	Conceptual Focus of Readiness	Developmental Phase
2020	Entrepreneurship curriculum, Teacher readiness, Employability skill, Industry demand	Curriculum alignment and institutional preparedness	Readiness as labor-market alignment and employability strategy	Institutional Alignment Phase
2021	Experience, Practice, Internship, Network	Experiential and industry-based exposure	Readiness as experiential capability building	Experiential Strengthening Phase
2022	Self-efficacy, Motivation, Attitude, Management	Psychological empowerment and internal capability	Readiness as cognitive and affective preparedness	Psychological Integration Phase
2023	Digital competence, Innovation, Technological competence	Digital entrepreneurship and innovation readiness	Readiness as technological adaptability and innovation capacity	Digital Orientation Phase
2024	Entrepreneurial personality, Leadership, Commitment	Entrepreneurial identity and leadership development	Readiness as entrepreneurial identity formation	Identity Consolidation Phase
2025	Ecosystem, Networking, Institutional support, Sustainable entrepreneurship	Systemic and ecosystem integration	Readiness as multidimensional ecosystem outcome	Ecosystem Integration Phase

Table 3 synthesizes the temporal evolution of entrepreneurial readiness into six progressive developmental phases. The findings demonstrate that research in 2020 predominantly framed readiness within institutional and curriculum alignment contexts. However, from 2021 onward, the focus gradually shifted toward experiential learning and psychological empowerment. The emergence of digital competence in 2023 marks a transition toward innovation-oriented readiness, while the consolidation of entrepreneurial identity in 2024 reflects deeper individual-level transformation. By 2025, readiness is conceptualized as a systemic ecosystem outcome integrating institutional, psychological, and technological dimensions. This structured year-by-year mapping extends beyond conventional bibliometric clustering by offering a developmental model of entrepreneurial readiness evolution, thereby contributing conceptual novelty to the field.

DISCUSSION

The findings presented in this study directly address the three research gaps identified in the introduction. First, regarding the bibliometric gap in mapping entrepreneurial readiness within vocational education, the five thematic clusters and 29 keywords identified in this study provide the first systematic bibliometric mapping of this domain, revealing an intellectual structure previously uncharted. Second, integrating global bibliometric findings into the Indonesian vocational education context addresses the identified gap between global analysis and national policy realities in developing countries. Third, the temporal evolution from curriculum-focused studies (2020–2021) toward ecosystem-based and digital entrepreneurship constructs (2022–2025) confirms the dominance of quantitative survey-based approaches in early studies while also capturing the emergence of more complex, multidimensional frameworks. Collectively, the five clusters – entrepreneurial readiness, work-integrated learning, entrepreneurial self-efficacy, entrepreneurial intention, and entrepreneurial education – mirror the theoretical pillars established in the introduction, particularly the role of the Theory of Planned Behavior (TPB) in linking attitude, subjective norms, and perceived behavioral control to entrepreneurial readiness outcomes in vocational contexts.

Cluster 1. Entrepreneurial Readiness

Represented by the red cluster in the bibliometric network, Cluster 1 consists of six closely interrelated keywords: business knowledge, business networking, business opportunity, self-initiated professional development, business growth, and facing business challenges. This cluster highlights the central position of entrepreneurial readiness as both an outcome and a holistic construct that integrates knowledge, networks, and resilience. The prominence of business knowledge and business networking suggests that students' preparedness is strongly tied to their ability to access and mobilize resources through both cognitive and social capital (Berniak-Woźny & Szelągowski, 2024; Hou & Wan, 2024; Sikandar et al., 2024). Meanwhile, keywords such as business opportunity and business growth represent forward-looking competencies, emphasizing readiness not merely to start but also to sustain and scale a venture (Munangi & Sibindi, 2025; Najmaei & Sadeghinejad, 2023; Vega & Salgado-Canto, 2024). The inclusion of self-initiated professional development reflects an emerging theme of lifelong learning and proactive capacity-building, aligning with studies that view readiness as a dynamic state rather than a fixed attribute (Kondrashev et al., 2024; Nurtanto et al., 2023; Verma, 2025; Wang et al., 2024). Taken together, the density of these terms indicates that entrepreneurial readiness in vocational education is conceptualized as a multidimensional construct that balances cognitive, behavioral, and social competencies to prepare students for complex entrepreneurial realities.

The keyword 'business challenges' highlights resilience, which is important in recent findings on entrepreneurial adversity competence among vocational students (Dabić et al., 2020; Han et al., 2021; Schaller et al., 2022). Readiness is shaped by more than technical knowledge and opportunities. It also depends on the ability to handle uncertainty, failure, and market changes – skills especially needed after the pandemic and in digital economies. Previous bibliometric reviews often focus on entrepreneurial intention (Anwar et al., 2024; Miah et al., 2024; Nautiyal & Pathak, 2023). In contrast, this study makes readiness a main cluster, suggesting a shift toward outcome-based approaches in vocational education. Future research should explore how

readiness develops over time. This is particularly relevant to technopreneurship education and work-integrated learning, as both help build business knowledge, networks, and resilience. Policymakers and educators should include experiential modules and mentoring in vocational curricula. This helps students not just intend to be entrepreneurs but be prepared for real entrepreneurial challenges.

Cluster 2. Work Integrated Learning

Represented by the blue cluster on the bibliometric network, Cluster 2 encompasses five central keywords: employability skills, experience, practice, network, and industry need. This cluster underscores the vital role of work-integrated learning (WIL) and internships in bridging theoretical learning with practical readiness for entrepreneurship. The prominence of employability skills and experience indicates that WIL contributes not only to workplace adaptability but also to transferable skills essential for entrepreneurial ventures (Amarathunga, 2024; Masduki et al., 2022). Keywords such as practice and network highlight the mechanisms through which internships operate, providing students with authentic exposure to problem-solving while building social capital that supports future entrepreneurial endeavors (Amarathunga et al., 2024; Dinh et al., 2022). The inclusion of industry needs signals strong alignment between vocational education and labor market demands, suggesting that WIL serves as a mediating space where institutional curricula and industry expectations converge. Collectively, these terms reflect a growing research focus on WIL as a structured learning pathway that strengthens students' entrepreneurial readiness through applied, experiential contexts.

The findings resonate with earlier studies that emphasize the transformative effect of internships on entrepreneurial competencies, particularly in enhancing students' ability to recognize opportunities, build resilience, and adapt to complex work environments (Alshahrani, 2022; Kaushik & Dangwal, 2025). However, unlike traditional perspectives that frame WIL primarily as a tool for employability, the emergence of this cluster suggests that vocational education research is increasingly positioning WIL as a catalyst for entrepreneurial capability-building. This reflects a conceptual shift in which readiness is not only about securing employment but also about preparing students to create employment through entrepreneurship. In vocational education settings, such as engineering programs, the urgency of industry-aligned WIL is magnified by the dual mandate of producing job-ready graduates while nurturing future entrepreneurs (Masduki et al., 2022; Raihan & Azad, 2023). Therefore, policymakers and educators should prioritize designing WIL programs that integrate entrepreneurial challenges, mentorship opportunities, and digital business practices to maximize their impact on readiness. In doing so, WIL can evolve from being a transitional bridge into a transformative platform for entrepreneurial career pathways.

Cluster 3. Entrepreneurial Self-Efficacy

Cluster 3, represented by the green region in the bibliometric map, comprises seven interlinked keywords: motivation, management, soft skills, entrepreneurial personality, leadership, attitude, and technological competence. This cluster captures the psychological and competence dimensions of entrepreneurial readiness, emphasizing how self-belief in one's abilities translates into entrepreneurial action. The prominence of motivation and attitude reflects the centrality of intrinsic drivers that shape students' persistence in pursuing business ventures (Adeniyi, 2023; Kholifah et al., 2024; Mack & Honig, 2024). In contrast, management and leadership suggest that efficacy is strongly tied to perceived competence in organizing and directing business operations. This perspective resonates with studies in vocational education that link self-efficacy with managerial confidence (Juhari et al., 2023; Vivekananth et al., 2023; Wen et al., 2020). Additionally, soft skills and technological competence point toward a more contemporary view of self-efficacy, incorporating interpersonal adaptability and digital fluency as prerequisites for entrepreneurial success. Collectively, this cluster reveals that entrepreneurial self-efficacy is not merely a psychological belief but an integrated construct shaped by personality, skills, and contextual demands.

These findings are consistent with prior research showing that self-efficacy acts as a critical mediator between education and entrepreneurial intention, making it one of the strongest predictors of entrepreneurial

readiness (Aboobaker et al., 2023; Yen & Lin, 2022). However, unlike intention, which primarily reflects a cognitive willingness to act, self-efficacy captures a deeper sense of “can-do” confidence rooted in skills and experiences. In vocational education, this is particularly relevant, as students are expected not only to conceptualize business opportunities but also to execute them through practice, leadership, and digital competence. The emergence of technological competence as a keyword highlights the shift toward digital entrepreneurship, signaling that modern self-efficacy in this domain must also encompass the ability to integrate technology into entrepreneurial practices (Adeniyi et al., 2022; Gao & Huang, 2022; Kholifah et al., 2024). For policy and practice, this implies that building entrepreneurial readiness requires more than delivering theoretical content; it demands curricula that cultivate confidence through skill-building, leadership development, and technology-enabled projects. Such an approach ensures that vocational graduates are not only motivated but also self-assured in their ability to navigate complex entrepreneurial environments.

Cluster 4. Entrepreneurial Intention

Cluster 4, represented by the yellow area in the bibliometric visualization, comprises six keywords: entrepreneurial orientation, entrepreneurial potential, achievement goal, work readiness, commitment, and innovation. This cluster underscores intention as the cognitive and motivational bridge between self-efficacy and readiness, reflecting students’ willingness and determination to pursue entrepreneurial careers. The prominence of entrepreneurial orientation and commitment indicates a forward-looking mindset and persistence as critical antecedents of entrepreneurial behavior (Abdullahi et al., 2021; Akbari et al., 2024; Fawaid et al., 2022). Meanwhile, keywords such as achievement goal and innovation highlight that intention is driven by both personal aspirations and the desire to generate novelty, aligning with vocational education’s mission to nurture applied creativity. Importantly, the inclusion of work-readiness connects intention to the broader employability agenda, suggesting that entrepreneurship is increasingly seen as a parallel or alternative career path to traditional employment. Thus, this cluster validates the established role of intention in models such as the Theory of Planned Behavior while situating it in a vocational context where readiness is tied not only to desire but also to industry-aligned competencies.

Cluster 5. Entrepreneurial Education

Cluster 5, marked by the purple region in the bibliometric network, contains five keywords: digital competence, university entrepreneurship support, entrepreneurship curriculum, industry demand, and teacher readiness. This cluster emphasizes the systemic and institutional foundations that enable entrepreneurial readiness, demonstrating that education plays a dual role as both a content provider and an ecosystem builder. The appearance of digital competence and curriculum reflects the urgency of embedding technology-driven and entrepreneurship-focused courses within vocational programs, while university support and teacher readiness highlight the importance of institutional capacity to deliver high-quality entrepreneurship education (Baggen et al., 2022; Ikebuaku & Dinbabo, 2018; Jamaluddin et al., 2019). The keyword industry demand further positions entrepreneurial education as responsive to external pressures, ensuring alignment between what students learn and what markets require. Together, this cluster suggests that entrepreneurial readiness is not solely the result of individual traits or experiences, but also of systemic design, in which curriculum, pedagogy, institutional support, and industry partnerships converge to create enabling environments for entrepreneurial pathways in vocational education.

Implications for the Indonesian Vocational Education Context

The findings are particularly relevant to the Indonesian vocational education system, where entrepreneurial readiness remains a strategic national priority. Indonesia’s vocational schools (SMKs) have historically emphasized employability; however, a bibliometric analysis indicates that global research has shifted away from employability toward psychological empowerment, digital competence, and entrepreneurial ecosystems. In the Indonesian context, the dominance of early themes such as curriculum

alignment and industry demand mirrors ongoing policy reforms aimed at linking and matching programs. However, the latter emphasis on self-efficacy, innovation, and networking suggests that Indonesia must strengthen psychological and ecosystem-based interventions to enhance entrepreneurial readiness among vocational students.

The global trend toward digital competence and technological entrepreneurship is particularly significant for Indonesia's rapidly expanding digital economy. Therefore, vocational entrepreneurship programs in Indonesia should not only focus on business knowledge but also on digital innovation capacity, leadership formation, and sustainable entrepreneurial ecosystems. This contextual interpretation positions Indonesia not merely as a consumer of global trends but also as a strategic site for implementing ecosystem-based models of entrepreneurial readiness.

CONCLUSION

This bibliometric analysis of 82 Scopus-indexed publications (2020–2025) reveals a clear developmental trajectory in entrepreneurial readiness research within vocational education, progressing from foundational concerns of curriculum alignment and employability during the COVID-19 period toward more advanced constructs of self-efficacy, digital competence, innovation, and ecosystem integration in recent years. The five identified clusters – entrepreneurial readiness, work-integrated learning, entrepreneurial self-efficacy, entrepreneurial intention, and entrepreneurial education – collectively illustrate that readiness is a multidimensional, ecosystem-driven construct shaped by the dynamic interplay of experiential learning, psychological empowerment, and institutional support. For the Indonesian vocational education system (SMK), these findings underscore the urgency of moving beyond conventional employability training to integrate digital entrepreneurship, leadership development, and industry-responsive ecosystems aligned with the Merdeka Belajar framework. Future research should prioritize longitudinal studies on vocational graduates' entrepreneurial outcomes, comparative cross-country analyses among developing economies, and deeper integration of digital transformation and sustainability themes into vocational entrepreneurship education.

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