

Reframing Entrepreneurial Education Assessment in Islamic Higher Education: Mapping Global Evidence and Proposing a Learning-Oriented Evaluation Framework

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ABSTRACT

Purpose – This study addresses the critical need for a contextual and comprehensive evaluation system for entrepreneurship education in Islamic Higher Education Institutions (PTKI). While global research increasingly supports the role of entrepreneurship education in driving innovation and sustainability, most existing studies focus on entrepreneurial intentions or self-efficacy, with limited attention to systematic evaluation frameworks. This study aims to map global scientific trends, identify adaptive evaluation models, and formulate a Learning-Oriented Assessment (LOA)-based conceptual framework tailored for PTKI.

Design/methods/approach – Using a mixed-methods exploratory design, the study integrates bibliometric analysis of 1,428 Scopus-indexed articles (2015–2025) with a systematic literature review (SLR) of 29 empirically and theoretically grounded studies. Analytical tools such as VOSviewer, R Studio Bibliometrix, and PRISMA 2020 protocols were employed to ensure methodological rigor. The PICOS framework guided article selection and synthesis.

Findings – Results show a steady 5.12% annual growth in publications, with hybrid models—particularly the CIPP-AHP-FCE—emerging as the most adaptive across diverse institutional contexts, including those with limited technological capacity. Dual-focused evaluations that integrate both learning processes and outcomes are found to be more holistic and sustainable. However, process-oriented assessment models remain underrepresented in current literature.

Research implications – PTKIs can adopt the synthesized models and proposed framework to develop evaluation systems that align with their technological readiness, educator competencies, and spiritual mandates. This supports the advancement of reflective, inclusive, and pedagogically effective entrepreneurship education.

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1. Introduction

Islamic Higher Education Institutions (PTKI) are of strategic importance in the development of a sustainable national entrepreneurship ecosystem. As institutions that not only produce Muslim intellectuals but also value-based development actors, PTKI are expected to integrate entrepreneurship education into their educational systems. In a global context, the importance of entrepreneurship education in driving innovation and economic growth is indisputable, particularly in the face of rapid changes brought about by the industrial revolution (Liu & Cui, 2025). Countries with strong



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entrepreneurial ecosystems have proven to be better prepared to navigate economic dynamics, reduce social inequality, and foster self-reliance and sustainability (Al Issa et al., 2025).

It is evident that higher education institutions are well-suited to nurturing an entrepreneurial mindset and cultivating tangible entrepreneurial competencies, given their role as centres for knowledge and technology development (Hailu, 2024). Access to academic resources, including experienced lecturers, laboratories, and business networks, provides strategic opportunities for universities, including PTKI, to build practical and inclusive entrepreneurship education (Harjawati & Kustiawati, 2023). This role is consistent with the Sustainable Development Goals (SDGs), particularly Goal 4 on quality education (Cai et al., 2022).

However, despite its urgency, the evaluation system for entrepreneurial education in higher education has not been optimally developed (Qi et al., 2024). While countries such as the United States and China have developed more systematic and sustainable assessment models (R. Zhang & Li, 2024), there is still a global gap in terms of formulating a comprehensive evaluation of entrepreneurship education (Cai et al., 2022).

Poland is an example of good practice in this area, as it has provided entrepreneurship education since secondary school, meaning that when students enter higher education, they have a more mature understanding and level of readiness. This includes entrepreneurial self-efficacy (ESE), such as the ability to identify opportunities, develop business plans and manage resources strategically (Nowiński et al., 2019). Ideally, evaluation in entrepreneurship education should be multidimensional, integrating real-world project simulations, mentoring by business practitioners and industry interactions (Folwell & Brennan, 2025). In the learning-oriented assessment (LOA) approach, the evaluation process develops students' reflective awareness of the learning process through constructive feedback, not merely assessing the final outcome (López-Hernández et al., 2023).

Unfortunately, many entrepreneurship education programmes do not provide students with sufficient practical experience (Nowiński et al., 2019). A common weakness found in many countries is the lack of real projects, case studies and direct involvement with the business world (Boldureanu et al., 2020). On the other hand, the competence of instructors also poses a challenge. Many lecturers teaching entrepreneurship courses lack practical experience in the field, impacting the quality of evaluation design and the objectivity of assessments (Cai et al., 2022; Jena, 2020; Tang et al., 2024).

There are also weaknesses in the evaluation system, which is overly focused on academic achievements without including indicators of practical skills and non-cognitive aspects such as creativity and resilience (Harjawati & Kustiawati, 2023). Evaluations are often subjective and lack feedback, failing to encourage student autonomy and confidence (Qi et al., 2024). Indeed, several studies demonstrate that students engaged in entrepreneurial activities experience mental health issues such as stress and anxiety due to a lack of institutional support (G. Yang et al., 2025).

In Indonesia, including in PTKI environments, entrepreneurship education is not as effective as expected (Rudnák et al., 2025). The evaluation system in place has not significantly increased students' interest in or capacity for entrepreneurship (Affandi et al., 2023). A learning approach that is overly theoretical and normative, limited practical experience and weak connections with the business world all make entrepreneurship education less impactful (Ikramullah et al., 2020; Ramdani et al., 2023).

Conversely, there has been a significant increase in publications related to the evaluation of entrepreneurship education at an academic level over the past decade. Cross-disciplinary studies demonstrate a growing variety of approaches, including fuzzy system-based evaluations to assess project maturity (J. Zhang et al., 2025), the IL-EDAS method to measure innovation learning effectiveness (Zhao et al., 2024), and psychological and neuroscientific methods such as the EICAA model and backpropagation neural networks for competency assessment (G. Liang et al., 2022; Teodoro et al., 2022). Studies in the environmental field even link educational evaluation with student

career awareness (Özdemir, 2024). However, very few studies have reviewed entrepreneurship education evaluation systems in the context of PTKI using a systematic, evidence-based approach.

In response to this gap, this study contributes to the field by taking a hybrid approach: combining bibliometric analysis with a systematic literature review to map the scientific landscape, evaluation models and assessment methodologies for inclusive and sustainable entrepreneurship education. The study also proposes a learning-oriented, assessment-based evaluation framework that can be applied more adaptively in the context of PTKI.

The objectives of this study are: (1) mapping the global scientific landscape of entrepreneurship education evaluation in higher education based on bibliometric analysis; (2) identifying effective and adaptive entrepreneurship evaluation models and approaches based on systematic evidence; and (3) formulating a contextual, learning-oriented, assessment-based conceptual framework for entrepreneurship education evaluation to be applied in PTKIs. Based on these objectives, three main research questions were formulated:

(1) What are the trends and contributions of global science related to entrepreneurship education evaluation in the context of higher education? (2) What models and approaches to entrepreneurship education evaluation have been proven to be effective and inclusive based on empirical evidence? (3) What conceptual framework for entrepreneurship education evaluation is relevant for application in PTKI?.

2. Methods

This study takes an exploratory approach based on secondary data, combining quantitative bibliometric analysis with a qualitative systematic literature review (SLR) in an integrated mixed-methods design (Creswell, 2014). This approach was chosen to identify the global scientific landscape and explore models and methods of entrepreneurship education evaluation that can be applied in the context of Islamic higher education institutions (PTKIs) (Dalton et al., 2014). The bibliometric analysis is grounded in the post-positivist paradigm, while the SLR adopts a constructivist approach to interpreting the meaning of the secondary data (Kerres & Bedenlier, 2020).

Data was collected from the Scopus database for the period from 2015 to 2025. The search, conducted on 5 May 2025, was carried out in two stages. The first stage aimed to map the global landscape using bibliometric analysis. The second stage focused on identifying models and methods for evaluating entrepreneurship education to meet SLR needs. The search strategy is shown in Table 1.

Table 1: Search techniques and inclusion criteria

Database	Keywords	Limitation & Inclusion	Result
Section 1			
Scopus	"assessment " OR " evaluation" OR "Impact" AND "entrepreneurship education" OR "Entrepreneur" AND "higher education" OR "University"	* Year limited to 2015 – 2025 * Document type limited to article	1.446 data
Section 2			
Scopus	"assessment " OR " evaluation" OR "Impact" AND "entrepreneurship education" OR "Entrepreneur" AND "higher education" OR "University" AND "Models" OR "Methods" AND	* Year limited to 2015 – 2025 * Document tipe limited to article	765 data

"evaluation models" OR "assessment models"		
Scopus	Jumlah	2.211 data

The inclusion and exclusion criteria were determined based on the PICOS framework, as shown in Table 2 below.

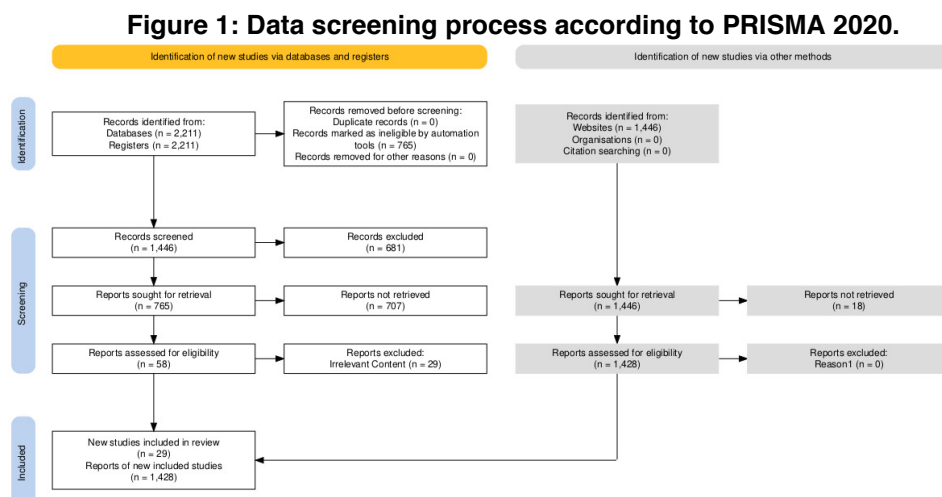
Table 2: PICOS Framework

Population	Students and educators in higher education
Intervention	Evaluation or assessment in entrepreneurship education
Comparison	Not applicable
Outcome	Effectiveness, sustainability and inclusiveness of evaluation
Study design	Empirical and theoretical journal articles that have undergone peer review.

Articles in the form of proceedings, editorials, dissertations, non-peer-reviewed reports or that are not relevant to entrepreneurship evaluation are excluded from selection.

The first stage yielded 2,211 articles. After filtering by publication year, document type and keyword matching, 1,446 documents remained. Further filtering using R Studio and Biblioshiny eliminated 18 invalid documents, leaving 1,428 for analysis using a bibliometric approach.

In the second stage, the search was narrowed down using more specific keyword syntax, resulting in 765 documents being reviewed using SLR. After filtering using the field search feature in Scopus and manual selection through the Mendeley application, 58 documents remained. These 58 documents were then manually reviewed by opening the full articles on the relevant journal websites to ensure that the content was relevant to the research focus. This left 29 articles deemed eligible for in-depth analysis. The screening process adhered to the PRISMA 2020 guidelines, as shown in Figure 1.



A bibliometric analysis was conducted using VOSviewer, R Studio Bibliometrix and Biblioshiny to generate visualisations of research trends and collaborations between authors, institutions and countries, as well as thematic mapping. Visualisation was carried out using a multidimensional approach based on co-authorship, co-occurrence and citation analysis.

A systematic literature review (SLR) was conducted on 29 selected articles using open coding and thematic content analysis techniques. The researchers identified categories and patterns from the evaluation model, LOA (learning-oriented assessment) principles, and the formative and summative approaches and evaluation instruments used. Validation was carried out through credibility testing of the selection and coding process by two independent researchers. The level of agreement between the researchers was verified using a Cohen's kappa calculation to ensure inter-rater reliability. As the research did not involve human participants, formal ethical approval was not required. Data validity was maintained through primary source tracking, transparent selection processes, and consistency between objectives, research questions, and analysis.

3. Results

3.1. Main Information for Bibliometrix Analysis

Figure 2 shows the results of the bibliometric analysis of 1,428 documents published between 2015 and 2025. These results indicate that research in this field has experienced stable and consistent growth, with an annual growth rate of 5.12%. The broad thematic distribution across various academic channels is reflected by the 615 journals or proceedings in which the publications were sourced, indicating the multidisciplinary nature of this topic. Regarding collaboration, the average number of authors per document is 3.16 and only around 14.57% of articles are written by a single author, highlighting the prevalence of collaborative work in knowledge production. Indeed, almost 28% of all documents involve international collaboration, suggesting that this issue is of global importance and attracts the attention of researchers worldwide.

Figure 2. Information centre



In terms of scientific impact, the average number of citations per document is 16.73, indicating that articles in this field are widely noticed and referenced by the scientific community. The 3,688 author keywords show the diversity of issues and broad research approaches, opening up opportunities to explore new topics or conduct further thematic studies. Meanwhile, the average age of documents is 3.8 years, indicating that literature in this field is relatively up to date and relevant. These findings confirm that research in this field is developing quantitatively and has conceptual and strategic appeal for supporting deeper, more applied academic studies in the future.

3.2. Eligible Data for Systematic Review

A total of 29 articles were identified and met the inclusion criteria for this study, as shown in Table 3. These articles were sourced from reputable journals indexed in Scopus, ranging from Q1 to Q4. This reflects the diversity of quality and scientific perspectives in studies related to the assessment of entrepreneurship education in higher education. The articles were systematically analysed to explore the models or methods used in various geographical and institutional contexts.

Tabel 3: Selected Articles for Review

No	Authors	Title	Journal	Index
1	(J. Zhang et al., 2025)	The Construction and Practice of Using a Fuzzy Comprehensive Evaluation System for Project Maturity Based on The Sustainable Development of Entrepreneurship Among Chinese University Students	Sustainability (Switzerland)	Scopus Q1
2	(Rizal, 2025)	Development of an Evaluation Model For Industrial Internship Programs	Journal of Information Systems Engineering And Management	Scopus Q3
3	(Qi et al., 2024)	The Application and Exploration of Curriculum Ideology and Politics in The Innovation and Entrepreneurship Education of Medical College Students Based on Hierarchical Analysis Method	Applied Mathematics and Nonlinear Sciences	Scopus Q3
4	(F. Hu, 2024)	Research on the Teacher Team Construction of Innovation and Entrepreneurship Education In Higher Vocational Colleges and Universities Under the Background of “Double Creation” Upgrading	Applied Mathematics and Nonlinear Sciences	Scopus Q3
5	(B. Li, 2024)	Construction and Implementation of Innovation and Entrepreneurship Education System in Colleges and Universities in the Internet Era	Applied Mathematics and Nonlinear Sciences	Scopus Q3
6	(D. Yang et al., 2024)	Coordinated Cultivation of Innovative and Entrepreneurial Knowledge and Ability of College Students Based on Markov Modeling	Applied Mathematics And Nonlinear Sciences	Scopus Q3
7	(L. Hu, 2024)	Effectiveness Evaluation of Employment and Entrepreneurship Education Models in Colleges and Universities Based on Multiple Fuzzy Evaluation System	Applied Mathematics and Nonlinear Sciences	Scopus Q3
8	(R. Zhang & Li, 2024)	Research on the Construction of Innovation and Entrepreneurship Education Model System in Universities Based on Big Data Technology	Applied Mathematics and Nonlinear Sciences	Scopus Q3
9	(P. Wang & Dong, 2024)	Research on The Influence Factors of Innovation and Entrepreneurship Education Based on Neural Network Model	Applied Mathematics and Nonlinear Sciences	Scopus Q3
10	(Tang et al., 2024)	Evaluation of Entrepreneurship Failure Education in Higher Education From the Perspective of The Cipp Model and Ahp-Fce Methods	Aims Mathematics	Scopus Q2
11	(G. Wang, 2024)	Construction of the Index System For the Integration of Professional Education and Innovation Entrepreneurship Education in Applied Universities: Based on the Kirkpatrick Evaluation Model	International Journal of Information and Communication Technology Education	Scopus Q2
12	(B. Zhang & Zhang, 2024a)	Research on Quality Evaluation of Innovation and Entrepreneurship Education in Colleges and Universities Under Big Data Environment	International Journal of Information and Communication Technology Education	Scopus Q2

13	(G. Liang et al., 2022)	The Evaluation of College Students' Innovation and Entrepreneurship Ability Based on Nonlinear Model	Applied Mathematics and Nonlinear Sciences	Scopus Q3
14	(Fu, 2022)	Evaluation Model of Employment and Entrepreneurship of University Students Based on Classification Algorithm	Mathematical Problems in Engineering	Scopus Q2
15	(Sun & Zhang, 2022)	An Improved Bp Neural Network Algorithm for the Evaluation System of Innovation and Entrepreneurship Education in Colleges And Universities	Mobile Information Systems	Scopus Q3
16	(Fan et al., 2022)	Quality Evaluation of Entrepreneurship Education in Higher Education Based on Cipp Model and Ahp-Fce Methods	Frontiers in Psychology	Scopus Q2
17	(X. Zhang et al., 2022)	College Students' Innovation and Entrepreneurship Ability Based on Nonlinear Model	Applied Mathematics and Nonlinear Sciences	Scopus Q3
18	(Zeng et al., 2022)	Rural E-Commerce Entrepreneurship Education in Higher Education Institutions: Model Construction Via Empirical Analysis	Sustainability (Switzerland)	Scopus Q1
19	(S. Li, 2022)	Evaluation Model of Innovation and Entrepreneurship Ability of Colleges and Universities Based on Improved Bp Neural Network	Computational Intelligence and Neuroscience	Scopus Q1
20	(Y. Liang et al., 2021)	Sustainable Development Evaluation of Innovation and Entrepreneurship Education Of Clean Energy Major in Colleges and Universities Based on Spa-Vfs and Grnn Optimized By Chaos Bat Algorithm	Sustainability (Switzerland)	Scopus Q1
21	(Nowiński et al., 2019)	The impact of entrepreneurship education, entrepreneurial self-efficacy and gender on entrepreneurial intentions of university students in the Visegrad countries	Studies in Higher Education	Scopus Q1
22	(Maresch et al., 2016)	The impact of entrepreneurship education on the entrepreneurial intention of students in science and engineering versus business studies university programs	Technological Forecasting and Social Change	Scopus Q1
23	(Klofsten et al., 2019)	The entrepreneurial university as driver for economic growth and social change - Key strategic challenges	Technological Forecasting and Social Change	Scopus Q1
24	(Jena, 2020)	Measuring the impact of business management Student's attitude towards entrepreneurship education on entrepreneurial intention: A case study	Technological Forecasting and Social Change	Scopus Q1
25	(Boldureanu et al., 2020)	Entrepreneurship education through successful entrepreneurial models in higher education institutions	Sustainability (Switzerland)	Scopus Q1
26	(Saeed et al., 2015)	The Role of Perceived University Support in the Formation of Students' Entrepreneurial Intention	Journal of Small Business Management	Scopus Q1

27	(Edelman et al., 2016)	The impact of family support on young entrepreneurs' start-up activities	Journal of Business Venturing	Scopus Q1
28	(Wardana et al., 2020)	The impact of entrepreneurship education and students' entrepreneurial mindset: the mediating role of attitude and self-efficacy	Heliyon	Scopus Q1
29	(Ahmed et al., 2020)	Entrepreneurship education programmes: How learning, inspiration and resources affect intentions for new venture creation in a developing economy	International Journal of Management Education	Scopus Q1

3.3. Identification of the Model Framework

An analysis of the available data revealed three main classifications of entrepreneurship education models in higher education. The first is conceptual, the second is objective-based and the third is technology-based.

3.3.1. From Classical to Hybrid Intelligence

Based on its conceptual approach, the entrepreneurial education evaluation model in global studies is divided into three main categories, as shown in Figure 3: classical, modern and hybrid. Classical models, such as the Kirkpatrick model and the CIPP–Countenance combination, focus on a systematic, deductive, step-by-step evaluation process. While these models are methodologically sound, they tend to be less adaptive to the dynamics of digital learning and contemporary practices. In contrast, modern models such as CS-BKT, GA-BPNN and machine learning-based classification algorithms use big data and artificial intelligence for real-time and predictive evaluation. However, they lack interpretive and participatory nuances.

Figure 3: Based on Conceptual Approach



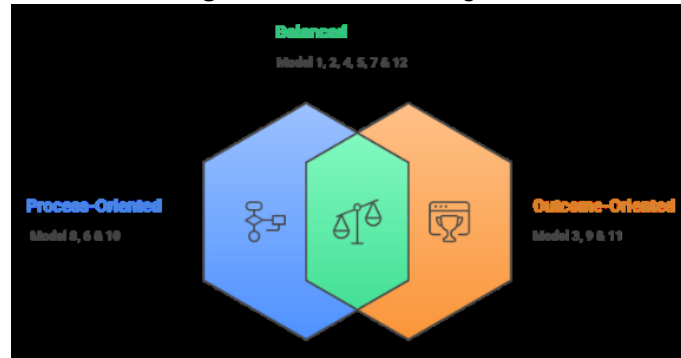
Hybrid models, which integrate classical frameworks such as CIPP and AHP with cutting-edge technical approaches such as Fuzzy Logic, Entropy, and Multiple Criteria Decision Making (MCDM), currently dominate. These models offer high flexibility, accuracy and adaptability in order to address the complex challenges of entrepreneurship education in various contexts, including PTKI.

3.3.2. Between Learning Process and Outcome Optimization

Based on their objectives, the evaluation models discussed in the literature can be classified as outcome-oriented, process-based or dual-focused (see Figure 4). Outcome-oriented models, such as the Back Propagation Neural Network and classification algorithms, focus on measuring students' final achievements with high efficiency, but provide minimal formative

feedback. Conversely, process-based models, such as CS-BKT and SPA-VFS, offer dynamic evaluation frameworks that provide regular feedback to improve learning in real time.

Figure 4: Based on the goals

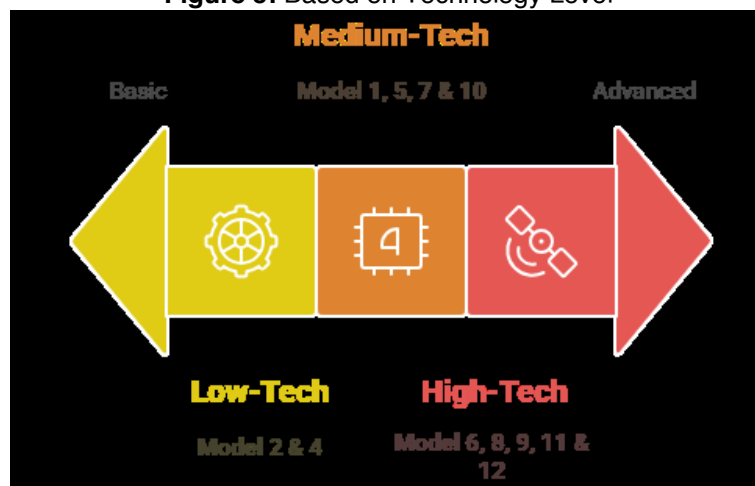


The most effective models combine both approaches, such as CIPP-AHP-FCE and Multiple Fuzzy Evaluation, capturing both process and outcomes. This makes them a strong foundation for building a comprehensive and sustainable evaluation system in higher education, especially in environments requiring high pedagogical flexibility.

3.3.3. Low-Tech to High-Tech Evaluation Models

Figure 5's third dimension classifies evaluation models based on their technological sophistication. These range from low-tech, manual, descriptive models to medium-tech models using fuzzy logic and multi-criteria systems, and finally to high-tech models integrating AI, deep learning and big data for automated decision-making. This framework is relevant for PTKE institutions with varying levels of technological readiness, offering opportunities to develop layered and phased evaluation systems ranging from local contextualisation to global connectivity.

Figure 5: Based on Technology Level



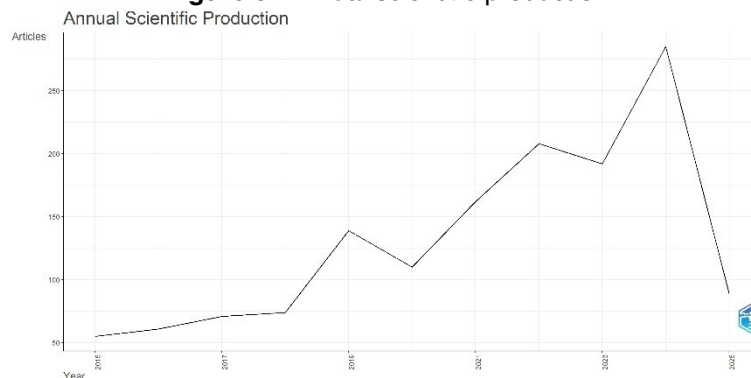
Understanding these three classifications of models not only highlights the variety of available approaches, but also provides practical guidance on designing inclusive, data-driven evaluation systems that align with Islamic educational values. These findings lay an important foundation for the conceptual framework discussed in the subsequent section.

4. Discussion

4.1. Global Study and Collaboration Trends

Figure 6 shows that there has been a significant surge in annual scientific publications on the topic of entrepreneurial education assessment over the past decade. Data visualised using Biblioshiny and VOSviewer shows that, while the number of publications remained relatively low from 2015 to 2018, it began to accelerate sharply in 2019. The highest level of productivity was reached in 2023, with over 275 publications. This reflects the growing global urgency to develop evaluation systems that respond to the demands of innovation, the digital economy and the need for higher education to be more inclusive and outcome-oriented (Villanueva-Paredes et al., 2024).

Figure 6: Annual scientific production



The increasing focus on evaluation marks a paradigm shift from traditional teaching methods to competency-based achievement measurement and sustainable learning (Huang et al., 2023). The fluctuations observed in the data for 2024-2025 are assumed to be due to limitations in indexing or publication timelines that have not yet been fully captured in the database, rather than indicating declining interest. This finding reinforces the importance of creating a relevant and applicable evaluation framework, especially in the PTKI environment, which is underrepresented in global literature.

Figure 7 shows the distribution of publications by country, highlighting China's strong dominance. It has experienced a significant surge in publications since 2020 and is expected to exceed 600 documents by 2025. The United States, Spain and the United Kingdom follow with stable growth trends. Notably, Indonesia has demonstrated a notable acceleration in academic productivity since 2021, suggesting an increased engagement of national academics in the global dialogue on entrepreneurship education and its evaluation. This phenomenon illustrates a geopolitical shift in knowledge production, with Asian countries progressively playing a strategic role in the global ecosystem, in line with the increasing digitalisation and inclusivity of academic research (Isac et al., 2023).

Figure 7: Country Production Over Time

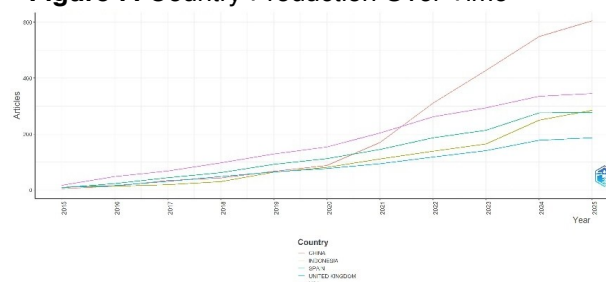
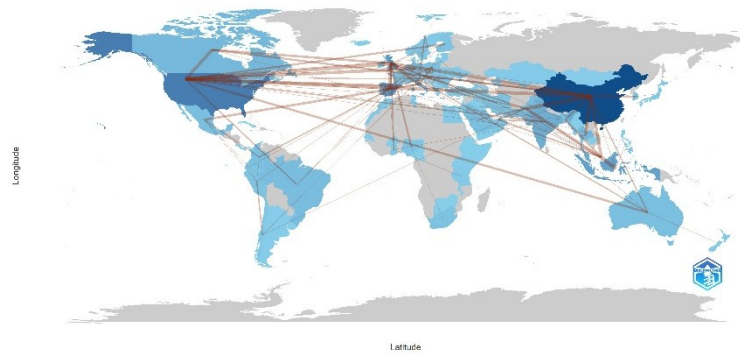


Figure 8 shows a map of country collaboration visualised using VOSviewer. It indicates that international collaboration in this field centres on countries with dark blue indices, such as China, the United States, the United Kingdom, and Germany. The intense connecting lines indicate multilateral collaboration networks between developed countries and Southeast Asia, the Middle East, and Africa. These collaborative patterns highlight the importance of global networks in developing interdisciplinary research that considers not only scientific principles, but also different cultural and institutional contexts (Thomas & Pugh, 2020).

Figure 8: Country Collaboration Map

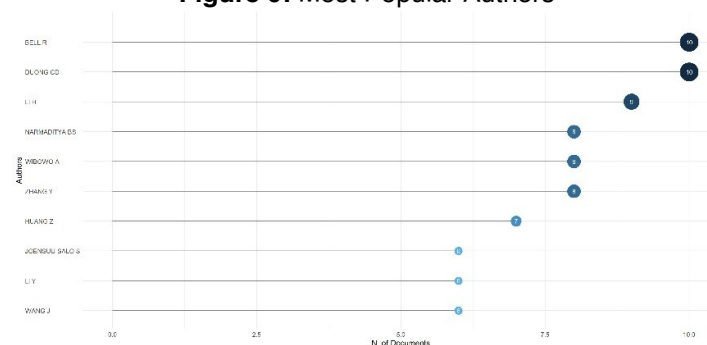


For Indonesia, particularly PTKI, this data highlights two key strategic points. First, there is a need to strengthen collaborative capacity and global visibility by establishing more active international research partnerships. Secondly, there is a need to formulate an entrepreneurship education evaluation system that responds to global developments and is also locally relevant in terms of the curriculum, the character of religious institutions and the resource constraints faced by PTKI. Therefore, the growing number of global publications should be viewed as an opportunity to reinforce the foundations of contextual and sustainable entrepreneurship assessment within the Islamic higher education environment.

4.2. The Most Impactful Authors, Journals and Institutions

Figure 9 shows an analysis of the ten most productive authors in entrepreneurial education assessment studies. Robin Bell and Duong Cong Doanh are identified as central figures, with 10 publications each in the last decade (Bell & Bell, 2016). This confirms their consistent production of evaluative studies on entrepreneurship based on local and regional approaches. They are followed by Li H (nine publications) and three other authors: Narmaditya Bagus Shandy, Wibowo Agus and Zhang Y, who have eight publications each. This highlights the significant contributions of researchers from Indonesia and China to the mainstream discourse on entrepreneurship in higher education.

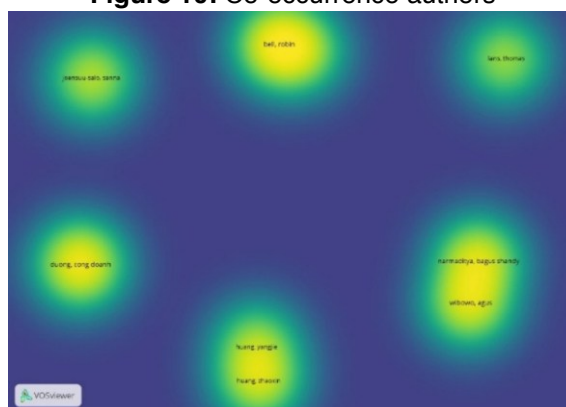
Figure 9: Most Popular Authors



However, beyond mere productivity, the substantive contributions of these authors reveal distinctive thematic patterns. For instance, Robin Bell is renowned for his learning-oriented approach to entrepreneurship assessment, emphasising the integration of student reflection in the evaluation process (Bozward et al., 2023). In contrast, Duong Cong Doanh has concentrated on devising measurement frameworks based on entrepreneurial culture and local economic sustainability in developing countries. Representing the voice of Indonesian academics, Narmaditya and Wibowo have extensively studied integrative models that combine Sharia economics and Islamic educational approaches with competency-based entrepreneurship assessment methods (Suparno et al., 2024).

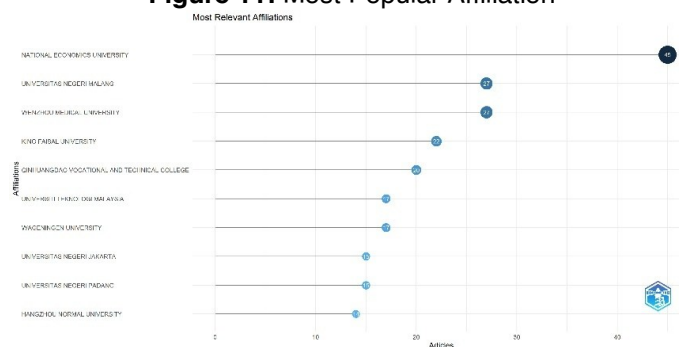
Figure 10 shows the visualisation of author contributions through VOSviewer, which confirms the intensity of publications and the distribution of author networks. The intense yellow colouring of the names 'Bell' and 'Doanh' indicates high publication density and influence, with strong contributions also coming from Southeast Asian authors such as 'Narmaditya' and 'Wibowo'. This reinforces the Asian region's position as a new centre of growth in the study of entrepreneurship education assessment and indicates a trend towards the regionalisation of more contextual evaluation approaches.

Figure 10: Co-occurrence authors



Meanwhile, Figure 11 shows that the most popular institutional affiliations place the National Economics University (Vietnam) at the top with 45 publications, establishing it as a leading centre for developing educational policy research and entrepreneurial innovation in Southeast Asia (Bui et al., 2023). Malang State University and Jakarta State University in Indonesia also feature significantly, with 27 and 15 publications respectively. This is in line with national policies emphasising the importance of enhancing research capacity in higher education (Kemendikbudristek, 2022).

Figure 11: Most Popular Affiliation



However, this quantitative dominance is also reflected thematically. The National Economics University has developed multiple fuzzy evaluation-based models and decision support systems that are widely used in transitional economies (Bui et al., 2023). Meanwhile, Malang State University has developed a CIPP approach based on local values and the integration of religious learning, and Jakarta State University has adopted a hybrid method combining conventional evaluation with big data-based digital technology.

These contributions signify a shift in the centre of gravity of knowledge from Western institutions to the Asian region. This supports the idea of knowledge decolonisation, which emphasises the importance of diverse perspectives in developing inclusive and adaptive systems for evaluating entrepreneurship. The growing influence of non-Western institutions also suggests that PTKI has great potential to contribute to global discourse by offering evaluative approaches that align with the characteristics of Islamic education and local wisdom.

4.3. Top Cited Articles and Gaps

Figure 12 shows the ten articles with the highest number of citations. It reveals that global research on entrepreneurship education in higher education is still dominated by topics such as entrepreneurial intention, self-efficacy, institutional support and gender dynamics in the development of entrepreneurial interest. (Nowiński et al., 2019) article has had the greatest impact, with a total of 859 citations and the highest normalised total citation value (15.32). This indicates that entrepreneurial intention, as measured by students' perceptions, remains at the heart of the global literature. Other notable articles, such as those by (Maresch et al., 2016) and (Klofsten et al., 2019), highlight the role of cross-disciplinary programmes and the strategic functions of universities in facilitating innovation and socio-economic transformation.

Figure 12: Top 10 Cite Paper

Rank	Author	Article Title	Journal	Total Citation	TC per Year	Normalised TC
1	Witold Nowiński et al. 2017	The impact of entrepreneurship education, entrepreneurial self-efficacy and gender on entrepreneurial intentions of university students in the Visegrad countries	Studies in Higher Education	859	61.43	15.32
2	Daniela Maresch et al. 2016	The impact of entrepreneurship education on the entrepreneurial intention of students in science and engineering versus business studies university programs	Technological Forecasting and Social Change	957	42.10	9.73
3	Magnus Klofsten et al. 2019	The entrepreneurial university as driver for economic growth and social change - Key strategic challenges	Technological Forecasting and Social Change	696	49.00	12.22
4	R.K. Jena 2020	Measuring the impact of business management Student's attitude towards entrepreneurship education on entrepreneurial intention: A case study	Computers in Human Behavior	743	51.00	8.79
5	Gabriela Boldureanu et al. 2020	Entrepreneurship Education through Successful Entrepreneurial Models in Higher Education Institutions	Sustainability	792	47.83	8.24
6	Saadat Saeed et al. 2015	The Role of Perceived University Support in the Formation of Students' Entrepreneurial Intention	Journal of Small Business Management	672	24.45	10.24
7	Pierluigi Ripa et al. 2019	Digital academic entrepreneurship: The potential of digital technologies on academic entrepreneurship	Technological Forecasting and Social Change	494	37.86	9.44
8	Linda F. Edelman et al. 2016	The impact of family support on young entrepreneurs' start-up activities	Journal of Business Venturing	533	25.30	5.85
9	Ludi Wishnu Wardana et al. 2020	The impact of entrepreneurship education and students' entrepreneurial mindset: the mediating role of attitude and self-efficacy	Heliyon	557	36.83	6.35
10	Tariq Ahmed et al. 2020	Entrepreneurship education programmes: How learning, inspiration and resources affect intentions for new venture creation in a developing economy	The International Journal of Management Education	482	36.17	6.23

However, the dominance of themes centred on entrepreneurial intention, self-efficacy perceptions or institutional approaches highlights a fundamental lack of systematic evaluation of the effectiveness of entrepreneurship education itself. Very few articles explicitly discuss the assessment framework or evaluation model used in the context of higher education. This can be attributed to the methodological complexity of developing comprehensive evaluation instruments, the need for longitudinal data which is not easily accessible, and the limited practical experience of entrepreneurship educators in designing and implementing learning-oriented evaluation systems.

Furthermore, the large number of studies focusing on output, such as entrepreneurial intent and behaviour, and the lack of attention given to process-based evaluation, shows that

formative and holistic evaluation approaches have not been given sufficient consideration (Boldureanu et al., 2020). This presents a strategic challenge and opportunity for Islamic higher education institutions (PTKIs), whose distinctive curricula and institutional values require a reflective, contextual and integrated assessment approach aligned with character education values.

This situation justifies the development of a Learning-Oriented Assessment (LOA) approach, which measures final outcomes and integrates reflective processes, continuous feedback and student empowerment as active participants in the evaluative process. Leveraging the strength of data citations from dominant literature, this study presents a conceptual framework that fills the assessment gap at both the theoretical and practical levels, with high relevance for application in the PTKE environment as it moves towards strengthening innovation and entrepreneurship capacity based on Islamic values.

4.4. Mapping Key Models of Evaluation in EE

4.4.1. The CIPP-AHP-FCE hybrid model

This is a combination of the CIPP (Context, Input, Process, Product) framework for educational evaluation and the Analytic Hierarchy Process (AHP), as well as the Fuzzy Comprehensive Evaluation (FCE) method. The aim is to evaluate the quality of entrepreneurship education programmes comprehensively from contextual, resource, implementation process and outcome perspectives. This type of evaluation is both formative, in terms of process and input, and summative, in terms of product (outcome). It helps universities to identify the dominant factors influencing programme success and to systematically improve weak areas. The model's strengths lie in its comprehensive approach based on classical educational evaluation theory, while limitations include the workload involved in determining weights between indicators and the requirement for high-quality data for valid analysis (Fan et al., 2022).

4.4.2. Kirkpatrick-Based Multi-Level Index System Model

This model adapts the Kirkpatrick Evaluation Model for the integration of vocational education and entrepreneurship in applied universities by creating a three-tier index system comprising response, learning, behaviour and results. The purpose of this model is to evaluate the effectiveness of entrepreneurship education from the students' perspective. It considers not only cognitive achievements, but also any changes in attitudes and behaviour that occur after participating in the programme. This type of evaluation is both formative and summative, as it informs both curriculum adjustments and final institutional performance reporting. The model's impact is improved programme efficiency based on evidence and accurate feedback from learners. The model's advantages include its practical structure of indicators based on classical educational evaluation theory. However, it is not yet widely used outside the context of applied universities and has limited adaptability for non-vocational education (G. Wang, 2024).

4.4.3. Entropy-TOPSIS-Based Evaluation Model in the Internet Era

This model integrates the Entropy Weighting method and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) in order to evaluate the quality of innovation and entrepreneurship education in higher education, particularly in the context of the 'Internet+' era. The aim is to provide an objective and comprehensive assessment of the four key aspects of education: institutional environment, instructional design, faculty quality and student performance. The evaluation is summative and is used for regional and national institutional rankings. It provides

ranking-based data that can inform educational policy-making and resource allocation. This model's advantages include its high objectivity, due to the use of entropy in weighting, and its ability to handle complex quantitative data. However, it relies on consistent statistical data being available and there is a risk of bias if indicators are not updated regularly (B. Li, 2024).

4.4.4. Integrated Model Based on CIPP, Countenance, and Kirkpatrick Frameworks

This combines three classical evaluation approaches: Context, Input, Process, Product (CIPP); the Countenance Model; and the Kirkpatrick Evaluation Model. It is used to assess the effectiveness of industrial internship programmes in vocational education. The aim is to create an integrated evaluation system that bridges the gap between higher education and the industrial world, particularly with regard to internship programmes that serve as a platform for learning about practical entrepreneurship. This type of evaluation is both formative and summative, covering all stages from planning to final learning outcomes. It significantly enhances the relevance of graduates to labour market needs and produces graduates who are ready to engage in entrepreneurship. This model's strengths lie in its comprehensive and adaptive nature in response to technological needs. However, its implementation across multiple models can be complex, necessitating collaboration between educational and industrial stakeholders (Rizal, 2025).

4.4.5. Multiple Fuzzy Evaluation Model with Entropy Weighting

This model combines the entropy weight method of determining indicator weights with the multivariate fuzzy comprehensive evaluation method in order to assess the effectiveness of entrepreneurship education. The aim is to conduct a systematic evaluation of various educational aspects, such as the learning environment, financial support and learning outcomes, based on student and expert perceptions. This summative evaluation is designed to assess overall effectiveness and compare performance across institutions. This model produces a multidimensional assessment that quantitatively describes real-world conditions and aligns with the perceptions of stakeholders (students, faculty and industry representatives). This model's advantages include its flexibility and ability to handle both qualitative and quantitative indicators. However, it is complicated to process fuzzy data and interpret the results, requiring an advanced understanding of statistics (L. Hu, 2024).

4.4.6. Polymorphic Rewarded Markov Model (CS-BKT Enhanced)

This is an extension of the Bayesian Knowledge Tracking (BKT) model, which is used to monitor students' mastery of innovation and entrepreneurship knowledge. CS-BKT (Contextualised Skills Bayesian Knowledge Tracking) incorporates a more complex and realistic matrix of inter-knowledge influence parameters. The aim is to quantitatively and continuously evaluate the development of students' innovative and entrepreneurial abilities, taking into account the learning context. This formative, process-based evaluation assesses transitions between mastery statuses ('not yet mastered' to 'mastered') and provides feedback at each stage of learning. This allows lecturers to understand in real time how well students grasp entrepreneurial skills, enabling them to adjust their teaching interventions immediately. Advantages include the predictive model's accuracy based on actual student data and its ability to personalise learning. However, disadvantages include the model design's complexity and the requirement for extensive longitudinal data to ensure stable evaluation results (D. Yang et al., 2024).

4.4.7.AHP-Fuzzy Comprehensive Evaluation Model

This model integrates two decision-making methods: The Analytic Hierarchy Process (AHP) is used to determine the weight or level of importance of each indicator. The Fuzzy Comprehensive Evaluation method uses fuzzy logic to handle uncertainty and qualitative data in the assessment process. The aim is to provide a system that considers both quantitative and perception-based data, particularly when assessing student competencies, lecturer effectiveness and the overall quality of entrepreneurship programmes. While this evaluation is generally summative in nature, it can be adapted for use in a formative approach within the internal quality assurance cycle. It enhances the accuracy of performance assessment through a flexible yet systematic approach. The method's strengths include its ability to coherently combine hard and soft data, while its weaknesses include the technical complexity of designing membership functions and the requirement for evaluators to have a deep understanding of fuzzy methods (Tang et al., 2024).

4.4.8.SPA-VFS and CBA-GRNN Hybrid Evaluation Model

This model combines two evaluation approaches: Set Pair Analysis (SPA) and Variable Fuzzy Sets (VFS), integrated with an artificial intelligence model called Generalised Regression Neural Network (GRNN), optimised using the Chaos Bat Algorithm (CBA). The primary objective of this model is to assess the sustainability of entrepreneurship education based on four dimensions: the educational environment, resource investment, the implementation process and learning outcomes. The evaluation is formative and summative, assessing both the educational process and outcomes in real time. The model's advantages include improved evaluation accuracy and the institution's ability to identify issues earlier and respond adaptively. The model's strengths lie in its ability to handle large-scale complex data with high precision. However, it has high technical requirements in terms of both hardware and algorithm-based data management skills (Y. Liang et al., 2021).

4.4.9.Genetic Algorithm-Optimized BP Neural Network Model

This model builds on the Backpropagation Neural Network (BP-NN) by incorporating Genetic Algorithm (GA) improvements to evaluate students' innovation and entrepreneurship abilities. The aim is to create an efficient, fast-converging, artificial intelligence-based evaluation system that can handle multidimensional data complexity. This summative evaluation is designed to produce an objective score of students' competency levels. The result is improved accuracy in assessing and predicting student performance in relation to industry readiness. The main advantages of this model are stability, speed and efficiency. However, its limitations include the lack of interpretability of the results and dependence on a high-quality initial data structure (S. Li, 2022).

4.4.10. CIPP-AHP-FCE Model for Entrepreneurial Failure Education (EFE)

This model is specifically designed to evaluate entrepreneurial failure education (EFE), equipping students with the knowledge and skills to deal with entrepreneurial failure. It combines the CIPP framework with the Analytic Hierarchy Process (AHP) for indicator weighting and Fuzzy Comprehensive Evaluation (FCE) to handle data uncertainty. It ensures the quality and effectiveness of EFE programmes at universities in terms of the environment, resource inputs, implementation processes and outcome achievements. The evaluation combines formative elements during the implementation process with summative elements for measuring learning

outcomes. The impact includes improving students' readiness to face business risks, building resilience and supporting a failure-based curriculum as part of educational innovation. The model's strengths lie in its ability to accommodate complex variables and subjective experiences, while its weaknesses include the high demand for evaluative data and institutional technical capacity (Fan et al., 2022).

4.4.11. Classification Algorithm-Based Evaluation Model

This model uses a classification algorithm approach to data mining in order to build an entrepreneurship education performance evaluation system based on employment indicators and entrepreneurial success. The model's purpose is to identify and categorise patterns of student and institutional performance based on key parameters such as policy support, campus readiness and student involvement in entrepreneurial practices. As a summative model, it places greater emphasis on final outcomes and graduate performance. The result is an objective basis for strategic decision-making at institutional and government levels. The advantages of this model include its ability to handle big data with high accuracy and clear segmentation. However, it is dependent on the quality of the input data and fails to capture aspects of the learning process (Fu, 2022).

4.4.12. Big Data-Based Fuzzy Comprehensive Evaluation Model

This model integrates big data technology with the fuzzy comprehensive evaluation method to assess the quality of entrepreneurship education in higher education. The aim is to develop an evaluation framework that responds to the dynamics of real-time, data-based learning and considers indicators such as teaching effectiveness, student learning behaviour and entrepreneurship practices. The model incorporates both formative and summative evaluations, depending on the institution's implementation and follow-up cycles. The result is an adaptive, contextual assessment system that can be updated periodically according to changes in institutional characteristics. The model's strengths lie in its broad and flexible scope of evaluation when dealing with ambiguous data. However, it has two main weaknesses: it is not very universal if not adapted locally, and it requires continuous system updates in line with technological and pedagogical developments (B. Zhang & Zhang, 2024b)

Various models of entrepreneurship education evaluation in higher education offer highly varied approaches, ranging from the use of technology to the focus of the evaluation and its potential application in local contexts. To provide a more structured overview and facilitate understanding, Table 4 below summarises the main characteristics of the twelve analysed models. This synthesis presents the types of technology used, the evaluation orientation (formative or summative) and the relevance to Islamic Religious Higher Education Institutions (PTKIs). It serves as an initial reference for selecting or designing an evaluation system that aligns with the institution's needs and capabilities.

Table 4: Comparative Synthesis of EE Evaluation Models

No	Model	Technology Level	Type of Evaluation	Relevance to Islamic Higher Education Institutions (IHEIs)
1	CIPP-AHP-FCE	Hybrid	Formative & Summative	Very high – suitable for integrated internal quality assurance

2	Kirkpatrick-Based Index System	Conventional	Formative & Summative	Moderate – requires contextual adaptation
3	Entropy-TOPSIS	Medium-Tech	Summative	Moderate – useful if numeric data is available
4	Integrated CIPP-Countenance-Kirkpatrick	Hybrid	Formative & Summative	High – aligns with industry-linked programmes
5	Multiple Fuzzy with Entropy Weighting	Medium-Tech	Summative	High – ideal for capturing student and stakeholder perceptions
6	Polymorphic CS-BKT	High-Tech	Formative	Low to moderate – suitable for digitally mature institutions
7	AHP-Fuzzy Comprehensive	Hybrid	Formative & Summative	High – feasible and adaptive for internal assessments
8	SPA-VFS + CBA-GRNN	High-Tech	Combined	Low – only feasible for flagship or pilot campuses
9	GA-Optimised BP Neural Network	High-Tech	Summative	Low – experimental or advanced pilot usage
10	CIPP-AHP-FCE for EFE	Hybrid	Formative & Summative	Very high – aligns with character education in Islamic ethos
11	Classification Algorithm-Based	High-Tech	Summative	Moderate – good for tracer studies and graduate tracking
12	Big Data Fuzzy Evaluation	High-Tech	Combined	Moderate – depends on digital readiness of the institution

4.5. Conceptual Framework of the LOA-based EE Evaluation Model

Developing a conceptual framework for an LOA-based entrepreneurship education evaluation model at Islamic religious universities would enrich the global evaluation approach. An analysis of various evaluation models applied in developed countries reveals that they generally fall into three classifications, as shown in Figures 3, 4 and 5. There is also a significant opportunity to refine these models using an approach that is more learning-oriented, reflective and transformative, based on big data and artificial intelligence.

The LOA approach not only assesses final results, but also supports students throughout their learning journey, fostering self-awareness and encouraging continuous growth in competence. In the context of PTKI, this approach is highly relevant as it can be integrated with Islamic values such as honesty, responsibility, social benefit and a spiritual work ethic. The development of an LOA-based conceptual framework is therefore expected to produce an entrepreneurship evaluation system that is pedagogically effective and aligned with the scientific and Islamic missions of religious higher education institutions. The LOA-based conceptual framework for evaluating entrepreneurship education in PTKIs is shown in Table 4 below.

Tabel 4: Conceptual Framework

Learning Input & Contextual Foundation	Learning Process			Feedback Mechanism
	Assessmen for learning	Assessmen as learning	Assessmen of learning	
Student Motivation	Active Participation	Self Assessment	Entrepreneurial Outcome	Continuous Improvement
Pre-College Experience	Project Based Learning	Peer Assessment	Social Impact	
Islamic Values	Islamic Integration	Reflective Journaling	Behavior Transformation	Stakeholder Engagement
Learning Goals	Feed Back Loop	Ethical Reasoning	Eftical Practices	
Institutional Support				

Finally, this study has important limitations that must be considered. One such limitation is that the approach used is still based on big data, meaning it does not cover empirical evidence or literature not integrated into the used database. Furthermore, the conceptual framework of the LOA-based higher education entrepreneurship education evaluation model has not been empirically validated in this study. Therefore, the researchers recommend that future studies employ mixed methods to test and refine the evaluation model, particularly at Islamic religious universities in Indonesia. Research could also focus on developing LOA-based evaluation instruments contextualised with Islamic values and entrepreneurial characteristics to increase their applicability and relevance in supporting entrepreneurial transformation at religious universities.

5. Conclusion

This study has successfully mapped the global scientific landscape, identified effective models of entrepreneurship education evaluation, and proposed a contextual *Learning-Oriented Assessment* (LOA)-based conceptual framework suitable for application in Islamic Higher Education Institutions (PTKI). Through a mixed-methods approach that integrates bibliometric analysis and systematic literature review (SLR), the study has comprehensively addressed the three main research questions regarding global trends, effective evaluation models, and the relevance of an adaptive framework for PTKIs.

The main findings show that research on entrepreneurship education evaluation has experienced steady growth, with increasing international collaboration and methodological diversity. The most adaptive models identified are hybrid models—such as the CIPP-AHP-FCE—which combine classical evaluation frameworks with advanced technologies like fuzzy logic, big data, and artificial intelligence. Furthermore, models that integrate both process and outcome-focused evaluations (dual-focus) have proven to be more holistic and relevant for supporting sustainable entrepreneurial competency development.

The primary contribution of this study lies in the formulation of an LOA-based conceptual framework that integrates input, learning processes, feedback mechanisms, and learning outcomes—contextualized within Islamic values. This framework supports not only *assessment of learning*, but also *assessment for* and *as learning*, fostering reflection, competence development, and character transformation. As such, it is highly relevant for advancing the strategic mission of PTKIs as institutions that integrate academic excellence, spiritual growth, and social impact.

Practically, the findings offer a guide for developing more contextualized entrepreneurship evaluation systems in PTKIs, with consideration for technological readiness, educator capacity, and the integration of Islamic ethical values. Institutions can utilize the synthesized evaluation models to select or adapt systems that align with their specific needs and capabilities, ranging from fuzzy logic-based tools to AI-enhanced models suitable for flagship campuses.

However, this study is not without limitations. One major constraint is its reliance on secondary data from indexed databases, which may exclude empirical evidence from non-indexed or localized sources. Moreover, the proposed LOA-based conceptual framework has not been empirically validated. Therefore, future research is recommended to employ mixed-methods designs to test and refine the framework, particularly in the context of Indonesian Islamic universities. Further studies should also focus on developing LOA-based evaluation instruments tailored to Islamic values and the entrepreneurial characteristics of PTKIs, thereby enhancing their applicability and contribution to the transformation of entrepreneurship education in religious higher education environments.

Declarations

Author contribution statement

Achmad Maulidi initiated the research idea and led the overall development of the manuscript. Badrut Tamami contributed to the theoretical framework and supported the methodological design. Sita Isna Malyuna was responsible for data collection, analysis, and interpretation. Kusaeri provided critical guidance during the research process and contributed to the review and editing stages. Suparto supervised the academic quality and ensured the alignment of the manuscript with publication standards.

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Data availability statement

The datasets generated during and analyzed during the current study are available from the corresponding author upon reasonable request.

Declaration of Interest's statement

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

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Suparto 

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