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Triple Helix Collaboration Model in Entrepreneurship Curriculum Transformation: Enhancing Graduate Entrepreneurial Competitiveness in the Global Era

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Abstract

The implementation of the Triple Helix model in higher education is an important strategy to increase the relevance of the entrepreneurship curriculum and improve graduate competitiveness. The purpose of this study is to examine the effectiveness of synergy between academia, industry, and government in curriculum transformation and its impact on improving graduate competency. Data were collected through a quantitative approach using questionnaires and a qualitative approach using in-depth interviews and tracer studies. The research hypothesis is that the Triple Helix model has a significant influence on curriculum transformation and graduate competitiveness. Data analysis was conducted using descriptive and inferential statistical methods combined with qualitative findings. The results show that academia and industry play a significant role in integrating research, project-based learning, and practice-based learning. However, government support remains limited to regulatory aspects. Experience-based curriculum transformation has been shown to improve graduate managerial competence, independence, and innovation, although global business reach remains low. These findings emphasize the need for strengthened government support and the development of digitalization- and globalization-oriented curricula to enhance graduate competitiveness.

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Keywords: ***Competitiveness; Curriculum Transformation; Entrepreneurship; Industry Collaboration; Triple Helix***

INTRODUCTION

Entrepreneurship is a key driver of economic growth, innovation, and competitiveness in a country. Universities play a strategic role in producing entrepreneurial graduates who not only master technical skills but also possess the capacity for innovation, creativity, and adaptability to rapidly changing global market dynamics (Yang, 2024) . Globally, the Global Entrepreneurship Monitor (GEM) report shows that the success of an entrepreneurial ecosystem is largely determined by the synergy between education, industry, and public policy. Developed countries have successfully integrated entrepreneurship education into practice-based curricula relevant to market needs, strengthened through strategic cross-sector partnerships (Rosienkiewicz et al., 2024) ; (Gomez, 2024) .

Efforts to develop entrepreneurship in Indonesia through higher education have been made, but there remains a significant gap between on-campus learning and the demands of the business world and industry (Elpisah et al., 2024) . Many graduates are not yet adequately prepared to compete in national and international markets, thus limiting their contribution to sustainable economic growth (Ncube & Lekhanya, 2025) . One approach that has the potential to bridge this gap is the Triple Helix collaboration model , which emphasizes synergistic interactions between academia, industry, and government (Vivar-Simon et al., 2022) ; (Bednarzewska, 2021) . In the context of entrepreneurship education, this approach is believed to be able to produce an adaptive, research-based curriculum, supported by conducive public policies and direct industry involvement in the design and implementation of learning (Hailu, 2024) ; (Cheng et al., 2024) .

along with digital transformation and revolution demanding industry 4.0 birth businessman innovative based technology . College high in Indonesia is necessary strengthen capacity student No only in aspect entrepreneurship traditional , but also deep utilise digital technology , artificial intelligence, big data, and economic platforms based on sharing economy (Rodrigues et al., 2024) ; (Xie, 2024) . In the context of Here , Triple Helix plays a role as framework collaboration that can facilitate integration technology through support industry , policy accelerative from government , as well as research and development conducted by academics (Afolabi & Adeyinka, 2024) ; (Diaz- Sarachaga , 2024) . This matter will allows creation ecosystem more digital entrepreneurship inclusive and empowered competition tall (Debeljak et al., 2022) .

Success transformation curriculum entrepreneurship Triple Helix based is also determined

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by sustainability collaboration between stakeholders interests . College tall No can stand Alone in develop curriculum , but rather must in a way active involving industry For ensure relevance teaching materials with job market needs and global trends (Rosienkiewicz et al., 2024) . On the other hand , the government need give support regulations , incentives , and facilities that encourage development ecosystem entrepreneurship sustainable (Wordu & Ahule, 2025) . With existence structured and consistent coordination , curriculum entrepreneurship will capable bridge gap between the academic world and practice business real , at the same time strengthen contribution college tall to development economy national (Pendriana et al., 2024) .

However, the implementation of the Triple Helix concept in transforming entrepreneurship curricula, particularly in developing countries including Indonesia, still faces several challenges. Existing collaborations are often partial, for example through short-term internships or non-credit training, and have not been integrated into a sustainable, practice-oriented curriculum (Hagain, 2024) . Furthermore, empirical studies directly assessing the impact of Triple Helix implementation on graduates' entrepreneurial competitiveness—which encompasses managerial skills, innovation capacity, and readiness for the global market—are still very limited (Hailu, 2024) . Most previous studies tend to focus on technology transfer, regional innovation systems, or economic development, with few examining its integration into entrepreneurship education (Debeljak et al., 2022) . Furthermore, there is no proven operational model available that can serve as a practical guide for universities in effectively implementing Triple Helix collaboration in this area (Vivar-Simon et al., 2022) .

Based on these conditions, this study seeks to develop and test a Triple Helix -based entrepreneurship curriculum transformation model that can be practically implemented by universities. The approach used combines qualitative exploration of the roles and synergies of stakeholders with quantitative analysis to measure the model's impact on graduate competitiveness. This study offers novelty in the form of adapting the Triple Helix concept specifically for entrepreneurship education, integrating industry-based curriculum design with hands-on learning and innovation-based pedagogy, and developing applicable outcomes in the form of a tested curriculum model, learning modules, and policy recommendations to strengthen sustainable collaboration between academia, industry, and government. Thus, it is hoped that this study will not only provide a theoretical contribution to the development of the Triple Helix concept in entrepreneurship education but also produce a practical implementation framework capable of enhancing the global competitiveness of university graduates (Rajagopal, 2020) .

This research contribution is also expected to provide concrete guidance for Indonesian

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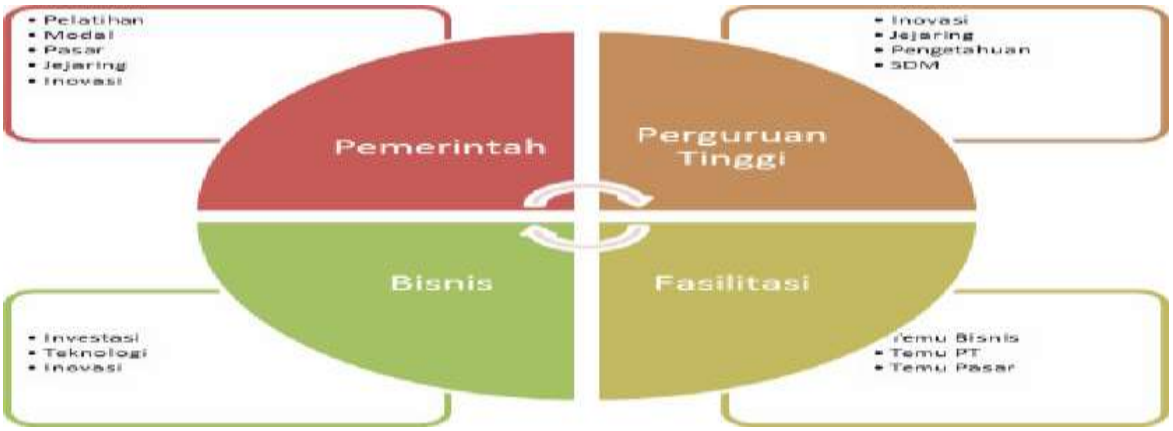
universities in developing more measurable entrepreneurship programs, oriented to global market needs, and grounded in innovation and sustainability. By testing the Triple Helix model in the context of transforming the entrepreneurship curriculum, this research offers applicable solutions to improve the employability and entrepreneurial capacity of graduates. Thus, the results of this research have the potential to become a reference not only for universities, but also for policymakers and industry players in building sustainable synergies to produce a generation of entrepreneurs who are globally competitive, digitally literate, and contribute significantly to national economic growth.

METHOD

This research employed a mixed methods approach with an explanatory sequential design. The research process began with quantitative data collection and analysis, followed by qualitative data mining to deepen the initial findings. This approach was chosen because it enabled researchers to obtain a statistical overview of the relationships between variables while simultaneously gaining a deeper understanding of the context and dynamics in the field. The quantitative phase focused on examining the impact of the Triple Helix model on the transformation of the entrepreneurship curriculum and graduate competitiveness. The qualitative phase explored the roles of academia, industry, and government in supporting collaboration-based curriculum development.

This research was conducted at universities that offer entrepreneurship courses, partner industrial companies, and relevant government agencies. The selection of these locations was based on the consideration that the three main actors in the Triple Helix model were directly accessible, thus facilitating the process of collecting relevant and representative data. The research was scheduled for the even semester of the 2024/2025 academic year, coinciding with the active period of lectures and the implementation of entrepreneurship programs at universities. The units of analysis in this study cover three levels: individuals (students and lecturers as direct actors in entrepreneurship education), higher education institutions (as organizers of the entrepreneurship curriculum), and external partners (industry and government agencies as supporting actors of the Triple Helix).

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Picture 1. Triple Helix Model

The research population included students who had taken entrepreneurship courses, lecturers, partner industry players, and representatives from government agencies involved in entrepreneurship development. From this population, the quantitative sample consisted of 150 students and 50 lecturers selected using purposive sampling to suit the research context. The quantitative sample size refers to the recommendations of Hair et al. (2019) for Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis, which is at least 10 times the number of indicators in the densest path in the structural model. Meanwhile, the qualitative sample included 15 industry players and 10 government representatives determined using snowball sampling. This technique was chosen based on the consideration that Triple Helix collaboration networks are often formed through recommendations from interconnected key actors, allowing researchers to reach relevant participants who have real influence in the research context.

The research instruments used included a quantitative questionnaire with a 5-point Likert scale to measure three main variables: the implementation of the Triple Helix (academia, industry, government), the transformation of the entrepreneurship curriculum (industry-based curriculum, practice-based learning, innovation-based curriculum, involvement of external actors), and graduate competitiveness (business and managerial competencies, innovation and market adaptation capabilities, business independence and sustainability, global business reach). Qualitative instruments included in-depth interview guidelines, focus group discussion (FGD) guidelines, observation sheets, and entrepreneurship curriculum and policy documents.

Data collection was conducted in two stages. The first stage was quantitative, involving the distribution of questionnaires to students and lecturers both online and offline. The collected data were analyzed using SPSS for descriptive analysis and SmartPLS for structural model testing, including evaluation of the measurement model (outer model) and structural model (inner

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model). The second stage was qualitative, involving data collection through in-depth interviews, focus group discussions (FGDs), and direct observation of entrepreneurship learning activities as well as student interactions with industry and government partners. The qualitative data were then analyzed using thematic analysis using NVivo software to identify key themes that could enrich and explain the quantitative results. Method triangulation was then conducted by comparing quantitative and qualitative findings to ensure more valid and reliable research results.

RESULT AND DISCUSSION

The respondents in this study consisted of students, lecturers, industry players, and representatives of government agencies involved in the higher education entrepreneurship ecosystem. In the quantitative phase, the number of respondents included 150 students who had taken entrepreneurship courses and 50 lecturers teaching related courses. The sampling technique used purposive sampling, considering that participants were directly involved in the implementation of the entrepreneurship curriculum. This quantitative sample size meets the minimum criteria recommended by Hair et al. (2019) for PLS-SEM analysis, which is at least 10 times the number of indicators in the densest path in the structural model.

Meanwhile, the qualitative phase involved 15 industry players who are university partners and 10 representatives from government agencies involved in entrepreneurship development. Qualitative respondents were selected using snowball sampling, as collaboration in the Triple Helix model typically develops through recommendations and inter-actor networks (Pregoner, 2024) .

Overall, the characteristics of the respondents reflect the three main actors in the Triple Helix model: academics (students and lecturers), industry, and government. This allows the study to obtain a more comprehensive picture of the relationship between Triple Helix implementation, curriculum transformation, and graduate competitiveness, both from an internal perspective and from external support.

Table 1: Demographic Distribution of Respondents

Demographic Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	45	56.3
	Female	35	43.7
Age	20–25 years	28	35.0
	26–30 years	30	37.5

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Demographic Variable	Category	Frequency (n)	Percentage (%)
	31–35 years	15	18.7
	Above 35 years	7	8.8
Work Experience	Less than 2 years	22	27.5
	2–5 years	38	47.5
	More than 5 years	20	25.0
Institutional Origin	University A	25	31.3
	University B	30	37.5
	University C	15	18.7
	Others	10	12.5
Total		80	100

Table 2: Descriptive Statistics of Research Variables

Variables / Dimensions	Mean (M)	Standard Deviation (SD)	Category
Implementation of Triple Helix	4.21	0.46	Tall
- Academics	4.35	0.42	Tall
- Industry	4.08	0.51	Tall
- Government	4.20	0.45	Tall
Entrepreneurship Curriculum Transformation	4.18	0.49	Tall
- Industry-based curriculum	4.15	0.48	Tall
- Practice-based learning	4.10	0.50	Tall
- Innovation-based curriculum	4.29	0.46	Tall

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- Involvement of external actors	4.17	0.47	Tall
Graduate Competitiveness	4.23	0.44	Tall
- Business and managerial competencies	4.18	0.45	Tall
- Ability to innovate and adapt to the market	4.34	0.41	Tall
- Independence and business sustainability	4.20	0.44	Tall
- Global business reach	4.19	0.43	Tall

The results of the descriptive analysis show that all research variables have an average score in the high category. The implementation of *Triple Helix* obtained an average score of 4.21 (SD = 0.46) on a Likert scale of 1–5, with the "Academic" dimension recording the highest score (M = 4.35) and "Industry" the lowest (M = 4.08). The transformation of the entrepreneurship curriculum had an average of 4.18 (SD = 0.49), with the "Innovation-based curriculum" dimension receiving the highest score (M = 4.29). Meanwhile, graduate competitiveness had an average of 4.23 (SD = 0.44), with the "Innovation and market adaptation capability" dimension being the highest (M = 4.34).

Table 3: Validity and Reliability Test Results

Variables / Constructs	AVE	CR	Cronbach's Alpha	Loading Factor Range	Criteria
Implementation of Triple Helix	0.68	0.88	0.86	0.72 – 0.85	Valid & Reliable
Transformation Curriculum Entrepreneurship	0.65	0.87	0.84	0.73 – 0.88	Valid & Reliable
Graduate Competitiveness	0.69	0.91	0.89	0.74 – 0.90	Valid & Reliable

The validity and reliability test results in Table 4.2 indicate that all research variables have

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met the required criteria. The AVE values for Triple Helix Implementation (0.68), Entrepreneurship Curriculum Transformation (0.65), and Graduate Competitiveness (0.69) are greater than 0.50, thus all constructs are declared convergently valid. Composite Reliability (CR) values above 0.87 for each construct further confirm the internal consistency of the research instrument. Meanwhile, Cronbach's Alpha values greater than 0.80 indicate high reliability and the instrument's ability to provide consistent results when retested. Furthermore, the factor loading range, all above 0.70, proves that each indicator makes a strong contribution to the construct it represents. This indicates that the research instrument is truly capable of accurately representing the theoretical concepts of Triple Helix, curriculum transformation, and graduate competitiveness. With these results, the instrument is declared suitable for use in further structural analysis.

Table 4: Validity Test Results Discriminant – Fornell-Larcker Criterion

Construct	**Implementation of Triple Helix**	**Transformation Curriculum**	**Graduate Competitiveness**
Implementation of Triple Helix	**0.825**		
Transformation Curriculum Entrepreneurship	0.712	**0.806**	
Graduate Competitiveness	0.695	0.728	**0.831**
Construct	Implementation of Triple Helix	Transformation Curriculum	Graduate Competitiveness

The results of the discriminant validity test in Table 4 using the Fornell-Larcker criteria indicate that the research instrument meets the requirements of discriminant validity. The diagonal value, which is the square root of the AVE for each construct, is greater than the correlation value between constructs. The Triple Helix Implementation has a value of 0.825, which is higher than its correlation with Curriculum Transformation (0.712) and Graduate Competitiveness (0.695). Similarly, Entrepreneurship Curriculum Transformation with a value of 0.806 is higher than its correlation with Triple Helix Implementation (0.712) and Graduate Competitiveness (0.728). Furthermore, Graduate Competitiveness has a value of 0.831, which is

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greater than its correlation with Triple Helix Implementation (0.695) and Curriculum Transformation (0.728). These findings prove that each construct has good discriminant, meaning that each variable is able to clearly distinguish itself from other constructs. Thus, the research model is worthy of being continued to the structural analysis stage.

Table 5: Validity Test Results Discriminant – HTMT Ratio

Construct	Implementation of Triple Helix	Transformation Curriculum	Graduate Competitiveness
Implementation of Triple Helix	–		
Transformation Curriculum Entrepreneurship	0.812	–	
Graduate Competitiveness	0.798	0.821	–

The results of the discriminant validity test using the Heterotrait-Monotrait Ratio (HTMT) approach show that all HTMT values between constructs are below the threshold of 0.85. The HTMT value between Triple Helix Implementation and Entrepreneurship Curriculum Transformation is 0.812, between Triple Helix Implementation and Graduate Competitiveness is 0.798, and between Entrepreneurship Curriculum Transformation and Graduate Competitiveness is 0.821. These results indicate that there are no discriminant problems in the research model. In other words, although there is a fairly strong relationship between constructs, the research instrument is still able to differentiate each variable conceptually and operationally. This indicates that the constructs studied—namely Triple Helix Implementation, Entrepreneurship Curriculum Transformation, and Graduate Competitiveness—have different characteristics, but are interrelated within the research framework. By fulfilling the discriminant validity criteria, the measurement model (outer model) can be declared feasible, so that the analysis can proceed to the structural model testing stage (inner model).

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Table 6: Findings Qualitative

Main Theme	Sub-Theme	Evidence / Data Source	Interpretation
The Strategic Role of Academics	1. Integration of lecturer research into the curriculum 2. Student business incubation 3. Strengthening alumni networks as mentors	RPS, lecturer & student interviews, observation of incubator activities	Academics play a vital role as developers of innovative curricula and facilitators of practice-based learning.
Industry Involvement in the Curriculum	1. Market-driven curriculum 2. Project-based learning based on real cases 3. Access to technology & industrial facilities	MoU documents, FGD with lecturers & industry, observations at industrial facilities	Industry provides relevant input, real-world case studies, and facilities that support practical learning.
Government Policy Support	1. Startup financing scheme 2. National campus entrepreneurship program 3. Cross-sector partnership regulations	Government official interviews, policy documents, service training reports	Government policies encourage cross-sector collaboration, although implementation remains hampered by bureaucracy.
Adaptive Entrepreneurship Curriculum	1. Digital industry content gap 2. Student interest in practice 3.	RPS, lecturer & student interviews	The curriculum needs to adapt more quickly to digital industry

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	Modules have not been updated		trends and global markets.
Collaboration Implementation Challenges	1. Bureaucratic obstacles 2. MoU has not been optimally realized	Government & lecturer interviews, observation of collaborative activities	Administrative obstacles slow down the realization of formally agreed cooperation.
Impact on Graduate Competitiveness	1. The percentage of entrepreneurial graduates is increasing. 2. Innovation is growing. 3. Market reach is still local.	Tracer study, industry interviews, observation of student activities	Curriculum transformation increases graduate independence and innovation, but market reach is still limited locally.

The analysis shows that collaboration between academia, industry, and government plays a crucial role in transforming the entrepreneurship curriculum. Academics contribute through the integration of lecturer research into the curriculum, the establishment of student business incubators, and the strengthening of alumni networks as mentors. Meanwhile, industry involvement is evident in the development of a market-driven curriculum, the implementation of *project-based learning* with real-life cases, and the provision of access to technology and facilities. Government support is also provided through startup financing policies and campus entrepreneurship programs, although their implementation remains hampered by bureaucratic hurdles. An adaptive curriculum is urgently needed due to the ongoing gap with developments in the digital industry, and learning modules that have not been fully updated. The main challenges lie in bureaucracy and the incomplete implementation of MoUs. Nevertheless, positive impacts are evident in the increasing number of entrepreneurial graduates and the growth of innovation, although their competitiveness remains limited to the local market.

This study confirms that the implementation of the Triple Helix model which integrates the roles of academia, industry, and government has had a significant impact on the transformation of the entrepreneurship curriculum in higher education. Quantitatively, the average score for the

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implementation of this model is in the high category (M = 4.21). This indicates that the synergy between actors in the higher education ecosystem is running relatively well, although the contributions of each actor are not entirely balanced. Academics play the most prominent role through the integration of lecturer research into the curriculum, the management of student business incubators, and the strengthening of alumni networks as mentors Siskandar et al. (2023). Industry also plays a role by providing a market-based curriculum, implementing project-based learning, and accessing technology and facilities, so that students are directly exposed to the dynamics of real entrepreneurship. However, the government dimension received the lowest score because support is still predominantly regulatory, with bureaucratic obstacles and delays in program implementation. These findings indicate that the government's role still needs to be directed at operational aspects, such as financing adaptive curriculum, providing industry incentives, and easily accessible cross-sector partnership schemes. This result is in line with the theory of Etzkowitz & Leydesdorff (2000) which emphasizes the importance of synergy between three main actors to create an innovative ecosystem, but shows that the role of the government in Indonesia still needs to be strengthened so that collaboration is truly optimal.

The transformation of the entrepreneurship curriculum also showed positive results. Quantitatively, the innovation-based curriculum dimension scored the highest (M = 4.29). This indicates that universities have taken strategic steps through the implementation of experiential learning, namely learning based on real experiences in the form of business simulations, industry case studies, and field projects. Qualitatively, interviews with lecturers and students confirmed that practice-based learning improves students' readiness to face the business world. Students participating in incubation programs are more focused on managing their businesses, while those involved in collaborative projects gain direct experience in overcoming market challenges. These findings reinforce the argument of Fayolle & Gailly (2015) that experiential learning is an effective approach to fostering entrepreneurial skills. However, the curriculum is still predominantly local in orientation. Content related to market globalization and business digitalization has not been fully integrated, resulting in graduates being more competitive domestically. Therefore, the curriculum needs to be strengthened with materials on digital literacy, MSME product export strategies, the use of global e-commerce, and financial technology literacy to enable graduates to compete internationally.

Graduates' competitiveness also increased significantly after the implementation of the Triple Helix model and curriculum transformation. Quantitative data showed the highest scores in innovation and market adaptation capabilities (M = 4.34). This indicates that graduates have

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better managerial competencies, are more innovative, and are more independent in entrepreneurship Raharjo et al. (2025). Tracer studies show an increase in the number of graduates choosing entrepreneurship, both in conventional businesses and digital-based start-ups Ardita et al. (2025). Qualitatively, students reported significantly benefiting from practice-based learning because they were better prepared to face market risks and challenges. However, challenges remain in the area of business sustainability, particularly access to capital, expanding global market networks, and mentoring support after graduation. Most graduate businesses still operate on a local or medium scale, indicating limitations in international market penetration Gachie (2019).

The overall results indicate that the Triple Helix model has proven effective in driving the transformation of the entrepreneurship curriculum. While the synergy between academia and industry is relatively strong, the government needs to take a more concrete role for broader impact. Curriculum transformation through experiential learning has been shown to increase the relevance of learning to the business world, but it must be expanded with content focused on globalization and digitalization to enable graduates to penetrate the international market. Graduates' competitiveness has increased, particularly in innovation, management, and business independence, although limited capital and global market access remain obstacles. Therefore, the results of this study confirm that the success of entrepreneurship development in higher education is determined not only by the quality of the curriculum but also by the strength of a sustainable collaborative ecosystem between academia, industry, and government.

CONCLUSION

Study This confirm that implementation of the Triple Helix model is capable increase quality and relevance curriculum entrepreneurship in college high . Collaboration between academics , industry , and government push transformation curriculum that has an impact on improving competence , innovation , and readiness business students . Analysis quantitative show connection positive significant between Triple Helix implementation , transformation curriculum , and power competition graduates . Findings qualitative strengthen matter said , with proof that success transformation depending on the intensity interaction consistent and sustainable inter-factors . However , research also found that that role government not optimal, especially in integration policy operational , support financing and incentives industry. Limitations This reduce effectiveness support systemic in strengthening curriculum . In addition, the power global competitiveness of graduates Still relatively low , indicating the need strengthening curriculum

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based digitalization , literacy technology , and international market orientation . In general theoretical , findings about importance synergy between universities, industry and government in build ecosystem innovation in education high . From the side practical , research presenting a collaborative model cross sectors that can replicated in college another height for increase Power competition entrepreneurship graduate of .

Recommendation study covering institutionalization Triple Helix collaboration to have base laws and mechanisms clear in development curriculum . Government need strengthen regulations , providing funding , giving incentive for industry, and simplify bureaucracy partnership cross sector . College tall expected integrate content digitalization and global markets, such as module MSME exports , international digital marketing , as well as literacy technology . Joint industry government and academics also need expanding incubation and acceleration programs business , as well as create matching fund scheme , certification entrepreneurship , and accelerators business based area.For study continued , important reviewed optimization role government in support ecosystem Triple Helix entrepreneurship , development of evaluation models sustainability business graduate of based on tracer studies, as well as internationalization strategies curriculum with technology such as AI and big data. Comparative studies inter-university height is also needed For understand factor contextual success implementation.With recommendation said , education entrepreneurship in college tall expected capable give birth to graduates who do not only empowered competition local , but also ready face global competition in general sustainable .

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