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Policy Incentives for Strengthening Industry–Academia Collaboration Toward Sustainable Innovation and Entrepreneurship

Cheng-Wen Lee [1,*], Chin-Chuan Wang [2], Mao-Wen Fu [2] and Hsiao Chuan Chen [3]

[1] Department of International Business, College of Business, Chung Yuan Christian University, No. 200, Zhongbei Rd., Zhongli Dist, Taoyuan City 320314, Taiwan
[2] Ph.D. Program in Business, College of Business, Chung Yuan Christian University, No. 200, Zhongbei Rd., Zhongli Dist, Taoyuan City 320314, Taiwan
[3] The Association of Global Industry Academia Collaboration Malaysia, Kuala Lumpur 50000, Malaysia
* Correspondence: chengwen@cycu.edu.tw

Abstract

This study examines how policy incentives enhance students' entrepreneurial mindset and agility through industry–academia collaboration. Unlike prior research that often adopts institutional or industry perspectives, this paper foregrounds the experiences of students as the primary beneficiaries of entrepreneurship education policies. Drawing on survey data from 528 students across Taiwan and Malaysia, the study tests a comprehensive conceptual framework incorporating professional engagement, curriculum design, and skill development as mediating mechanisms. Using structural equation modeling, the findings show that policy incentives exert strong direct and indirect effects on entrepreneurial outcomes, although some mediating pathways are contingent on the quality of engagement. By positioning student perspectives at the center of analysis, this study contributes to understanding how policy support translates into experiential learning and entrepreneurial agility. Implications are drawn for educators, policymakers, and students, with suggestions for refining collaboration structures and fostering student-centered entrepreneurship ecosystems.

Keywords: open innovation; global talent cultivation; non-profit organizations; university alliances

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1. Introduction

Industry–academia collaboration has long been recognized as a driver of innovation, talent development, and entrepreneurial ecosystems. Much of the existing research, however, emphasizes institutional arrangements or industry outcomes, while the student perspective has received relatively less attention. Yet students represent the core beneficiaries of educational policies and the frontline participants in collaboration programs. Understanding how students perceive and respond to policy incentives is therefore critical for assessing the effectiveness of entrepreneurship education initiatives and for designing learning environments that foster entrepreneurial mindset and agility [1].

Policy incentives play a critical role in shaping and sustaining a vibrant entrepreneurial ecosystem. Targeted policy measures—such as support for entrepreneurship education, startup funding mechanisms, tax incentives, and the promotion of academia–industry

partnerships—are particularly instrumental in fostering entrepreneurial activity [2]. Recognizing the strategic importance of entrepreneurship for economic growth and innovation, governments worldwide have adopted comprehensive policy frameworks to support entrepreneurial development. For example, the European Union's Entrepreneurship 2020 Action Plan underscores the significance of integrating entrepreneurship into education systems, reducing regulatory burdens, and creating an enabling environment conducive to startup growth. Likewise, in the United States, key federal initiatives such as the Small Business Innovation Research (SBIR) program and the Startup America initiative have been implemented to stimulate innovation, provide early-stage funding, and support entrepreneurial ventures through inter-agency collaboration and public–private partnerships [3].

Educational institutions play a critical role in promoting entrepreneurship by integrating entrepreneurial education into academic curricula and facilitating experiential learning to develop students' entrepreneurial competencies. Such institutions can foster an entrepreneurial culture through the implementation of structured programs, interactive workshops, innovation challenges, and business plan competitions [4]. These initiatives not only enhance theoretical understanding but also cultivate essential entrepreneurial traits such as creativity, risk-taking, and opportunity recognition. Furthermore, entrepreneurial learning is inherently a social and interactive process involving meaningful engagement with peers, mentors, and the wider community [5]. By fostering such interactions, particularly through partnerships with industry–educational institutions, a conducive environment for entrepreneurial growth is created, thereby strengthening students' intentions and capacities to pursue entrepreneurial ventures.

The Triple Helix model underscores the critical role of collaborative interactions among academia, industry, and government in driving innovation and fostering entrepreneurship [6]. This framework posits that the integration of these three institutional spheres creates a dynamic and synergistic environment that accelerates entrepreneurial development. Strengthened collaboration among universities, industry partners, and policymakers not only facilitates the transfer of knowledge and technology but also cultivates ecosystems that sustain entrepreneurial activity. Empirical research supports these claims, showing that university–industry partnerships significantly enhance students' entrepreneurial competencies, motivation, and innovation-oriented thinking [7,8]. Building on this foundation, the present study emphasizes how government incentives, industry collaboration, and university initiatives converge to shape students' entrepreneurial learning experiences. By positioning students at the nexus of Triple Helix interactions, we extend the model from a predominantly macro-level framework to one that also accounts for micro-level learning outcomes, thereby clarifying how policy incentives function as catalysts in fostering entrepreneurial mindset and agility.

Non-governmental organizations (NGOs) play a crucial role in advancing social entrepreneurship by empowering students to develop business models that address pressing social and environmental issues. Through supportive policy frameworks, NGOs can foster sustainable entrepreneurship and drive the creation of innovative business models that are not only economically viable but also socially responsible [9]. In parallel, social networks significantly influence the entrepreneurial process by enhancing access to vital resources such as knowledge, mentorship, and financial capital. Social groups—including community organizations and professional associations—further contribute by advocating for policy reforms that strengthen the entrepreneurial ecosystem, thereby fostering a more inclusive, collaborative, and supportive environment for aspiring entrepreneurs [10].

Effective policy incentives emerge from various institutional supports, including higher education initiatives, industry–academia collaborations, government interventions,

and the involvement of NGOs and social groups. This research highlights the significance of cross-sector partnerships in shaping entrepreneurial mindsets and enhancing the capacity of higher education institutions to drive both economic growth and societal development.

Taiwan exemplifies a mature innovation system with strong policy frameworks, while Malaysia provides insight into emerging-economy contexts where NGOs and academic alliances play a critical role. Including other countries in smaller proportions further enables benchmarking, yet avoids overgeneralization. Other regions were excluded to maintain research focus and methodological consistency. Most existing studies on industry–academia collaboration have been conducted within single-country contexts, offering limited cross-national perspectives. This study seeks to bridge this gap by examining Taiwan and Malaysia, two countries with distinct policy structures, to generate deeper insights into how contextual variations in policy incentives shape collaborative mechanisms.

Accordingly, we propose the following three research questions: RQ1: How do policy incentives influence professional engagement, curriculum design, and skill development? RQ2: To what extent do these factors mediate the relationship between policy incentives and entrepreneurial mindset and agility? RQ3: What similarities and differences emerge across countries in these relationships?

Building on these questions, this study examines how policy incentives shape students' entrepreneurial mindset and agility through the mediating roles of professional engagement, curriculum design, and skill development. By emphasizing student perceptions, the study illustrates how national and institutional policies are translated into individual-level learning outcomes. This student-centered approach provides a distinctive contribution to the literature on industry–academia collaboration, complementing prior research that has primarily focused on institutional or policy-level analyses. The remainder of the article presents the theoretical background, methodology, results, and implications, with particular attention to how students experience and interpret policy-supported collaboration.

2. Literature Review and Theoretical Hypotheses

2.1. Policy Incentives and Professional Engagement

Policy incentives play a crucial role in shaping educational ecosystems that foster the development of entrepreneurial competencies and promote professional growth, particularly within the realm of entrepreneurship education. Among these, higher education initiatives act as foundational enablers by providing essential infrastructure such as entrepreneurship centers, structured mentorship programs, and experiential, practice-oriented curricula. These institutional support mechanisms empower students to engage deeply with entrepreneurial ecosystems, thereby enhancing their professional development [4,11]. Furthermore, the integration of experiential learning opportunities, such as business simulations, internships, and real-world projects, within academic curricula has been shown to significantly increase students' professional engagement [12].

Industry–academia collaborations provide a vital conduit between theoretical learning and practical application. Programs such as internships, cooperative education, and joint research initiatives allow students to immerse themselves in professional settings and develop practical skills. These collaborations enhance professional competence and expand students' access to real-world networks [13]. Structured engagement with industry partners fosters a professional mindset and strengthens students' readiness for entrepreneurial careers [14].

Government interventions, including financial support programs, regulatory reforms, and targeted educational policies, significantly enhance students' professional engagement. Initiatives such as research grants, start-up subsidies, and funding focused on innovation help lower entry barriers and encourage students to participate in entrepreneurship-related activities [3,15] actively. Additionally, public policies that promote collaboration between

universities and industries are crucial in fostering dynamic and professionally enriching academic environments [6].

The involvement of NGOs and social groups plays a vital role in enhancing students' professional engagement by providing mentorship, skill development opportunities, and access to expansive professional networks. These entities are especially important in supporting students from underrepresented or marginalized backgrounds, offering targeted interventions that promote equity and inclusion [16]. NGOs commonly deliver a range of capacity-building resources, including workshops, community engagement initiatives, and structured advisory networks, all of which contribute to improving students' professional readiness. By bridging academic knowledge with practical, real-world application, these initiatives enable students to transform theoretical learning into socially meaningful outcomes, thereby strengthening both their professional competencies and civic engagement [17]. Drawing from a thorough interdisciplinary literature base that highlights the collaborative and complex impact of policy incentives across various domains on enhancing students' professional engagement, we propose the following hypothesis.

Hypothesis 1. *Policy incentives, including higher education incentives, industry–academic programs, government interventions, and involvement of NGOs and social groups, positively and significantly influence students' professional engagement.*

2.2. Policy Incentives and Curriculum Design

Entrepreneurial universities actively cultivate a culture of innovation and enterprise through continuous curriculum development and reform [18]. A key driver of this transformation is the strategic collaboration between academia and industry, which facilitates the co-creation of curricula that integrate real-world challenges, case studies, and insights from industry professionals [7]. Such partnerships enable the development of industry-relevant modules, internships, and project-based learning experiences that significantly strengthen students' practical competencies [19]. By involving industry stakeholders in the curriculum design process, we can enhance students' practice-oriented learning, strengthen graduate employability, and foster a workforce equipped with the skills and mindset valued by employers.

Government funding and policy initiatives are essential for the sustainability and growth of entrepreneurship education programs [20]. Such support allows institutions to create comprehensive curricula that extend beyond theoretical instruction by including practical training, experiential learning, and real-world applications. This approach fosters innovation and curricular flexibility. Additionally, the integration of multiple disciplines in entrepreneurship education is crucial, as it significantly enhances students' problem-solving abilities, creativity, and adaptability in complex business environments [21]. The involvement of social groups and NGOs is crucial in enhancing entrepreneurship education by incorporating real-world social challenges into the curriculum [22]. These organizations offer students opportunities to participate in social entrepreneurship projects, thereby enriching the learning experience through hands-on involvement in meaningful initiatives.

Effective curriculum design in entrepreneurship education should focus on practice-oriented learning, flexible curricular approaches, professional knowledge development, and the active involvement of industry mentors and expert lecturers. Practice-oriented learning enhances students' experiential learning and skill acquisition through hands-on activities, real-world projects, and reflective engagement [23]. Flexible curriculum refers to the ability of educational programs to adapt to rapidly changing market demands and technological advancements, ensuring they remain relevant and responsive [12]. Professional knowledge training is a fundamental aspect, providing students with a solid theoretical foundation and current, domain-specific insights necessary for navigating complex

business environments [24]. Lastly, the inclusion of industry mentors and guest experts bridges the gap between academic learning and practical application, thereby reinforcing the relevance and impact of entrepreneurship education [25]. Accordingly, we propose the following hypothesis.

Hypothesis 2. *Policy incentives have a positive and significant impact on effective curriculum design, emphasizing practice-oriented learning, innovative curriculum flexibility, professional knowledge training, and the involvement of industry mentors and expert lecturers.*

2.3. Policy Incentives and Skill Development

Policy incentives play a crucial role in the delivery and effectiveness of professional skill training within educational institutions [19]. Especially, government policies and funding initiatives are most important for supporting these training programs [20]. Collaborative efforts between academic institutions and industries are vital to ensure that professional skill training programs remain relevant and effective [26]. Additionally, NGOs and social groups contribute significantly to professional skill training initiatives, particularly in underserved communities [22].

The significance of soft skill development, including teamwork, problem-solving, and adaptability, is crucial for achieving entrepreneurial success [22]. Furthermore, policy frameworks need to emphasize the integration of soft skills into educational curricula [27]. As a result, government-funded initiatives that focus on soft skills training can enhance students' employability and better prepare them for the workforce [28]. Proficiency in data analysis and digital literacy has become increasingly essential across various fields. The importance of digital literacy in entrepreneurship emphasizes how policy incentives can encourage the adoption of digital platforms and tools in education [29].

Professional ethics and interpersonal skills are crucial for making ethical decisions and fostering successful collaboration [30]. Industry-sponsored programs, such as mentorship initiatives and internships, provide students with opportunities to enhance their ethical decision-making abilities and interpersonal skills in real-world contexts [31]. By partnering with industry professionals, students can gain valuable insights into moral dilemmas and interpersonal dynamics, preparing them for leadership roles focused on ethics in their future careers. Accordingly, we propose the following hypothesis.

Hypothesis 3. *Policy incentives positively impact skill development, including professional skill training, soft skill development, data analysis and digital literacy, and professional ethics and interpersonal skills.*

2.4. Professional Engagement and Entrepreneurial Mindset/Agility

Students engage in professional development by participating in industry-related projects. This involvement increases their likelihood of developing creative thinking skills, as they face challenging real-world problems and work on open-ended tasks [32]. These projects often require students to apply their knowledge creatively, prompting them to explore unconventional solutions. Experienced mentors and industry professionals enhance creative thinking by sharing their experiences, asking challenging questions, and providing feedback on students' ideas [19].

Professional engagement with industry experts offers students valuable insights into the current market, which are essential for improving their ability to adapt to market changes [25]. Furthermore, the significance of collaborating with industry professionals in curriculum design demonstrates that this direct involvement allows students to align their academic learning more closely with market demands, thereby enhancing their market-adapting ability [7].

Problem-solving ability, which is enhanced through interactions with faculty and industry professionals, improves students' ability to analyze and solve complex problems [33]. This approach is based on experiential learning theory, which suggests that learning occurs through direct experiences. Professional engagement with real-world problems is especially effective in facilitating the development of professional skills [34]. Entrepreneurial role models and mentors who have successfully navigated risks in their ventures encourage students to adopt a similar mindset [35]. Strengthening students' risk-taking abilities through projects initiated by the government, educational institutions, and NGOs that incorporate real-world challenges and uncertainties helps students become more comfortable with taking risks [12].

The importance of social capital in achieving career success is evident in how professional networks offer access to valuable resources, information, and support [36]. Mentorship programs and industry partnerships are essential for helping students develop networking skills through various opportunities [37]. Professional engagement, which includes faculty expertise, input from industry professionals, and insights from external experts, is critical for developing entrepreneurial skills such as creative thinking, market adaptation, problem-solving, risk-taking, and networking. Based on this, we propose the following hypothesis.

Hypothesis 4. *Professional engagement has a positive and significant impact on entrepreneurial mindset and agility, including skills in creative thinking, market adaptation, problem-solving, risk-taking, and networking.*

2.5. Curriculum Design and Entrepreneurial Mindset/Agility

Practice-oriented learning (POL) is a vital component of curriculum design that enhances students' entrepreneurial mindset and agility by offering practical experience and knowledge. Experiential learning plays a crucial role in developing essential entrepreneurial skills [34]. By participating in hands-on activities, students gain a better understanding of the complexities involved in running a business, which is key to cultivating an entrepreneurial mindset. POL combines theoretical knowledge with practical application, thereby improving students' abilities to innovate and adapt effectively to changing market conditions [38]. Comprehensive entrepreneurship education encompasses various business functions, including finance, marketing, and operations [5]. Additionally, entrepreneurship education should provide advanced training in areas such as opportunity recognition and strategic planning, which are critical for entrepreneurial success [39].

Curriculum design plays a crucial role in preparing students to adapt to the market by offering exposure to real-world case studies, market research projects, and hands-on learning opportunities. Fostering problem-solving skills emphasizes the importance of developing a growth mindset among students. The concept of "falling forward" highlights the significance of viewing failure as an opportunity for growth, particularly in entrepreneurship [40]. Additionally, effective curriculum design can improve the development of networking skills by incorporating networking events, industry guest lectures, and mentorship programs. Therefore, we propose that,

Hypothesis 5. *Curriculum design significantly impacts the development of the entrepreneurial mindset and agility by fostering creativity, enhancing problem-solving abilities, improving market adaptation skills, encouraging risk-taking, and developing networking capabilities.*

2.6. Skill Development and Entrepreneurial Mindset/Agility

Skill development is a cornerstone of entrepreneurship education, forming the foundation upon which students build the entrepreneurial mindset and agility necessary to thrive in dynamic and competitive business environments. Professional skill training equips students with the practical competencies and specialized knowledge essential for navigating the complexities of entrepreneurial ventures. Equally important is the development of soft skills, which foster creativity, resilience, and adaptability—qualities critical to entrepreneurial success [16]. As digital technologies continue to transform business landscapes, entrepreneurs must increasingly leverage data-driven insights to inform strategic decision-making and maintain a competitive edge [41]. Soft skills—such as effective communication, collaboration, and leadership—serve as the intangible yet indispensable assets that support entrepreneurial effectiveness. Moreover, integrating ethical leadership into entrepreneurship education promotes the alignment of organizational practices with broader societal values and expectations, fostering responsible and sustainable innovation [42]. Therefore, we propose that,

Hypothesis 6. *Skill development significantly impacts the development of the entrepreneurial mindset and agility by fostering creativity, enhancing problem-solving abilities, improving market adaptation skills, encouraging risk-taking, and developing networking capabilities.*

2.7. Policy Incentives and Entrepreneurial Mindset/Agility

Collaboration among universities, industry, and government plays a pivotal role in fostering innovation and entrepreneurship [6]. Effective industry–academia partnerships facilitate the development of industry-specific curricula, internships, and project-based learning initiatives that enhance students' practical skills and entrepreneurial mindset [19]. Policies that encourage such collaborations provide students with valuable insights into market dynamics, consumer behavior, and competitive environments, thereby strengthening their adaptability to rapidly evolving market conditions. Moreover, government initiatives aimed at promoting entrepreneurship education across all educational levels significantly increase students' exposure to entrepreneurial concepts and opportunities [11]. In addition, policies introduced by social enterprises and non-governmental organizations (NGOs) can further broaden students' horizons by involving them in social entrepreneurship projects, thus cultivating agility and a socially responsive entrepreneurial mindset [22]. Well-designed policy incentives also play a crucial role in enhancing students' capacity for market adaptation by promoting experiential learning and fostering industry–academia collaboration that develops critical problem-solving skills [43]. Furthermore, governmental support for entrepreneurship centers, startup accelerators, and networking platforms helps connect students with industry mentors, investors, and potential collaborators, thereby improving their professional networking and innovation capabilities [7]. Accordingly, we posit that,

Hypothesis 7. *Policy incentives significantly impact the development of the entrepreneurial mindset and agility by fostering creativity, enhancing problem-solving abilities, improving market adaptation skills, encouraging risk-taking, and developing networking capabilities.*

2.8. Professional Engagement as a Mediator Between Policy Incentives and Entrepreneurial Mindset/Agility

Triple Helix interactions—comprising government (policy), universities (engagement), and industry—promote entrepreneurial innovation [7]. For instance, while Taiwan's government-funded incubators prioritize commercialization, NGOs in Malaysia frequently emphasize social impact and inclusivity. These objectives may diverge, revealing tensions

that a purely harmonious Triple Helix model does not capture. Institutional environments and government incentives are effective only when there are professional engagement mechanisms in place, such as academic entrepreneurship, training, and incubators, which help translate these incentives into mindset and behavior. Entrepreneurship education, often supported by public policy, fosters professional engagement and experience, thereby enhancing students' entrepreneurial mindset and long-term adaptability [25]. The persistence effect indicates a mediating role of practical engagement. Policy incentives and support from NGOs or social enterprises can engage students in real-world entrepreneurial contexts. These engagements create a bridge between top-down policies and the grassroots development of entrepreneurial capabilities, cultivating agility in uncertain and dynamic markets [22]. Moreover, university involvement in entrepreneurship-related activities—such as incubators, mentorship programs, and experiential projects—often facilitated by policy, indirectly fosters entrepreneurial intentions and adaptability. This suggests a clear mediating role for professional engagement [44].

Hypothesis 8. *Professional engagement mediates the relationship between policy incentives and entrepreneurial mindset and agility.*

2.9. Curriculum Design as a Mediator Between Policy Incentives and Entrepreneurial Mindset/Agility

Well-designed entrepreneurship education, which incorporates experiential and action-oriented curricula, has a significant long-term impact on students' entrepreneurial attitudes and intentions. This shows the importance of curriculum design as a key mechanism that translates policy incentives into entrepreneurial capabilities [25]. Government policies have encouraged the implementation of entrepreneurship education, emphasizing how curriculum structure and pedagogy—such as opportunity recognition, business planning, and innovation—serve as crucial intermediaries in developing an entrepreneurial mindset and agility among students [45]. According to an OECD report, entrepreneurship-focused curriculum designs that include experiential learning and interdisciplinary modules facilitate the transformation of policy-driven educational reforms into tangible changes in student mindset and entrepreneurial behavior [46]. The design of entrepreneurship curricula, particularly those integrating reflection, networking, and real-life projects, mediates external influences, such as policy support, in fostering agile, opportunity-oriented graduates [47].

Hypothesis 9. *Curriculum design mediates the relationship between policy incentives and entrepreneurial mindset and agility.*

2.10. Skill Development as a Mediator Between Policy Incentives and Entrepreneurial Mindset/Agility

Entrepreneurship education enhances entrepreneurial competence, which subsequently improves performance. This mediated effect is particularly pronounced in dynamic environments [48]. This finding emphasizes that skill development is a crucial link between policy-driven educational inputs and the cultivation of agile, performance-oriented mindsets. Additionally, entrepreneurial leadership contributes to an innovative climate that fosters employees' intellectual agility, which in turn leads to innovative behavior [49]. This sequential mediation illustrates that skill agility acts as a bridge between leadership support—often influenced by policy—and positive entrepreneurial outcomes. Furthermore, two dimensions of entrepreneurial agility are explored: opportunity agility and planning agility, which entrepreneurs utilize in response to adversity. Developing these skills facilitates the necessary mindset shifts to effectively leverage policy incentives. A

moderated mediation model is proposed, wherein entrepreneurial agility fosters business model innovation, which in turn enhances sustainable performance. This indirect relationship is further moderated by environmental dynamism, which influences the strength of the mediation effect [50]. This reinforces the idea that agile skill sets mediate the relationship between enabling policies, market conditions, and entrepreneurial agility.

Hypothesis 10. *Skill development mediates the relationship between policy incentives and entrepreneurial mindset and agility.*

2.11. Theoretical Foundation

The conceptual model of this study is anchored in three complementary theoretical perspectives: Experiential Learning Theory (ELT), the Resource-Based View (RBV), and Social Cognitive Theory (SCT). Together, these perspectives explain how policy incentives shape entrepreneurial mindset and agility through multi-level mechanisms. ELT posits that learning occurs through cycles of concrete experience, reflection, conceptualization, and experimentation [34]. Policy incentives create structured opportunities—such as internships, incubators, and project-based collaborations—that immerse students in real-world contexts. These experiences strengthen professional engagement, inform practice-oriented curricula, and develop applied skills, thereby fostering agility in uncertain environments. RBV emphasizes that competitive advantage arises from valuable, rare, inimitable, and non-substitutable resources [51]. Policy incentives help universities and industries build intangible assets such as specialized curricula, expert mentorship, and collaborative networks. At the student level, these resources are transformed into employable skills and entrepreneurial capabilities, positioning human and social capital as central outcomes of industry–academia collaboration. SCT underscores the role of observational learning and self-efficacy in shaping behavior [52]. Policy-supported mentorship programs and role models enable students to internalize entrepreneurial norms, enhance confidence, and cultivate risk-taking, problem-solving, and networking capacities. Such mechanisms explain why professional engagement is a critical pathway from policy to entrepreneurial agility. Collectively, ELT explains how experiential opportunities drive entrepreneurial learning, RBV highlights what resources policy-driven collaborations generate, and SCT clarifies why these processes translate into behavioral change. By integrating these perspectives, the study advances a comprehensive theoretical rationale for the proposed model and underscores the multi-level pathways through which policy incentives foster entrepreneurial mindset and agility.

3. Methodology

3.1. Research Conceptual Framework

Drawing upon relevant literature, this study posits relationships among policy incentives, professional engagement, curriculum design, skill development, and entrepreneurial mindset and agility. It examines the effect of policy incentives on industry–academia collaboration on entrepreneurial mindset and agility, with professional engagement, curriculum design, and skill development serving as sequential mediators. For example, students with prior startup experience may actively pursue professional engagement opportunities such as internships, suggesting that EMA (entrepreneurial mindset and agility) $\rightarrow$ PE (professional engagement) could be equally plausible. Our cross-sectional design cannot capture such reciprocal dynamics. Thus, Figure 1 presents the proposed research framework and corresponding hypotheses. In line with prior studies, this research formulates a conceptual model and advances ten hypotheses.

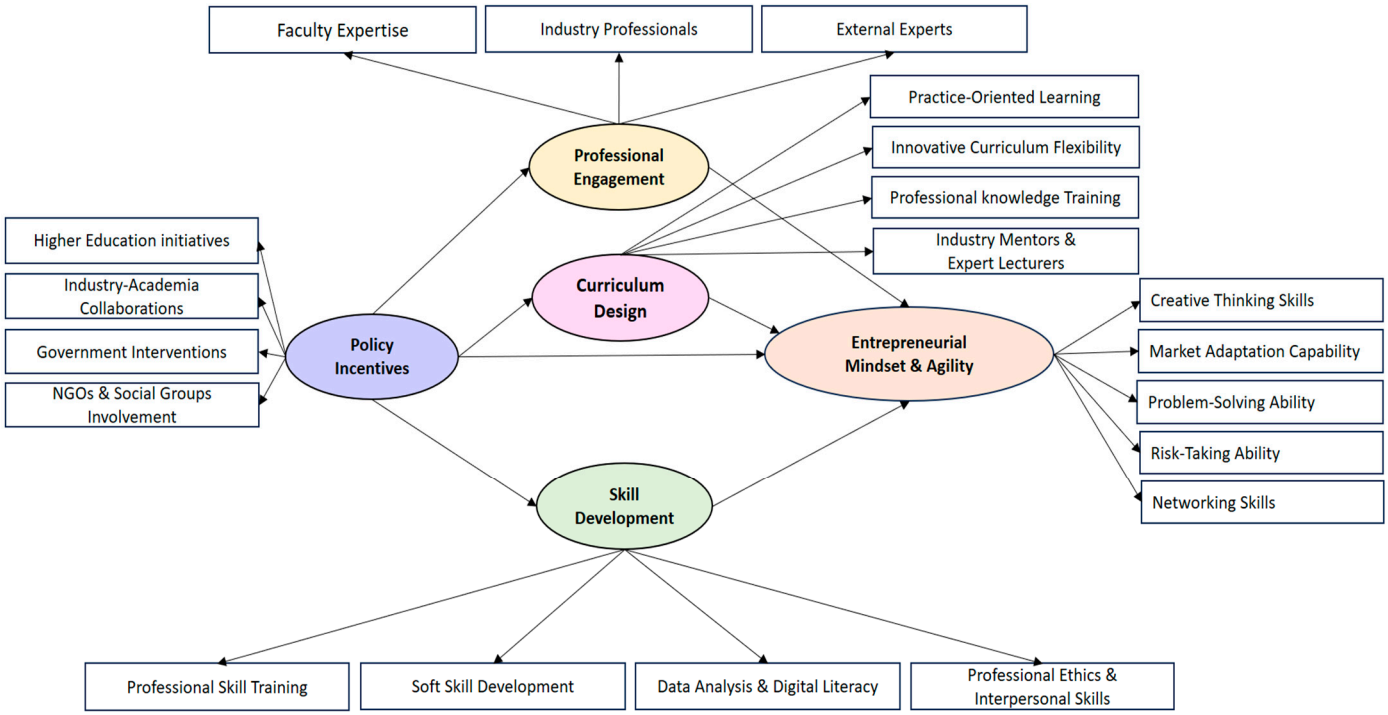

Figure 1. The Research Conceptual Framework.

3.2. Research Variable Manipulation and Measurement

In Table 1, the latent construct "policy incentives" is represented by several observed indicators, including higher education initiatives, industry collaboration, government interventions, and the involvement of NGOs and social groups. Additional latent constructs include professional engagement (faculty expertise, industry professional, and external experts); curriculum design (practice-oriented learning, innovative curriculum flexibility, professional knowledge training, and industry mentors and expert lecturers); skill development (professional skill training, soft skill development, data analysis and digital literacy, and professional ethics and interpersonal skills); and entrepreneurial mindset and agility (creative thinking skills, market adaptation capability, problem-solving ability, risk-taking ability, and networking skills).

Table 1. Questionnaire Design.

Construct	Item Description	Reference
Policy Incentives (PC)		
PC1	Academic institutions can support policies through teaching, internationalization, research, and information technology.	[53]
PC2	The industry can offer supportive policies through talent development, internships, joint R&D centers, incubators, entrepreneurial support, research, and information systems.	[10]
PC3	Supportive policies require government funding to encourage enterprise–academia collaboration, driving innovation and knowledge transfer.	[10]
PC4	NGOs and social groups may provide funding, resources, or support to advance industry–academia collaboration.	[22]

Table 1. *Cont.*

Construct	Item Description	Reference
Professional Engagement (PE)		
PE1	Educational institutions can contribute faculty expertise to enhance project implementation and outcome transformation in industry–academia collaboration.	[54]
PE2	Industry professionals from technical, design, and marketing teams can greatly enrich students' perspectives in collaboration projects.	[33]
PE3	External experts provide valuable talent that supports the smooth progress and successful outcomes of industry–academia collaboration projects.	[37]
Curriculum Design (CD)		
CD1	Practice-oriented learning equips students with problem-solving and innovative thinking through real industry–academia collaboration.	[55]
CD2	Flexible and innovative courses help students become more adaptable in industry–academia collaboration.	[12]
CD3	Specialized training courses better align students' skills and knowledge with industry–academia collaboration projects.	[13]
CD4	Involving industry experts and entrepreneurs in teaching and course design can inspire students with practical experience and entrepreneurial thinking.	[34]
Skill Development (SD)		
SD1	Professional training programs, covering technical and industry-specific skills, align learning with industry needs and enhance competitiveness.	[56]
SD2	Soft skills development equips students for success in today's dynamic work environments and future careers.	[28]
SD3	Cultivating data analysis and digital proficiency enhances students' problem-solving abilities.	[29]
SD4	Developing professional ethics and interpersonal skills helps students build positive, trustworthy workplace relationships.	[30]
Entrepreneurial Mindset and Agility (EMA)		
EMA1	Innovative thinking involves generating ideas, creativity, and spotting opportunities, crucial for identifying market gaps, creating value, and managing uncertainty.	[57]
EMA2	Market adaptability enables entrepreneurs to lead effectively by quickly responding to changing conditions, customer needs, and competition.	[43]
EMA3	Problem-solving is vital in entrepreneurial thinking, enabling challenge resolution, opportunity recognition, and innovation.	[33]
EMA4	Risk-taking is equally essential, involving the courage to face uncertainty, stay composed, and make sound decisions.	[5]
EMA5	Building and leveraging networks, gathering information, identifying opportunities, and collaborating effectively reflect entrepreneurial thinking and adaptability.	[7]

This study employs a structured questionnaire methodology, using instruments developed by international scholars that have been translated into Chinese to facilitate simultaneous surveys. Each Chinese-language questionnaire clearly outlines the research objectives, eligibility criteria, and instructions for completion, following a comprehensive sampling design approach. The assessment was conducted using a multidimensional framework comprising five dimensions and a total of 20 items, each evaluated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Each construct encompasses multiple perspectives. For example, creative thinking (EMA1) reflects a cognitive orientation, whereas networking (EMA5) represents a social and behavioral dimension. These

items capture conceptually distinct facets, which may not necessarily cohere empirically as indicators of a single unidimensional construct.

3.3. Sample Profile

The research adopted a quantitative, deductive approach, employing convenience sampling due to the accessibility of respondents across universities in Taiwan and Malaysia. To improve the efficiency of data collection, the study utilized Google Forms as the primary cloud-based survey platform. The target population consisted of students, and a total of 528 valid responses were received, reflecting a robust and representative sample (Table 2).

Table 2. Sample Profile.

Variables	Categories	No.	%
Gender	Male	310	58.71
	Female	186	35.23
	Others/Not specified	32	6.06
Age	19–22 years old	185	35.04
	23–26 years old	141	26.70
	27–30 years old	133	25.19
	above 30 years old	69	13.07
Nationality	Malaysia	233	44.13
	Taiwan	295	55.87
Educational Level	Currently enrolled undergraduate student	370	70.08
	Undergraduate degree	40	7.58
	Postgraduate degree	81	15.34
	Others	37	7.01
Experience	Less than 1 year	173	32.77
	1–3 years	263	49.81
	3–5 years	92	17.42
	above 5 years	0	0.00
Number of employees	SME (1–250)	373	70.64
	Large (above 251)	99	18.75
	Not Sure/Not Applicable	56	10.61
Years of business operation	Start-up and Young (0–10 years)	219	41.48
	Established (11–25 years)	202	38.26
	Mature (>25 years)	56	10.61
	Not Sure/Not Applicable	51	9.66
Purpose	Career Preparation	140	26.52
	Networking	119	22.54
	Entrepreneurial Skills	269	50.95
	Industry Insight	156	29.55
	Skill Enhancement	307	58.14
	Practical Experience	292	55.30
	Economic factors	221	41.86
	Others	80	15.15

This substantial response rate highlights the study's rigorous data collection process, which aims to investigate the influence of policy incentives on collaboration between industry and academia from the students' perspective. This method ensures that the sample accurately represents the characteristics of the study population. The demographic details of the respondents include gender, with males comprising 58.71% and females making up 35.23%. The data also encompasses age, nationality, educational level, experience, number

of employees, years of business operations, and business objectives. Notably, the largest age group within the sample is those aged 19–22 years, representing 35.04% of the participants.

In terms of educational level, the majority of respondents—70.08%—are currently enrolled undergraduate students. When examining their experience in industry–academia collaboration, 49.81% of students reported having 1–3 years of experience, while 32.77% indicated they had less than 1 year of experience. The study also looked at the types of companies with which students engaged in industry–academia collaborations based on employee numbers and the operational age of the companies. It was found that a significant proportion—70.64%—of the students came from small and medium-sized enterprises (SMEs) with 1 to 250 employees.

A significant portion of the participants, 41.48%, were startups with an operational age of 0 to 10 years. Established enterprises, which had been operational for 11 to 25 years, made up 38.26%, while only 10.61% were mature enterprises with an operational age of 25 years or more. Additionally, the study examined the motivations behind students' participation in these collaborations, allowing for multiple responses. The top three reasons identified were skill enhancement at 58.14%, practical experience at 55.3%, and the development of entrepreneurial skills at 50.95%. Other motivating factors included economic considerations (41.86%), industry insight (29.55%), career preparation (26.52%), and networking opportunities (22.54%). Additional reasons accounted for 15.15% of the responses.

3.4. Reliability Analysis and Validity Analysis

Cronbach's Alpha is a widely recognized statistic used to evaluate the internal consistency and reliability of items within a measurement instrument. The Cronbach's Alpha formula assesses how closely related a set of items is as a group, as shown in Equation (1). Cronbach's α value of 0.60 or above is generally considered acceptable [58]. If the results do not achieve statistical significance, it may be necessary to modify or remove certain indicators to better align with the construct being measured. In this study, the Cronbach's α values for both latent and observed variables exceed 0.80, with some constructs exceeding 0.90. This demonstrates strong consistency and stability within the research framework.

$$\alpha = \frac{k}{k-1} \times \left(1 - \frac{\sum_{i=1}^{k} \sigma_i^2}{\sigma_T^2}\right) \quad (1)$$

In the analysis of construct validity, both Factor Loading and the Kaiser–Meyer–Olkin (KMO) test are used together. Factor Loading is an important metric in factor analysis that assesses how much observed variables contribute to latent variables (or factors). Higher factor loadings indicate that the observed variable strongly explains the factor. Generally, a factor loading value greater than 0.5 is considered significant, although this threshold can vary depending on the research field and sample size. Very high loading values, approaching 1, denote a strong correlation between the observed variable and the factor, thereby confirming the validity of the construct.

The KMO test evaluates the adequacy of sampling for factor analysis by assessing whether the data are suitable for this technique. It measures the proportion of variance among variables that can be attributed to shared factors, indicating how well the items in a measurement instrument align with the underlying construct they are intended to measure [59]. The KMO statistic ranges from 0 to 1, with higher values closer to 1 indicating a stronger suitability of the data for factor analysis. In summary, higher KMO values signify better suitability for factor analysis, with values above 0.7 generally considered acceptable. The KMO value is calculated based on the correlation matrix and the partial

correlation matrix between variables. The formula for calculating the KMO statistic is given in Equation (2).

$$KMO = \frac{\sum_{i \neq j} r_{ij}^2}{\sum_{i \neq j} r_{ij}^2 + \sum_{i \neq j} u_{ij}^2} \quad (2)$$

Table 3 presents the reliability and validity statistics for each construct. The Cronbach's Alpha coefficients for all scales exceed the commonly accepted threshold of 0.70, indicating excellent internal consistency reliability. Specifically, Policy Incentives ($\alpha = 0.966$) and Professional Engagement ($\alpha = 0.967$) demonstrate very high reliability, while the remaining constructs—Curriculum Design ($\alpha = 0.819$), Skill Development ($\alpha = 0.820$), and Entrepreneurial Mindset and Agility ($\alpha = 0.858$)—all fall well within the acceptable range. The cumulative variance explained by each construct exceeds 75%, with Policy Incentives (91.10%) and Professional Engagement (93.85%) showing particularly strong explanatory power. This suggests that the items effectively capture the underlying dimensions of each construct.

Table 3. Reliability and Validity Analyses Results.

		Reliability		Validity	
Dimension	**Item**	**Cronbach's Alpha**	**Overall Cronbach's Alpha**	**Cumulative Variance (%)**	**KMO Value**
PC	PC1	0.965	0.966	91.100	0.889
	PC2	0.950			
	PC3	0.953			
	PC4	0.954			
PE	PE1	0.939	0.967	93.851	0.873
	PE2	0.960			
	PE3	0.952			
CD	CD1	0.950	0.819	77.687	0.888
	CD2	0.743			
	CD3	0.728			
	CD4	0.726			
SD	SD1	0.731	0.820	81.059	0.809
	SD2	0.730			
	SD3	0.730			
	SD4	0.977			
EMA	EMA1	0.802	0.858	77.145	0.827
	EMA2	0.803			
	EMA3	0.813			
	EMA4	0.799			
	EMA5	0.955			

In addition, the Kaiser–Meyer–Olkin (KMO) values for all constructs range from 0.809 to 0.889, surpassing the minimum criterion of 0.60. These results confirm the adequacy of the sample for factor analysis and further support the construct validity of the measurement model. Taken together, the high Cronbach's Alpha values, strong cumulative variance, and satisfactory KMO values collectively demonstrate that the scales used in this study possess strong reliability and validity, providing a robust foundation for subsequent structural model analysis. To further assess the validity of the measurement scales, a factor loading analysis was conducted (see Figure 2). The results indicate that all factor loadings exceed the recommended threshold of 0.50, confirming that each observed variable (item) loads significantly onto its respective latent construct (factor). This demonstrates that the measurement model possesses satisfactory convergent validity. Furthermore, the KMO values were calculated (refer to Table 3). The cumulative variance explained by the factors is

high, suggesting robust construct validity, while the KMO values for all dimensions further verify that the dataset exhibits adequate sampling adequacy and good overall validity.

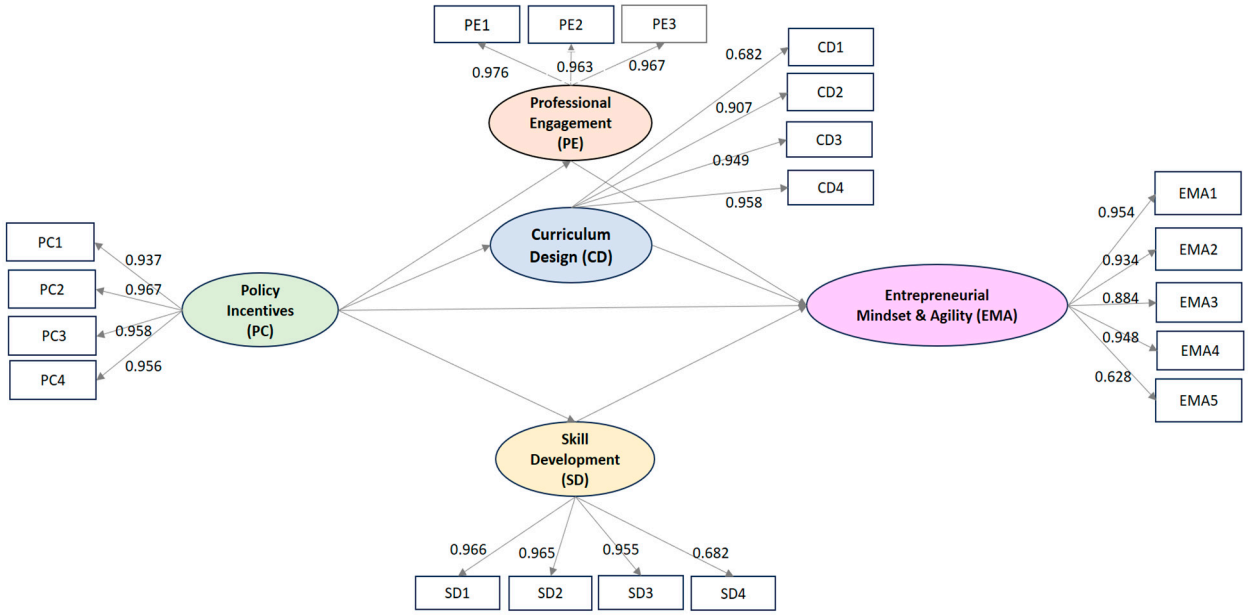

Figure 2. The Analysis of Factor Loadings.

In addition, we also examined potential common method bias (CMB). Harman's single-factor test revealed that the first factor accounted for only 34.7% of the total variance, well below the 50% threshold, suggesting that CMB is unlikely to be problematic. To further validate this, we calculated variance inflation factor (VIF) values for all constructs, which ranged from 1.21 to 2.43—well below the recommended cutoff of 3.3. These results confirm that CMB is not a significant issue and that the dataset is suitable for further structural analysis.

4. Analysis and Result

4.1. Correlation Analysis

Pearson correlation analysis is used to assess the strength and direction of the linear relationship between two continuous variables, quantifying how closely they co-vary [60]. This method is most appropriate when the variables are continuous and approximately normally distributed. When statistical significance testing is involved, normality of the variables or the sampling distribution of the correlation coefficient is assumed. According to the Central Limit Theorem, for large sample sizes (e.g., $n > 500$), the sampling distribution of the correlation coefficient tends to be approximately normal, thereby justifying the application of Pearson correlation even if the original variables deviate from normality.

Table 4 presents the descriptive statistics and Pearson correlation coefficients among the five latent dimensions: PC, PE, CD, SD, and EMA. The mean scores range from 4.20 to 4.26, with standard deviations between 0.46 and 0.52, indicating relatively high and consistent responses across constructs. All correlation coefficients are statistically significant at the 0.01 level, denoted by **, suggesting strong positive linear relationships among the variables. Notably, the correlation between PC and PE is extremely high ($r = 0.973$), raising concerns that these constructs may not be empirically distinct. This suggests that policy incentives might better be treated as a second-order formative construct, or separated into government, industry, higher education, and NGO dimensions. Other notable correlations include PC–CD ($r = 0.896$), PE–CD ($r = 0.898$), and SD–EMA ($r = 0.816$). These findings indicate that the constructs are closely related, which supports convergent validity.

Table 4. Descriptive Statistics and Correlation Analysis.

Dimension	Mean	SD	PC	PE	CD	SD	EMA
PC	4.26	0.46	1				
PE	4.25	0.47	0.973 **	1			
CD	4.21	0.52	0.896 **	0.898 **	1		
SD	4.20	0.52	0.885 **	0.839 **	0.823 **	1	
EMA	4.21	0.51	0.880 **	0.847 **	0.812 **	0.816 **	1

Note: ** $p < 0.01$; all correlation coefficients are statistically significant.

The plots in Figure 3 demonstrate that Policy Clarity (PC) is a crucial foundational factor affecting all other variables. In practical terms, improving policy clarity could lead to significant benefits in educational effectiveness, program design, skill development, and entrepreneurial readiness. These insights are valuable for policymakers and curriculum designers who are seeking integrated strategies for improvement.

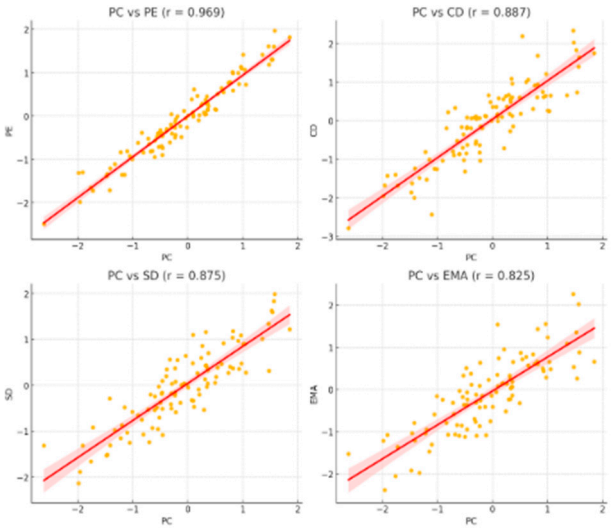

Figure 3. Scatterplots of PC and Related Educational Dimensions.

Although high correlations (e.g., values exceeding 0.85) suggest strong associations among constructs, they may also indicate potential multicollinearity, which warrants further investigation through confirmatory factor analysis (CFA) or structural equation modeling (SEM). As shown in Figure 2, all factor loadings surpass the recommended threshold of 0.50, demonstrating that each observed item exhibits a sufficiently strong relationship with its corresponding latent construct [61]. These results provide evidence of convergent validity and confirm that the observed variables are reliable indicators of their respective dimensions within the measurement model.

4.2. Structural Model Analysis

A fundamental component of Structural Equation Modeling (SEM) is the measurement model, which evaluates how well observed (manifest) variables correspond to their respective latent constructs. To assess the validity of the measurement model, several tests were conducted, including reliability, convergent validity, and discriminant validity assessments. Before estimating the structural model, the reliability and validity of the measurement model were examined to ensure a satisfactory model fit. Internal consistency was assessed using Cronbach's Alpha (CA) and the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy (see Table 2).

A widely accepted threshold for factor loadings is 0.50 or higher, which is considered indicative of strong construct validity, as supported by established guidelines in psychometric and structural equation modeling (SEM) literature. After confirming data normality and internal consistency, the measurement model was empirically validated. The results showed that all constructs demonstrated adequate and acceptable validity based on established standards. Furthermore, the critical ratio (C.R.) values for all measurement items ranged from 4.422 to 8.350, indicating that the factor loadings were statistically significant at $p < 0.01$. These findings confirm that the observed variables reliably represent their corresponding latent constructs.

The model parameters were estimated using Structural Equation Modeling (SEM), with fully standardized path coefficients obtained through the maximum likelihood estimation method in AMOS (see Figure 4). The structural model showed an acceptable fit, with all fit indices meeting the recommended thresholds, thus confirming the overall adequacy of the model. The relationships examined included perceived competence (PC) with perceived effort (PE), concept development (CD), skill development (SD), and educational motivation (EMA). These coefficients indicate the strength and direction of the hypothesized effects, and they should be both substantial and theoretically consistent.

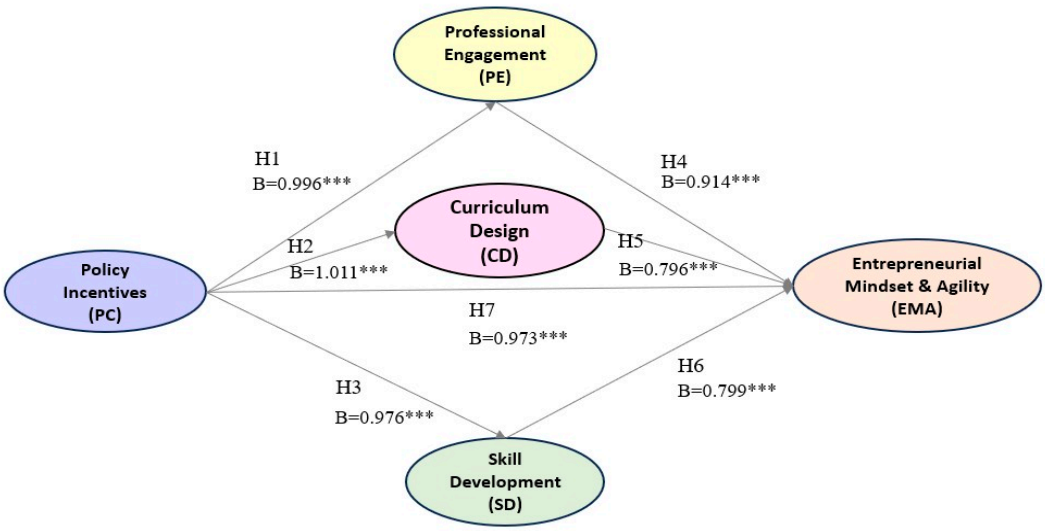

Figure 4. Structural Model Analysis (*** $p < 0.001$).

Among the four hypothesized paths, three were found to be statistically significant. As illustrated in Figure 4, the results were as follows: PC → PE (β = 0.9962, $p < 0.001$), PC → CD (β = 1.001, $p < 0.001$), PC → SD (β = 0.976, $p < 0.001$), PE → EMA (β = 0.914, $p < 0.001$), CD → EMA (β = 0.796, $p < 0.001$), SD → EMA (β = 0.799, $p < 0.001$), and PC → EMA (β = 0.973, $p = 0.000$). Thus, Hypotheses 1 to 7 are supported.

4.3. Multiple Mediation Regression Analysis

Multiple regression analysis, conducted using Process v4.2 [62], explores the relationships and causal mechanisms The model parameters were estimated using Structural Equation Modeling (SEM), with fully standardized path coefficients obtained through the maximum likelihood estimation method in AMOS (see Figure 3). The structural model showed an acceptable fit, with all fit indices meeting the recommended thresholds, thus confirming the overall adequacy of the model. The relationships examined included perceived competence (PC) with perceived effort (PE), concept development (CD), skill development (SD), and educational motivation (EMA). These coefficients indicate the strength and direction of the hypothesized effects, and they should be both substantial and theoretically consistent.

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$$Y = \beta_1 X + \epsilon_1 \tag{3}$$

$$M = \beta_2 X + \epsilon_2 \tag{4}$$

$$Y = \beta_3 X + \beta_4 M + \epsilon_3 \tag{5}$$

In the course of conducting multiple regression mediation analysis, it is often essential to examine indirect effects. These can be determined by computing the product of the coefficients β_2 and β_4 for the intermediary variable M.

Table 5 presents an analysis of whether professional engagement (PE) mediates the relationship between policy incentives (PC) and entrepreneurial mindset and agility (EMA). Model 1: PC significantly predicts PE (β = 0.996, t = 96.931, $p < 0.001$), explaining 94.7% of the variance ($R^2 = 0.947$). Model 2: PC significantly predicts EMA (β = 0.973, t = 42.473, $p < 0.001$), with $R^2 = 0.774$. Model 3: PE significantly predicts EMA (β = 0.914, t = 36.483, $p < 0.001$), with $R^2 = 0.717$. Model 4: When PC and PE are entered together, PC remains significant (β = 1.169, t = 11.057, $p < 0.001$), while PE has a small negative effect (β = −0.197, t = −2.031, $p < 0.05$). The explained variance is $R^2 = 0.776$.

Comparison of Model 1 and Model 4 indicates that PE does not serve as a positive mediator between PC and EMA. Instead, its effect becomes slightly negative when controlling for PC. This finding challenges the conventional assumption that professional engagement universally promotes entrepreneurial outcomes, suggesting that in certain policy-driven contexts, high engagement may prioritize compliance and policy alignment over adaptability and entrepreneurial thinking. The surprising suppressor effect of PE suggests that engagement may not mediate sequentially but could operate simultaneously with curriculum and skills. A longitudinal design would be necessary to establish whether these mediators truly occur in sequence.

The findings suggest that the mediating role of PE is context-dependent. In settings with strong policy incentives, the direct motivational impact of policy may overshadow—or even counteract—the indirect influence of engagement. This underscores the importance of examining interaction effects between institutional drivers and individual-level engagement in shaping entrepreneurial behavior. In such contexts, policy incentives may exert a more direct influence, bypassing anticipated intermediary variables, which calls for the-

oretical models that incorporate both direct and non-linear relationships. Furthermore, while the use of sequential regression models aligns with [62], the emergence of suppressor effects highlights its limitations. This reinforces the need to complement regression-based mediation tests with bootstrapped estimates of indirect effects to enhance robustness and validity.

Table 5. The Mediation Relationship for Professional Engagement (PE) between Policy Incentives (PC) and Entrepreneurial Mindset and Agility (EMA).

Y / X	PE (M1)		EMA (Y1)					
	Model 1		Model 2		Model 3		Model 4	
	β_1	t_1	β_2	t_2	β_3	t_3	β_4	t_4
PC (X1)	0.996 ***	96.931	0.973 ***	42.473			1.169 ***	11.057
PE (M1)					0.914 ***	36.483	−0.197 *	−2.031
R^2	0.947		0.774		0.717		0.776	
ΔR^2	0.947		0.774		0.716		0.775	
F-value	9395.582 ***		1803.940 ***		1331.000 ***		909.390 ***	
df	(1526)		(1526)		(1526)		(2525)	
Hypothesis Verification	Supported		Supported		Supported		Supported, Partial Mediation	

Note: * $p < 0.05$, *** $p < 0.001$

Table 6 examines whether curriculum design (CD) mediates the relationship between policy incentives (PC) and entrepreneurial mindset and agility (EMA) through four regression models. Model 1: PC significantly predicts CD (β = 1.011, t = 46.382, $p < 0.001$), explaining 80.4% of the variance ($R^2 = 0.804$). Model 2: PC significantly predicts EMA (β = 0.973, t = 42.473, $p < 0.001$), with $R^2 = 0.774$. Model 3: CD significantly predicts EMA (β = 0.796, t = 31.856, $p < 0.001$), with $R^2 = 0.659$. Model 4: When PC and CD are included together, PC remains significant (β = 0.858, t = 16.682, $p < 0.001$), while CD also has a significant positive effect (β = 0.114, t = 2.496, $p < 0.05$). The explained variance is $R^2 = 0.777$. These results indicate that CD partially mediates the PC–EMA relationship. Although PC continues to have a significant direct effect on EMA after including CD, its magnitude decreases, and CD contributes an additional significant effect. This confirms that policy incentives influence EMA both directly and indirectly through curriculum design.

The concept of partial mediation suggests that curriculum design plays a significant role in how policy incentives affect entrepreneurial mindset and agility. This finding expands on existing theories in entrepreneurship and education by emphasizing curriculum structure as a key institutional factor that connects policy frameworks to entrepreneurial competencies. Additionally, the observation that policy incentives have a strong direct impact while also influencing entrepreneurial mindset and agility indirectly through curriculum design supports a dual-pathway framework. This provides empirical evidence for hybrid mediation models, where institutional factors have both direct effects and those mediated by curriculum. The results highlight the relationship between policy environments and educational design, aligning with previous research that points to the multi-level influences—policy, institutional, and individual—on entrepreneurial development.

To promote entrepreneurship effectively, policymakers should not only provide direct incentives but also focus on enhancing curriculum design. It is essential that educational content aligns with policy goals and encourages adaptive, innovative thinking. Educators and academic institutions can leverage curriculum redesign as a strategic approach

to convert policy support into practical entrepreneurial skills. This can be achieved by incorporating experiential learning, interdisciplinary methods, and real-world problem-solving into the curriculum. However, since direct policy support has a significant impact, relying solely on changes to the curriculum may not be enough. Therefore, effective strategies should combine strong policy incentives with innovative curriculum development to achieve the greatest impact on entrepreneurial agility.

Table 6. The Mediation Relationship for Curriculum Design (CD) between Policy Incentives (PC) and Entrepreneurial Mindset and Agility (EMA).

	Y	CD (M1)		EMA (Y1)					
		Model 1		Model 2		Model 3		Model 4	
X		β_1	t_1	β_2	t_2	β_3	t_3	β_4	t_4
PC (X1)		1.011 ***	46.382	0.973 ***	42.473			0.858 ***	16.682
CD (M1)						0.796 ***	31.856	0.114 *	2.496
R^2		0.804		0.774		0.659		0.777	
ΔR^2		0.803		0.774		0.658		0.776	
F-value		2151.265 ***		1803.940 ***		1014.807 ***		914.048 ***	
df		(1526)		(1526)		(1526)		(2525)	
Hypothesis Verification		Supported		Supported		Supported		Supported, Partial Mediation	

Note: * $p < 0.05$, *** $p < 0.001$.

Table 7 presents the analysis of whether skill development (SD) mediates the relationship between policy incentives (PC) and entrepreneurial mindset and agility (EMA) using four regression models. Model 1: PC significantly predicts SD (β = 0.976, t = 39.554, $p < 0.001$), explaining 74.8% of the variance ($R^2 = 0.748$). Model 2: PC significantly predicts EMA (β = 0.973, t = 42.473, $p < 0.001$), with $R^2 = 0.774$. Model 3: SD significantly predicts EMA (β = 0.799, t = 32.370, $p < 0.001$), with $R^2 = 0.666$. Model 4: When PC and SD are included together, PC remains significant (β = 0.765, t = 17.191, $p < 0.001$), while SD also has a significant positive effect (β = 0.213, t = 5.408, $p < 0.001$). The explained variance is $R^2 = 0.786$. These results suggest a partial mediation effect: while PC has a significant direct impact on EMA, its effect decreases when SD is considered. At the same time, SD contributes an additional significant effect. This finding highlights that policy incentives influence EMA both directly and indirectly through skill development, emphasizing the crucial role of skill enhancement in cultivating an entrepreneurial mindset and agility.

In terms of academic implications, the confirmation of partial mediation enhances theoretical models by demonstrating that skill development is a significant pathway through which policy incentives promote an entrepreneurial mindset and agility. This finding adds depth to the policy–entrepreneurship literature, which often assumes a direct relationship between these factors. The results support human capital theory by showing that investments in skill development enable the translation of institutional incentives into entrepreneurial capabilities. This reinforces the need to integrate skill-related constructs into models that examine the impacts of policy. Additionally, the finding that policy incentives have both direct effects and skill-mediated effects on entrepreneurial mindset and agility (EMA), which is a dual-pathway influence, suggests that future research should investigate non-linear and synergistic relationships between institutional policies and capability-building processes.

Table 7. The Mediation Relationship for Skill Development (SD) between Policy Incentives (PC) and Entrepreneurial Mindset and Agility (EMA).

Y / X	SD (M1)		EMA (Y1)					
	Model 1		Model 2		Model 3		Model 4	
	β_1	t_1	β_2	t_2	β_3	t_3	β_4	t_4
PC (X1)	0.976 ***	39.554	0.973 ***	42.473			0.765 ***	17.191
SD (M1)					0.799 ***	32.370	0.213 ***	5.408
R^2	0.748		0.774		0.666		0.786	
ΔR^2	0.748		0.774		0.665		0.785	
F-value	1564.533 ***		1803.940 ***		1047.840 ***		965.035 **	
df	(1526)		(1526)		(1526)		(2525)	
Hypothesis Verification	Supported		Supported		Supported		Supported, Partial Mediation	

Note: ** $p < 0.01$, *** $p < 0.001$

Policymakers should combine financial or regulatory incentives with structured skill development programs to enhance long-term entrepreneurial agility. Educational institutions and training organizations need to align their skill development initiatives with existing policy frameworks to ensure that these incentives effectively translate into entrepreneurial competencies. Given the strong direct impact of policies, interventions should not depend solely on training programs. Instead, they should adopt a balanced approach that integrates policy incentives with targeted skill-building efforts to achieve sustainable entrepreneurial outcomes.

4.4. Model Fit

Following the confirmation of the reliability and validity of individual constructs and the overall measurement model, the study proceeded to evaluate the model's overall fitness. The goodness-of-fit of the measurement model was assessed using a range of standard indices, as reported in Table 8. These include the Goodness-of-Fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI), Comparative Fit Index (CFI), Incremental Fit Index (IFI), and Root Mean Square Error of Approximation (RMSEA). All indices met their respective cut-off criteria, indicating a satisfactory model fit [63]. Specifically, the model yielded the following values: CMIN/df = 1.936 (p = 0.000), CFI = 0.864, GFI = 0.805, AGFI = 0.800, RMSEA = 0.078, and IFI = 0.867, which collectively demonstrate acceptable fit in accordance with established guidelines [64]. These results affirm the validity and appropriateness of the overall measurement model in capturing bank customers' adoption of online banking services during the pandemic.

Table 8. Model Fit.

Statistic	Model Fit Indices	Recommended Value	Source
CMIN/df	1.936	<3	[64,65]
p-Value	0	$p < 0.001$	
CFI	0.914	≥0.90	
GFI	0.905	≥0.90	
AGFI	0.912	≥0.90	
RMSEA	0.078	≤0.08	
IFI	0.926	≥0.90	

5. Discussion

The results of this study offer strong empirical support for the proposed framework (Table 9). H1–H3 were supported, confirming that policy incentives significantly enhance professional engagement, curriculum design, and skill development. These findings underscore the role of institutional support in creating structured opportunities for students to connect with industry, access innovative curricula, and strengthen both technical and soft skills. This aligns with prior research that emphasizes the enabling role of government and university policies in bridging the gap between theory and practice.

Table 9. Summary of Hypotheses Testing.

Hypotheses	Results
Hypothesis 1: Policy Incentives (PC) → Professional Engagement (PE)	supported
Hypothesis 2: Policy Incentives (PC) → Curriculum Design (CD)	supported
Hypothesis 3: Policy Incentives (PC) → Skill Development (SD)	supported
Hypothesis 4: Professional Engagement (PE) →Entrepreneurial Mindset & Agility (EMA).	supported
Hypothesis 5: Curriculum Design (CD) → Entrepreneurial Mindset & Agility (EMA).	supported
Hypothesis 6: Skill Development (SD) → Entrepreneurial Mindset & Agility (EMA).	supported
Hypothesis 7: Policy Incentives (PC) → Entrepreneurial Mindset & Agility (EMA)	supported
Hypothesis 8: Professional Engagement (PE) → between Policy Incentives (PC) and Entrepreneurial Mindset & Agility (EMA)	Partially supported
Hypothesis 9: Curriculum Design (CD) → between Policy Incentives (PC) and Entrepreneurial Mindset & Agility (EMA)	Partially supported
Hypothesis 10: Skill Development (SD) → between Policy Incentives (PC) and Entrepreneurial Mindset & Agility (EMA)	Partially supported

The results also validated H4–H7, showing that professional engagement, curriculum design, and skill development each contribute directly to entrepreneurial mindset and agility, and that policy incentives exert a significant direct effect on these outcomes. Together, these results highlight that entrepreneurial agility is shaped not only by institutional policies but also by the quality of engagement and the depth of skill acquisition. This dual pathway—both direct and indirect—demonstrates that policy support is an essential but not sufficient condition, as it must be complemented by strong implementation within curricula and skills training.

By contrast, the mediating hypotheses (H8–H10) were only partially supported, suggesting that while professional engagement, curriculum design, and skill development do serve as mediators, their effects are not uniformly strong. For instance, the mediation of professional engagement sometimes revealed a suppressor effect, indicating that when engagement is driven more by policy compliance than by authentic collaboration, it may dampen rather than enhance entrepreneurial agility. Similarly, curriculum design and skill development showed partial mediation, highlighting that contextual and institutional factors—such as resource availability and cultural variation—moderate the extent to which policies are translated into entrepreneurial outcomes. Collectively, these findings provide a nuanced picture: policy incentives have a robust and consistent direct effect on entrepreneurial mindset and agility, while their indirect effects through engagement, curriculum, and skill development vary in strength. This demonstrates that while policy frameworks are crucial, their ultimate effectiveness depends on how well educational institutions, industry partners, and NGOs implement them in practice-oriented, student-centered ways.

This study also investigates how policy incentives can strengthen students' entrepreneurial skills and adaptability by fostering collaboration between educational institutions and industries. Drawing on the literature review and empirical analysis results, it synthesizes key findings and outlines their implications for policymakers, educators, and industry partners. The main discussion points are as follows:

1. Role of Policy Incentives

Government initiatives—such as funding for entrepreneurship programs, innovation grants, and supportive policy frameworks—are pivotal in shaping students' entrepreneurial mindset. These incentives provide financial resources, mentorship, and infrastructure that encourage active engagement in entrepreneurial activities [15]. Programs like the U.S. Small Business Innovation Research (SBIR) link academic research with market-ready innovations, offering students valuable real-world experience and confidence to pursue ventures [66].

2. Institutional Policies and Student Agility

Institutional policies enhance agility by promoting practice-oriented learning, flexible curricula, and close industry collaboration. Entrepreneurship education supported by such policies is more effective in developing skills [25]. Opportunities like internships, project-based assignments, and university-based incubators provide essential resources, networks, and practical insights, enabling students to adapt in dynamic business environments [67].

3. Academia Collaboration

Collaboration with industry exposes students to real business challenges, aligning theoretical knowledge with practical application. These partnerships foster co-designed curricula, mentorship, and sustained industry interaction, equipping students to respond to market shifts and entrepreneurial risks [8,14].

4. Skill Development as a Policy Priority

Policies that prioritize skill development—covering professional, soft, and digital skills—prepare students for entrepreneurial success. Integrating real-world projects and industry engagement into the curriculum promotes creativity, problem-solving, and risk-taking [68]. Comprehensive programs that combine such initiatives are more effective in producing capable entrepreneurs [17]. For instance, Taiwan's mature innovation system relies on structured government support, whereas Malaysia's entrepreneurial ecosystem relies heavily on NGO involvement. Multi-group analysis could reveal whether policy incentives operate differently across these contexts.

Although this research draws from both Taiwan and Malaysia, its implications extend primarily to emerging economies where institutional infrastructures for industry–academia collaboration are still evolving. In such contexts, policy incentives act as substitutes for mature innovation systems, helping to compensate for resource constraints and institutional fragmentation. The results highlight that in developing or transitional economies, collaborative policies should not simply replicate high-income models but adapt to local socioeconomic conditions—such as funding asymmetry, regulatory rigidity, and uneven access to industry partnerships. By acknowledging these contextual realities, the study provides guidance for policymakers in emerging economies to prioritize flexible, inclusive, and capacity-building mechanisms that enhance the translation of policy incentives into practical, student-centered outcomes.

This study explored the relationships between Policy Incentives (PC), Professional Engagement (PE), Curriculum Design (CD), Skill Development (SD), and Entrepreneurial Mindset and Agility (EMA). All measurement scales demonstrated strong reliability (Cronbach's $\alpha > 0.7$) and validity. Descriptive and correlation analyses revealed strong positive relationships between PC and all other dimensions. A multiple mediation regression analysis confirmed that PC significantly and positively influences PE, CD, SD, and EMA. Additionally, PE, CD, and SD each have a significant impact on EMA, and they partially mediate the relationship between PC and EMA. These findings indicate that policy incentives affect EMA both directly and indirectly, through professional engagement, curriculum design, and skill development.

The findings emphasize the importance of developing integrated policy frameworks that offer direct support while enhancing engagement, curricula, and skill development. Policymakers should create incentives that promote experiential learning and collaboration with the industry. Educators need to incorporate practical, flexible, and industry-aligned content into their curricula. Industry partners should play an active role in providing training and mentorship. Together, these elements foster an entrepreneurial mindset and adaptability, which are essential for success in today's competitive and rapidly changing environment.

6. Conclusions

This study's central contribution is to demonstrate that policy incentives, when aligned with institutional and educational engagement mechanisms, directly foster entrepreneurial mindset and agility among students. The evidence shows that while indirect pathways through professional engagement, curriculum design, and skill development remain important, the most robust impact stems from coherent policy frameworks that are effectively implemented at the institutional level. Practically, this means that governments and universities in emerging economies should prioritize actionable, cross-sector collaboration models over purely symbolic incentive structures. The findings thus reinforce the need for sustainable and context-aware policy interventions that nurture entrepreneurial ecosystems from the ground up.

6.1. Theoretical Implications

This study contributes to theory by demonstrating how policy incentives shape entrepreneurial outcomes through industry–academia collaboration. First, the findings extend Experiential Learning Theory (ELT) by showing that institutional policy support creates structured opportunities—such as internships and project-based learning—that systematize experiential cycles. ELT is thus broadened from an individual-level process to a policy-driven mechanism that enhances entrepreneurial agility. Second, the results enrich the Resource-Based View (RBV) by evidencing that policy incentives generate intangible resources—skills, networks, and collaborative capacities—that students carry as forms of human and social capital. This extends RBV beyond firms to educational ecosystems, highlighting how policy acts as a catalyst for building VRIN (valuable, rare, inimitable, non-substitutable) resources. Third, the study refines Social Cognitive Theory (SCT) by showing that professional engagement mediates the link between policy incentives and entrepreneurial outcomes. The observed suppressor effect suggests that while mentorship and modeling can enhance self-efficacy, engagement framed primarily by compliance may constrain entrepreneurial confidence—an important nuance that adds depth to SCT. Finally, by integrating ELT, RBV, and SCT, this research highlights how policy incentives influence how students learn, what resources they acquire, and why these translate into entrepreneurial behaviors. These insights offer a multi-level theoretical contribution and provide a foundation for cross-national extensions in future research.

6.2. Managerial Implications

Figure 5 illustrates the structural model linking policy incentives, professional engagement, curriculum design, skill development, and entrepreneurial mindset and agility. Policy incentives function as the central driver, exerting both direct and indirect effects on entrepreneurial outcomes. The mediating pathways—professional engagement, curriculum design, and skill development—show how institutional support is translated into entrepreneurial mindset and agility. Collectively, the figure highlights that while policy pro-

vides the foundation, its impact depends on how effectively these pathways are activated and sustained.

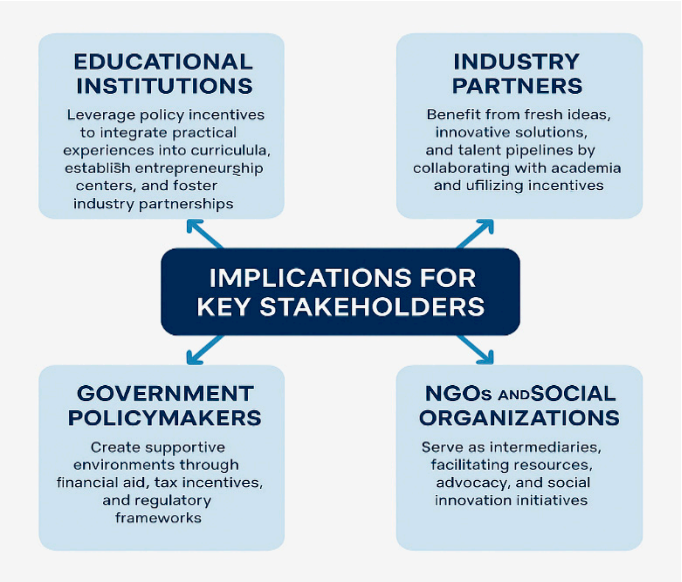

Figure 5. Implications for Key Stakeholders.

This model carries important implications for key stakeholders. Educational institutions should leverage policy incentives to embed experiential learning into curricula, establish entrepreneurship centers, and expand partnerships that provide students with internships, mentorship, and project-based opportunities. Industry partners can benefit by collaborating with academia to access fresh ideas, innovative solutions, and future talent, while strategically using incentives such as R&D funding and technical support. Government policymakers play a critical role by designing coherent incentive frameworks—such as financial aid, tax benefits, and regulatory support—that ensure collaborations are sustainable and innovation-driven. Finally, NGOs and social organizations can act as intermediaries, offering advocacy, resources, and socially oriented initiatives that complement industry–academia partnerships and broaden their societal impact.

Effective collaborations require tailored strategies that consider context, industry type, and cultural factors, as well as a commitment to building long-term relationships based on trust and shared goals. Regular evaluation and adjustment of policy measures ensure that incentives remain relevant and impactful. By aligning policy incentives, institutional support, and industry collaboration, stakeholders can create a robust ecosystem that develops innovative, adaptable, and resilient entrepreneurs. Integrating practical learning, industry insights, and flexible, practice-oriented curricula is essential for preparing students to thrive in today's dynamic and uncertain business environment.

6.3. Limitations and Future Research

The findings of this study should be interpreted with caution, particularly concerning the measurement of entrepreneurial mindset and agility. As the sample primarily comprised students, their perspectives may lack the depth and breadth of insights that experts in industry–academia collaboration could provide. Differences in educational backgrounds and interpretations of these concepts, especially among students from diverse countries, may also introduce bias and reduce consistency in responses. Moreover, the diverse and complex nature of industry–academia collaboration projects—varying by industry, project type, and firm size—makes direct comparison challenging, limiting the generalizability of the results to specific contexts. The dataset covers a specific period, which may restrict its

relevance in a rapidly evolving business environment. Cultural, institutional, and regulatory differences between countries can further affect the reliability of findings. Additionally, the use of self-reported measures may be susceptible to bias and measurement error, while moderating effects, such as firm size, may influence the accuracy of responses. Addressing these limitations will require future research to incorporate multiple data sources, expert perspectives, and alternative measurement approaches to enhance the robustness of the conclusions.

Future research should adopt more diverse methodologies and alternative metrics to validate the measurement of entrepreneurial mindset and agility, reducing the risk of bias and measurement error. Integrating both student and expert perspectives can provide a more comprehensive understanding of collaboration processes, while longitudinal studies tracking students' career development could offer valuable insights into the long-term effects of industry–academia collaboration on entrepreneurial success and adaptability. Comparative analyses across different industries, countries, and cultural contexts would allow researchers to identify tailored collaboration strategies and develop culturally sensitive models. Further exploration of global industry–academia networks could reveal how international collaborations foster knowledge exchange, cultural interaction, and global competitiveness. Gathering feedback from corporate partners would help refine collaboration models to better align with industry needs. In addition, examining interdisciplinary collaborations that span multiple academic fields and sectors could highlight how diverse perspectives stimulate creativity and innovation. The integration of advanced technologies, such as artificial intelligence, big data, and the Internet of Things, into collaborative efforts could also open new pathways for enhancing entrepreneurial thinking and agility. Expanding the scope of inquiry to include other strategic partnerships—such as those involving government research institutions, non-profits, or multinational corporations—could broaden the applicability of the framework. Finally, considering additional variables, including the presence of university incubators, community services, levels of partner involvement, and partner country origins, may further enrich future analyses. By addressing these areas, researchers can develop a more holistic understanding of how to optimize industry–academia collaboration to foster innovation, adaptability, and entrepreneurial capacity.

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