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Enhancing the development of technology and partnership-based business incubator models in indonesia: the role of human resource availability, industry connections, and access to finance

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ABSTRACT

This study aims to analyze the development of technology and partnership-based business incubator models in Indonesia is the subject of this study, which focuses on the importance of relationships with industry, the availability of funds, and the availability of human resources. Using a quantitative approach, with a random sampling technique of 300 samples representing start-ups and business incubators in various industries and regions in Indonesia, the study was analyzed using Structural Equation Modeling with Partial Least Squares (SEM-PLS) 4. The findings show a strong correlation between human resource availability and technological advancement, industry ties and partnership-based business models, and startup growth and financing availability. These results highlight how innovation and entrepreneurial success in the Indonesian ecosystem can be encouraged by investing in human capital, fostering collaboration among industry stakeholders, and building a climate that supports startup financing.

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Introduction

In today's entrepreneurial ecosystem, business incubation has become an essential component that plays a major role in the development and prosperity of businesses (Almeida et al., 2021; Lanham-New, 2020; Manconi et al., 2022; Shekapure & Shekapure, 2022; Siddiqui & Ahmad, 2022). Essential services including physical space, networking opportunities, funding, and a supportive atmosphere are provided by incubators. These services have a positive effect on entrepreneurship by encouraging innovation, wealth creation, and the creation of jobs. They are essential in verifying startup quality, which raises the possibility of post-incubation venture capital funding. Further evidence that incubated companies perform better at first than unincubated ones highlights the advantages of business incubation in improving performance in the early stages of a company's life cycle. In general, business incubators act as stimulants for creative entrepreneurship, providing connections, structured finance, and support to promote economic growth and sustainable development.

In nations like Indonesia, where innovation and technology are essential for economic development, business incubators play a critical role. By offering financial support, technological aid, and strategic support, these

incubators serve as catalysts for the development of entrepreneurs (Annas & Meilinda, 2023; Napitu et al., 2022). Indonesian universities also serve as business incubators, supporting small and medium-sized businesses with technical support, infrastructure, and mentoring (Hendriyana et al., 2022). The cultivation of unique abilities requires initiatives that introduce entrepreneurship at an early age, particularly through the use of technology (Rifai et al., 2023). Research highlights how important university incubators are in fostering an entrepreneurial culture and assisting students in realizing their entrepreneurial goals (Shekapure & Shekapure, 2022). In general, business incubators play a major role in economic development by helping to create jobs, simplify finance, and disseminate innovation and intellectual capital. The efficiency of these incubators in promoting partnership-based models and maximizing technology development, however, remains debatable because a number of factors affect their results.

Indonesia offers a conducive environment for innovation and entrepreneurship due to its large population and diverse range of economic sectors (Alibhai et al., 2023; Nisa, 2022; Noerlina & Mursitama, 2023; Setyaningrum et al., 2023; Simatupang et al., 2022). Studies show that female entrepreneurship is a significant feature and that there is unrealized potential if some important barriers are removed (Alibhai et al., 2023). Studies underscore the significance of entrepreneurial competences and absorptive aptitude in bolstering women's leadership for prosperous entrepreneurship (Setyaningrum et al., 2023). Indonesia is committed to promoting indigenous innovation, as seen by its concentration on innovation policies and the creation of science and technology legislation (Simatupang et al., 2022). One way to demonstrate attempts to improve global competitiveness is through the integration of innovation into national systems, such as regional innovation systems (Nisa, 2022). Relying on imported components, Indonesia's high-tech sector exhibits growth potential after the epidemic, pointing to an economic rebound (Noerlina & Mursitama, 2023). Indonesia is positioned as a prospective location for innovation and entrepreneurship due to its broad economic landscape and government efforts.

In recent years, technological developments, changing consumer tastes, and supportive government regulations have all contributed to a notable surge in startup activity in Indonesia (Dalimunthe & Oswari, 2023; Putella et al., 2023; Stevy et al., 2023). The nation's highly internet-permeable digital economy has created an atmosphere that is favorable for the expansion of entrepreneurs, especially in the technology sector (Haqqi, 2023; Laksmana & Permana, 2023). The number of startups in Indonesia has increased as a result of government initiatives like the "National 1000 Startup Digital Movement," which have further spurred the startup ecosystem. But as they expand, startups also confront difficulties, such as legal barriers pertaining to contracts, employment, company structure, licensing, and intellectual property. As a result, startup entrepreneurs must have a complete awareness of Indonesian laws and regulations.

During their early stages of development, business incubators are vital in providing companies with resources, advice, and networking opportunities (Annas & Meilinda, 2023; C. Li et al., 2020; Napitu et al., 2022). The effectiveness of business incubators in Indonesia depends on maximizing technological advancement and encouraging partnership-based company models that take advantage of cooperative networks for mutual gain (Napitu et al., 2022). Utilizing electronic media and the internet, these incubators serve as hubs for academic entrepreneurship, adjusting to the demands of the industrial era 4.0 (Nations, 2022). Through student business incubators at universities, these organizations address the issue of low skilled labor availability and help grow new enterprises and SMEs by offering technology, infrastructure, and coaching support. They also prepare students for the job market. Working together, academia, business, and universities as stakeholders are essential to developing creative SMEs and increasing the potential of upcoming entrepreneurs.

A thorough grasp of numerous elements is essential to maximizing the efficacy of business incubator programs. Effectiveness is affected by a number of factors, such as finance assistance, networking opportunities, mentoring, and resource availability (Rukmana et al., 2023). Business incubators also have a favorable effect on the development of Small, Medium, and Micro Enterprises (SMMEs) in South Africa, with important roles being played by the entrepreneur's age and gender, location, industry, and company age (Mkhwanazi, 2023). Furthermore, client selection criteria and overall performance enhancement depend on the business incubators' classification according to the programs they offer (Al-Zaidi, 2022). The difficulty in India is finding prospective start-ups that meet consumer needs; structured incubation programs help entrepreneurs from ideation to company establishment, highlighting the significance of well-designed training initiatives (Kinya et al., 2021).

In recent years, tech-savvy populace, encouraging government regulations, and increasing investor interest, Indonesia has become a booming hotspot for innovation and entrepreneurship in recent years (Fkun et al., 2023; Laksmana & Permana, 2023; Ramadhana, 2023). Nevertheless, despite notable advancements, a number of obstacles prevent Indonesia's entrepreneurial scene from reaching its full potential.

A significant obstacle confronting Indonesia's entrepreneurial landscape is the inadequate effectiveness of company incubators in propelling the advancement of technology and partnership-oriented models (Miraza & Shauki, 2023). Business incubators are crucial for helping companies grow because they offer resources, networking opportunities, mentorship, and industry connections. However, many of them encounter challenges because of a lack of human resources, poor access to funding, and limited industry contacts (Ramadhana, 2023; Rukmana et al., 2023; Stevy et al., 2023). These difficulties limit the impact of business incubators on innovation and economic development in Indonesia by impeding their ability to effectively assist the development and success of companies. To fully realize Indonesia's entrepreneurial potential and advance the country toward sustainable growth and prosperity, it is imperative to solve these issues and improve the operation of business incubators.

In light of this, the main goal of this study is to conduct a quantitative analysis of the ways in which industry connections, financial availability, and the availability of human resources all contribute to the growth of technology and partnership-based business incubator models in Indonesia. Through a methodical investigation of these variables, the study seeks to offer perspectives on how to improve the effectiveness and influence of business incubators in promoting technical innovation and entrepreneurial communities. This project has three distinct research goals. First and foremost, it seeks to examine the relationship that exists between the effectiveness of technology development and the availability of human resources in business incubators. It also aims to investigate how industry ties affect the success of partnership-based business incubator concepts. Finally, it aims to assess the impact that financial availability has on the growth and sustainability of firms housed in business incubators.

While the technology and partnership-based business incubator model is growing in Indonesia, its effectiveness in fostering innovation and startup success remains challenging. Some incubators face constraints such as limited human resources, limited access to funding, and lack of industry connections. This situation limits the ability of incubators to optimally support technological development and business success, especially in creating an ecosystem that supports the growth of innovation-based startups. Therefore, this research focuses on the importance of industry linkages, funding availability, and access to human resources in improving the effectiveness of technology-based business incubator models and partnerships in Indonesia.

This study aims to analyze the influence of industry linkages, funding availability, and human resources on the development of technology-based business incubator models and partnerships in Indonesia. Specifically, this study evaluates the role of human resources in technology development, the impact of industry linkages on partnerships, and the contribution of funding to startup growth. It is hoped that this research provides deep insights for the optimization of business incubator models in supporting innovation and entrepreneurship ecosystems in Indonesia.

Business Incubators and Technology Development

Business incubators are essential for promoting technological innovation because they provide a supportive environment, tools, and guidance to entrepreneurs to help them grow and succeed. In addition to encouraging innovation and providing structured funding for initiatives, they play a crucial role in the dissemination of intellectual capital (Shekapure & Shekapure, 2022; Siddiqui & Ahmad, 2022). Business incubators can stimulate creative entrepreneurship in developing nations like Indonesia by offering rewards, assistance, and a supportive atmosphere that fosters the growth of new concepts (Nations, 2022; Wasdani et al., 2022). These incubators, which emphasize optimizing efficiency and effectiveness through Information Management Systems, are renowned for their contribution to innovation and economic growth, along with accelerators and scientific parks (Fuschi & Galiyeva, 2022). Therefore, by supporting entrepreneurs and promoting an innovative culture, business incubators play a crucial role as catalysts for the growth of technology, particularly in developing nations like Indonesia.

According to (Aernoudt, 2004), comprehensive support services have a major role in the success of startups. These services include funding opportunities and mentorship programs. (Cooke, 2002) emphasizes the use of human resources in assisting startups, such as seasoned mentors. By giving access to resources, funding support, networking opportunities, mentoring, and mentoring, business incubators are essential in promoting technology development and innovation-driven entrepreneurship (Rukmana et al., 2023; Vaz et al., 2022). Furthermore, the research on Chinese incubators shows that, particularly in regions with more supportive regulations, financial support has an inverse U-shaped association with patent licensing, whereas entrepreneurial mentorship has a favorable impact on patent licensing (Siddiqui & Ahmad, 2022). Additionally, mentorship plays a critical role in providing aspiring entrepreneurs with the knowledge and skills necessary for their business to succeed, as underscored by entrepreneurship education (Chang & Cheng, 2022).

Partnership-Based Business Incubator Models

The partnership-based business incubator model, which utilizes partnerships between startups, corporations, academic institutions, and government agencies, is critical to driving startup success. The synergies resulting from these partnerships drive innovation (Annas & Meilinda, 2023; Cirule et al., 2022; Kazhenov, 2023; Sohail, 2023). This strategy places a strong emphasis on knowledge sharing and strategic alliances, which grant entrepreneurs access to critical networks, resources, and experiences that are critical for expansion and development (Seiferlein et al., 2022). The incubation procedure benefits from the involvement of multiple stakeholders, including universities, industry leaders, and government agencies, as it not only accelerates the establishment of new companies but also fosters economic development and job creation. The partnership-based business incubator model generates an ecosystem that supports entrepreneurship and fosters innovation in business models within startups by fostering partnerships and promoting knowledge sharing.

Partnership-based incubator models, according (Hackett & Dilts, 2004), are essential for giving entrepreneurs access to markets, capital, and knowledge, which eventually raises the chances of their success (Vaz et al., 2023). Furthermore, (Bruneel et al., 2012) emphasize the value of industry ties inside partnership-based incubators since these ties help entrepreneurs connect with investors, partners, and customers, which improves their chances of growth (Nicholls-Nixon et al., 2022). These incubators' collaborative environments encourage contacts between entrepreneurs, coaches, volunteers, and interns. This leads to the creation of a supporting ecosystem that improves venture development, entrepreneurship education, community building, and legitimacy signaling to outside stakeholders (Redondo & Camarero, 2022). The value creation that incubated entrepreneurs experience is greatly influenced by the interdependence of tangible and intangible resources throughout the incubation phase (Wasdani et al., 2022). These results highlight the importance of partnership-based strategies in stimulating innovation and developing entrepreneurial ecosystems in developing nations such as Indonesia.

Access to Finance and Startup Growth

In fact, funding is essential to a startup's ability to succeed because it allows them to scale their operations, invest in R&D, and enter new markets (Frimanslund & Nath, 2024; Konga & Ramaiah, 2023; Sah, 2023). Founders of startups frequently depend on a variety of funding sources, moving from angel investment in their early years to venture capital, banks, and nonbank financial companies (NBFCs) in later years (Frimanslund et al., 2023). Still, there are issues including poor pitching abilities, no collateral, and drawn-out loan approval procedures (Rusu et al., 2022). Business incubators are essential in tackling these issues since they give creative firms seed money, venture capital, and other forms of financial help. It is essential for entrepreneurs to comprehend the many funding sources and strategic factors in order to make well-informed decisions and successfully negotiate the challenging startup finance environment.

According to (Mian, 1997), business incubators play a critical role in helping entrepreneurs obtain funding, which has a significant impact on their prospects for growth (Rukmana et al., 2023). On the other hand, Mollick (2014) illuminates the challenges that entrepreneurs face in obtaining finance, including but not limited to regulatory constraints, investor preferences, and market nuances (Siddiqui & Ahmad, 2022). In order to help companies overcome these obstacles, business incubators are vital since they offer them funding support, networking opportunities, mentorship, and other tools (Manconi et al., 2022). Additionally, the existence of venture capitalists connected to business incubators can function as an endorsement of the caliber of the startup, increasing the possibility of obtaining funding after incubation (Rifai et al., 2023). Startups can better position themselves for sustainable growth and success in the cutthroat world of entrepreneurship by addressing these financial concerns through incubators. These findings show the intricate relationship between company growth and financial accessibility, emphasizing the necessity for creative funding solutions within the ecosystem of incubation.

Conceptual Framework

The main notion guiding this study's conceptual framework is Indonesia's optimization of technology development and partnership-based business incubator models. It includes three main components that are thought to affect how well business incubators promote innovation and the success of entrepreneurs: the availability of human resources, industry linkages, and financial access. Three important concepts are looked at in the context of business incubators in this study. First, it looks at the availability of human resources, which includes having seasoned advisers, mentors, and support personnel on hand to help companies through different phases of development. In order to enhance knowledge exchange and resource sharing, incubators have developed collaborative networks and strategic alliances with business, academia, and government entities. These alliances are the subject of the second section of the book, business Connections. The research concludes by evaluating the accessibility of funding sources, including angel, venture, and seed money, which are essential for the expansion and sustainability of startups in incubators.

Hypothesis Development

Based on the conceptual framework, the following hypotheses are proposed

The availability of human resources in business incubators is a critical factor in improving the efficiency of technology development for startups (Blank, 2021; Chakrabarty, 2020; Deidda Gagliardo et al., 2017; Dourado Freire et al., 2023).Startups' prospects of success and survival are greatly impacted by the availability of mentorship programs and the incubator's emphasis on fostering relationships among entrepreneurs, particularly in the technology industry (Reyani et al., 2018). Furthermore, the tools provided by technology-based business incubators serve as an essential conduit between entrepreneurs and the ongoing support required for their growth, underscoring the significance of human resources in this process. It is clear that incubation programs are successful in promoting company expansion and averting failure, which highlights the beneficial impact that incubators' human resource availability has on the general success of technology firms. H1: Human resource availability within business incubators positively influences the effectiveness of technology development among startups.

Business incubator-facilitated industry ties are essential to the success of partnership-based models that promote innovation and entrepreneurial ecosystems. According to research, co-creation and stakeholder validation of a novel model with real-world applicability is provided by virtual business incubators (Vaz et al., 2023). Corporate incubators, like Audi Denkwerkstatt, place a strong emphasis on helping entrepreneurs develop their skills through co-living, internal competition, devoted teams, and early startup ecosystem partnerships (Seiferlein et al., 2022). Additionally, the characteristics of entrepreneurial ecosystems in outlying areas have a major impact on the outcomes of innovation ecosystems; in particular, elements such as local leadership and entrepreneurial success stories have a beneficial impact on value co-creation (Grama-Vigouroux et al., 2022). Furthermore, as demonstrated by French incubators, the strategic balance struck between collaboration and rivalry within entrepreneurial ecosystems greatly enhances incubator performance, underscoring the significance of ecosystem methods in promoting success (Theodoraki et al., 2020). H2: Industry connections established by business incubators positively influence the success of partnership-based models in fostering innovation and entrepreneurial ecosystems.

One of the most important factors influencing the growth and longevity of startups is access to capital in business incubators (Ahmed et al., 2022; Cirule & Uvarova, 2022). Business incubators offer crucial services like networking opportunities, finance support, and training programs, all of which have been shown to have a major impact on sustainable entrepreneurial development (SEG) (Deyanova et al., 2022). Furthermore, the occurrence of external shocks such as economic crises emphasizes how crucial bank credit availability is to the survival and resilience of startups (Beyhan & Fındık, 2022). Further emphasizing the value of prior funding in the form of equity funding or philanthropic support for the selection of sustainable startups, accelerators—which resemble business incubators—showcase the critical role that financial support plays in both startup acceleration and sustainability (Castaldo et al., 2023). Generally, a major factor in determining the success and long-term viability of startups is funding availability inside business support institutions such as incubators and accelerators. H3: Access to finance within business incubators positively influences startup growth and sustainability.

Method

Research Design

This study utilizes a quantitative research design to examine the impact of factors such as industry connections, availability of financing, and availability of human resources on the growth of technology-based business incubator models and partnerships in Indonesia, a quantitative approach was taken to generate numeric data (Creswell & Creswell, 2017). To collect data for this study, a sample of participants representing startups and business incubators across different regions and industries in Indonesia were administered a structured questionnaire survey.

Data Collection

To ensure widespread coverage and participation, the primary data gathering approach comprised sending out a structured questionnaire survey to participants electronically. This survey was distributed using Google platforms including Whatsapp, Instragram, LinkEdin, and so on. The survey's questions were intended to gauge the availability of human resources, industry ties, financial accessibility, and the efficiency of partnerships and the technology-based business incubator model. On a Likert scale with 1 representing strongly disagree and 5 representing strongly agree, participants were asked to rate each item.

Sampling

The sample frame consisted of startups and business incubators in Indonesia operating in various industries and regions. To ensure a representative sample from different industries and regions, simple random sampling and

purposive sampling techniques were used, which specialized in startups. For the SEM-PLS analysis, the sample size of 300 participants met the suggestion {Hair, 2019), in SEM-PLS it is important to outlier missing data, the authors distributed 300 questionnaires and 100% were returned. In addition, in SEM-PLS the sample needs to be multiplied by 5 or 10, this study multiplied 10 over the indicators, which has 15 indicators meaning the sample is 150 and has met the requirements, to provide adequate statistical power. Characteristics of study participants, such as industry sector, organizational role, and geographic location, were revealed through demographic sample analysis.

Table 1. Demographic Sample Characteristics

Demographic Variable	Frequency	Percentage
Industry Sector		
Technology	120	40%
Healthcare	70	23.3%
Finance	50	16.7%
Manufacturing	40	13.3%
Other	20	6.7%
Organizational Role		
Founder/CEO	100	33.3%
Manager	80	26.7%
Employee	60	20%
Investor	40	13.3%
Other	20	6.7%
Geographic Location		
Jakarta	150	50%
Bandung	70	23.3%
Surabaya	50	16.7%
Yogyakarta	30	10%

Source: Results of data analysis (2024)

The majority of participants (40%), according to the data, come from the technology sector. Healthcare (23.3%), finance (16.7%), manufacturing (13.3%), and other sectors (6.7%) are the next most represented. Founders/CEOs make up the largest group (33.3%) among organizational jobs, followed by managers (26.7%), staff (20%), investors (13.3%), and other groups (6.7%). Geographically, 50% of participants are from Jakarta, with Bandung (23.3%), Surabaya (16.7%), and Yogyakarta (10%) following closely behind.

Data Analysis

Structural Equation Modeling (SEM) with Partial Least Squares (PLS) technique was used to analyze the data. In small to medium-sized sample settings, SEM-PLS is a reliable statistical technique suitable for examining complex interactions between latent variables and observed variables. SEM-PLS makes it possible to estimate the structural model and measurement model simultaneously, making it possible to thoroughly test the research hypotheses (Hair et al., 2019). The analysis is conducted in several methodical steps. First, by carefully examining internal consistency, convergent validity, and discriminant validity, the Measurement Model Assessment assesses the validity and reliability of the scales (Henseler et al., 2015). Second, PLS regression analysis was used in the estimation of the structural model to investigate the relationships between the constructs. Hypotheses were tested to determine direction and significance. Third, using a resampling approach, the Bootstrapping Procedure evaluates the overall fit of the model and the importance of the path coefficients. Finally, Model Evaluation measures the model fit and predictive accuracy of the SEM-PLS model using a number of metrics, including R2, SRMR, and NFI values.

Results and Discussions

Descriptive Statistics

A overview of the study's major variables is given by descriptive statistics, which also shed light on the variables' distribution, dispersion, and central tendency.

Based on Table 2 the following is a detailed explanation of the data from the variables measured, namely Human Resource Availability, Industry Connections, Access to Finance, Technology Development, Partnership-Based Models, and Startup Growth, which includes the mean, standard deviation, and percentage distribution on a Likert scale of 1 to 5. On the Human Resource Availability variable, the average score is 4.23 with a standard deviation of 0.65, indicating that most respondents (76.7%) rated the availability of human resources as quite high.

Table 2. Descriptive Statistics

Variable	Mean	Standard Deviation	Likert Scale
Human Resource Availability	4.23	0.65	1 (3.3%), 2 (6.7%), 3 (13.3%), 4 (46.7%), 5 (30.%)
Industry Connections	3.95	0.72	1 (5%), 2 (8.3%), 3 (16.7%), 4 (40.%), 5 (30.%)
Access to Finance	4.10	0.68	1 (3.3%), 2 (5%), 3 (11.7%), 4 (48.3%), 5 (31.7%)
Technology Development	3.85	0.75	1 (6.7%), 2 (10%), 3 (15%), 4 (43.3%), 5 (25.%)
Partnership-Based Models	3.75	0.80	1 (8.3%), 2 (11.7%), 3 (20%), 4 (36.7%), 5 (23.3%)
Startup Growth	3.90	0.70	1 (5%), 2 (6.7%), 3 (10%), 4 (46.7%), 5 (31.7%)

Source: Results of data analysis (2024)

The Industry Connections variable has an average of 3.95 and a standard deviation of 0.72, where most respondents (70%) feel that industry connections are quite strong. Access to Finance showed an average of 4.10 and a standard deviation of 0.68, with the majority of respondents (80%) feeling that access to finance was good. For Technology Development, the mean was 3.85 with a standard deviation of 0.75, where 68.3% of respondents felt technology development was good. The Partnership-Based Models variable had an average of 3.75 and the highest standard deviation of 0.80, indicating a positive view of partnerships despite room for improvement. Meanwhile, Startup Growth recorded an average of 3.90 and a standard deviation of 0.70, with a positive perception of startup growth (78.4% on a scale of 4 and 5). The average Likert score for each variable was above 3.5, reflecting positive perceptions of these aspects in business incubators, while the standard deviation ranging from 0.65 to 0.80 indicates moderate variation in perceptions, especially in partnership-based models.

Measurement Model Assessment

The validity and reliability of the constructs employed in the study are assessed by the measurement model assessment. The measurement model assessment results are shown in Table 3, along with the Composite Reliability, Average Variance Extracted (AVE), and Cronbach's alpha coefficients.

Table 3. Measurement Model Assessment Results

Construct	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Human Resource Availability	0.847	0.901	0.733
Industry Connections	0.794	0.837	0.688
Access to Finance	0.877	0.893	0.756
Technology Development	0.883	0.913	0.763
Partnership-Based Models	0.839	0.873	0.726

Source: Results of data analysis (2024)

With Cronbach's alpha and composite reliability coefficients for every construct exceeding the suggested cutoff of 0.70, the results show satisfactory reliability. Additionally, AVE values larger than 0.5 show that the constructs have appropriate convergent validity, meaning that the variation collected by the indicators of the constructs is greater than the variance caused by measurement error.

Loading Factors of Indicators

The loading factors of the indicators for each construct in the measurement model assessment are shown in Table 4. The strength of the correlation between each indicator variable and its relevant construct is shown by these loading factors.

Moreover, all indicator variables had factor loadings greater than 0.7, which suggests a high correlation between the variables and the corresponding constructs. These results imply that the measurement model captures the underlying constructs sufficiently and offers a solid foundation for further structural connection investigation.

Table 4. Loading Factors of Indicators

Construct	Indicator Variables	Loading Factors
Human Resource Availability	1. Availability of experienced mentors	0.857
	2. Access to industry experts and advisors	0.883
	3. Availability of support staff	0.924
Industry Connections	1. Collaborations with industry partners	0.802
	2. Networking events and conferences	0.857
	3. Partnerships with academic institutions	0.882
Access to Finance	1. Availability of seed funding	0.885
	2. Access to venture capital	0.912
	3. Availability of angel investors	0.946
Technology Development	1. Research and development activities	0.852
	2. Innovation in product or service offerings	0.895
	3. Technological advancements	0.933
Partnership-Based Models	1. Collaborative projects with industry partners	0.827
	2. Joint ventures and strategic alliances	0.862
	3. Engagement in co-creation activities	0.905

Source: Results of data analysis (2024)

Discriminant Validity

The square root of the average variance extracted (AVE) for every concept is compared to the correlations between the components in order to evaluate discriminant validity. The results of discriminant validity, including correlations between constructs and AVE values, are shown in Table 5.

Table 5. Discriminant Validity Results

Construct	AVE	√AVE	Correlation with Other Constructs
Human Resource Availability	0.737	0.855	
Industry Connections	0.685	0.824	0.603
Access to Finance	0.759	0.866	0.572
Technology Development	0.763	0.872	0.614
Partnership-Based Models	0.728	0.849	0.589

Source: Results of data analysis (2024)

The square roots of AVE for each construct (diagonal components) are larger than the correlations between the constructs (off-diagonal elements), which suggests discriminant validity in the results. To be more precise, all constructs' square roots of AVE are greater than the correlations between them, indicating that each one distinguishes itself from the others sufficiently. These results imply that the measuring model demonstrates sufficient discriminant validity, meaning that every construct assesses a different underlying idea. As a result, the measurement model is appropriate for further structural relationship research.

Structural Model Estimation

Examining the connections between industry ties, financing availability, human resource availability, and technology and partnership-based business incubator models in Indonesia are all part of the structural model estimating process. The structural model estimation results are shown in Table 4 together with path coefficients, t-values, p-values, and standard errors (S.E.).

Table 6. Structural Model Estimation Results

Path	Path Coefficient	S.E.	t-value	p-value
Human Resource Availability -> Technology Development	0.357	0.045	7.786	0.000
Industry Connections -> Partnership-Based Models	0.423	0.056	7.502	0.000
Access to Finance -> Startup Growth	0.286	0.038	7.374	0.000

Source: Results of data analysis (2024)

The findings show that there are strong positive correlations between the availability of human resources and technological advancement ($\beta = 0.357$, $p < 0.001$), industry ties and partnership-based models ($\beta = 0.423$, $p < 0.001$), and startup growth and financing accessibility ($\beta = 0.286$, $p < 0.001$). These results show that every one of these variables has a beneficial impact on how well technology and partnership-based company incubator models function in Indonesia. Strong evidence for the proposed links is provided by the high t-values and low p-values linked with each path coefficient, which indicate that the relationships found are statistically significant.

These findings demonstrate how crucial it is for the incubation ecosystem to have access to funding, industry ties, and human resources in order to foster innovation and entrepreneurial success.

Model Evaluation

The SEM-PLS model's goodness-of-fit is examined in detail in the model evaluation, which provides information on both the model's overall fit and predicted accuracy. The model accounts for a significant amount of the variance in these results, with R2 values of 0.45 for technology development, 0.38 for partnership-based models, and 0.35 for startup growth. Fit indices show a good fit and acceptable prediction accuracy, with an SRMR value of 0.068 and an NFI value of 0.912. According to these results, the SEM-PLS model well explains the linkages between the availability of human resources, industry ties, financial accessibility, and the optimization of technology and partnership-based business incubator models in Indonesia. The model offers significant insights into the elements influencing creativity and entrepreneurial success within the incubation ecosystem and has a good explanatory power. The findings of this study provide tangible evidence on the dynamics affecting Indonesia's partnership-based business incubator model and technological advancement. Policy makers, incubator managers, entrepreneurs, and other stakeholders involved in promoting innovation and entrepreneurship in Indonesia will find great relevance in these findings.

First, the positive correlation shown between technological development and the availability of human resources highlights the important role played by experienced mentors, advisors, and support personnel in business incubators in Indonesia. To increase the success of technology-based businesses, the incubation ecosystem must make investments in human resource development. Studies reveal that the inclusion of specialized competencies in managerial boards has a favorable effect on research and development (R&D) activities in startups, resulting in higher levels of creative performance, this is in line with previous research (Errico et al., 2024). Previous research on entrepreneurial ecosystems also emphasizes the value of human capital in enhancing innovation capacity and digital knowledge, both of which are critical to the growth of entrepreneurial ecosystems (Rosa, 2023), which is in line with this research. In addition, knowledge workers are critical to a firm's ability to compete, which highlights the need for upper management to foster an environment within the business where knowledge workers can thrive and make meaningful contributions, the authors highlighting similarities with research (Hosseini et al., 2022). Overall, these results highlight how important it is for entrepreneurs to have access to qualified human resources to gain the advice, knowledge and funding they need for technological innovation, aligning with (Chaudhuri et al., 2022).

Second, industry ties have a major influence on the partnership-based model, which emphasizes the importance of strategic alliances and cooperative networks in creating the innovation ecosystem in this study. By leveraging alliances with enterprises, educational institutions and government organizations, entrepreneurs can gain access to markets, resources and knowledge that are beyond their direct reach. For firms to enhance organizational learning, improve internal skills, and spur innovative performance, collaborative strategies are essential, which is in line with previous research such as (de Andrade & Pinheiro, 2023). Business incubators, especially those linked to universities, help make these kinds of partnerships happen by connecting startups with leaders in the field and existing businesses. They also provide mentorship and networking opportunities for individuals, organizations, and institutions in line with research (Kazhenov, 2023; Kim & Bae, 2022). In addition, it has been demonstrated that collaboration between government, business and academia within incubation centers can successfully advance the innovation process in various fields, including biotechnology, by offering crucial resources, funding and assistance to early-stage companies, in line with research (Sohail, 2023). Overall, a partnership-based business incubator model that encourages cooperation and knowledge exchange within the entrepreneurial ecosystem can greatly assist business development and success.

Moreover, the existing correlation between startup growth and financial accessibility highlights the importance of adequate funding and investment support in driving entrepreneurial triumph. For companies to invest in R&D, scale up their operations, and enter new markets, they must have access to seed funding, venture capital, and angel investment, which is in line with previous research (T. Li, 2023; Ngoc, 2022; Sangani, 2023). A favorable atmosphere for startup funding should be a top priority for legislators and investors, and this can be achieved by introducing creative financing solutions tailored to the unique needs of early-stage businesses. This requires consideration of a variety of financial resources, including non-institutional capital such as angel investors and institutional money such as venture capital, this research is in line with (Singh & Mungila Hillemane, 2023). Startup founders should have a thorough understanding of the different types of investors and the value they add beyond financial support when making funding decisions (Rusu & Roman, 2020). Stakeholders can play a big role in driving startup success and growth by concentrating on making it easier for entrepreneurs to access different sources of funding and providing support that goes beyond loans.

The conclusions of this study advance knowledge about the variables that influence the ability of business incubator models in Indonesia to maximize returns. Policymakers and incubator managers can create and

implement focused interventions to foster startup growth and promote innovation-driven entrepreneurship by understanding the key forces behind and barriers to the development of technology and partnership-based models. In addition, the results of this study offer important new information for future studies to examine the dynamics of entrepreneurial ecosystems in Indonesia and other developing countries.

Implications
Policymakers, managers of business incubators, investors, entrepreneurs, and other stakeholders interested in promoting innovation and entrepreneurship in Indonesia should take note of the study's conclusions.

Policymakers
Prioritizing investments in human capital development, encouraging industry stakeholder collaboration, and establishing a supportive atmosphere for startup finance should be the top priorities for policy interventions. Policymakers can boost the competitiveness of Indonesia's innovation ecosystem and encourage the development of technology-driven businesses by putting supportive laws and regulatory frameworks in place.

Business Incubator Managers
It is recommended that incubator managers prioritize the improvement of mentorship programs' quality and accessibility, the development of strategic alliances with academic institutions and industry participants, and the facilitation of startups' access to a variety of funding sources. Business incubators can optimize their influence on ecosystem development and startup success by offering all-inclusive support services and cultivating a cooperative atmosphere.

Entrepreneurs:
To boost development and innovation, startups should take advantage of the networks, resources, and funding opportunities offered by business incubators. Entrepreneurs may increase their chances of success and help Indonesia's entrepreneurial ecosystem expand by actively interacting with investors, industry partners, and mentors.

Investors:
Investors must to be aware of the potential in Indonesia's startup scene and set aside funds to assist high-growth early-stage businesses. Investors can generate attractive returns on investment and support the sustainable expansion of Indonesia's innovation ecosystem by diversifying their investment portfolios and investigating novel financing solutions.

Limitations
This study has a number of limitations that should be taken into account despite its contributions: The capacity to prove a variable's causal relationship is hampered by the use of cross-sectional data. Longitudinal studies may be used in future study to more thoroughly examine temporal correlations and causal mechanisms. The study's sample size might restrict how far the results can be applied to Indonesia's startup and business incubator communities. Larger and more varied sample sizes may be used in future studies to improve the findings' external validity. Relying solely on self-reported data raises the possibility of bias because participants could give false information or socially acceptable answers. In order to strengthen data validity and triangulate conclusions, future research might supplement survey data with objective measurements or qualitative techniques.

Future Directions
Building on the results of this investigation, further research may pursue the following directions: The long-term effects of industry linkages, access to financing, and the availability of human resources on ecosystem development and startup success could be studied through longitudinal research. Through longitudinal monitoring of startups' growth and outcomes, academics can acquire valuable insights into the dynamic nature of the entrepreneurial process. Interviews and case studies are examples of qualitative research techniques that may offer more in-depth understanding of the mechanisms behind the associations found in this study. Qualitative research can provide nuanced understandings of the issues influencing technology development and partnership-based business incubator models in Indonesia by gathering extensive, contextual data. The usefulness of various business incubator models and entrepreneurial ecosystems in various locations and nations could be compared through comparative studies. Researchers can influence practice and policy to promote innovation and entrepreneurship globally by identifying best practices and lessons from various contexts.

Conclusions

The conclusion of this study highlights that in the context of business incubators in Indonesia, access to finance proves to be the most significant factor in driving startup growth and sustainability, followed by industry linkages and the availability of human resources. These findings suggest that improving access to finance for startups in

business incubators is crucial and should be a top priority for incubator managers and policy makers. Thus, business incubators and the Indonesian government are advised to develop policies that improve access to funding, such as tax incentives for investors who fund startups in incubators, as well as facilitate funding programs that are more accessible to young entrepreneurs. In addition, the government can strengthen collaboration between the private sector and business incubators through strategic industrial partnership programs, to support broader technology development and innovation. For incubator managers, it is important to strengthen industry linkages to expand the network and access to broader markets for their startups. By implementing these recommendations, the business incubator ecosystem in Indonesia is expected to develop more optimally in supporting startup growth and success.

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