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The Role of Digital Infrastructure, Digital Economy Regulations, and Technology Literacy in Driving the Growth of Digital Startups in Indonesia

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ABSTRACT

The rapid growth of the digital economy has accelerated the development of digital startups in Indonesia, making it important to understand the factors that support their growth. This study aims to examine the effects of Digital Infrastructure, Digital Economy Regulations, and Technology Literacy on Digital Startup Growth in Indonesia. A quantitative approach was employed using a survey of 155 respondents consisting of founders, managers, and employees involved in digital startup businesses. Data were collected using a five-point Likert scale questionnaire and analyzed through multiple linear regression with SPSS version 25. The results indicate that Digital Infrastructure has a positive and significant effect on Digital Startup Growth, while Digital Economy Regulations also positively and significantly influence startup growth. Technology Literacy demonstrates the strongest positive and significant effect, highlighting the critical role of digital competencies in supporting innovation and adaptability. Simultaneously, Digital Infrastructure, Digital Economy Regulations, and Technology Literacy significantly influence Digital Startup Growth, explaining 57.3% of the variance in startup growth. These findings suggest that strengthening digital infrastructure, improving regulatory support, and enhancing technology literacy are essential for fostering a sustainable and competitive digital startup ecosystem in Indonesia.

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1. INTRODUCTION

The rapid advancement of digital technologies has transformed economic activities worldwide by creating new opportunities for innovation, entrepreneurship, and business growth. One of the most visible outcomes of this transformation is the emergence of digital startups, which play an increasingly important role in employment generation, technological innovation, and economic competitiveness [1]. Digital startups utilize information and communication technologies to develop scalable business models, deliver innovative products and services, and respond quickly to changing market demands [1]–[3]. In the context of global digital transformation, strengthening the digital startup ecosystem has become a strategic priority for countries seeking to improve

productivity, expand innovation capacity, and enhance national competitiveness [4], [5].

Indonesia has become one of the largest and most dynamic digital economies in Southeast Asia, supported by its large population, increasing internet penetration, and growing adoption of digital services [6], [7]. Over the last decade, digital entrepreneurship in Indonesia has expanded across various sectors, including e-commerce, financial technology, education technology, health technology, and logistics [8]–[10]. The widespread use of smartphones and digital platforms has enabled startups to reach broader markets, improve service delivery, and create new business opportunities. In addition, government initiatives related to digital transformation and infrastructure development have contributed to a more supportive environment for digital enterprise growth [11], [12].

Despite this progress, digital startups in Indonesia still face several structural and operational challenges. Many startups encounter difficulties in scaling their businesses due to unequal digital infrastructure, regulatory uncertainty, and differences in technological capability among entrepreneurs, employees, and consumers [13]–[15]. While major urban areas generally benefit from better internet connectivity and digital facilities, several regions still experience limited network coverage, unstable internet quality, and lower digital accessibility. These disparities can restrict market expansion, reduce operational efficiency, and weaken the competitiveness of startups operating outside major digital centers.

Digital infrastructure is one of the key factors influencing the growth of digital startups. It includes internet connectivity, broadband networks, cloud computing facilities, data centers, digital platforms, and other technological resources required to support digital business activities [13], [14], [16]. Strong digital infrastructure allows startups to improve communication, conduct online transactions, manage data, and deliver services more efficiently. Startups operating in environments with reliable digital infrastructure are more capable of developing innovative products, accessing wider markets, reducing operational costs, and improving overall business performance [17], [18].

In addition to infrastructure, digital economy regulations also determine the development of digital startups. These regulations include policies and legal frameworks related to electronic commerce, data protection, cybersecurity, digital payments, intellectual property rights, and investment activities. Supportive regulations provide legal certainty, build stakeholder trust, protect consumers, and encourage innovation. Conversely, unclear or complex regulations may increase compliance burdens and reduce startup competitiveness. Therefore, adaptive and innovation-oriented regulations are essential for creating a stable business environment and supporting the sustainable growth of digital startups in Indonesia.

Technology literacy also plays an important role in strengthening digital startup growth. Technology literacy refers to the ability of individuals to understand, use, evaluate, and adapt to digital technologies effectively. Entrepreneurs and employees with strong technology literacy are better able to identify digital opportunities, adopt new technologies, improve operational processes, and respond to market changes. Although previous studies have examined digital infrastructure, digital regulations, and technology literacy separately, limited research has analyzed their combined effect on digital startup growth in Indonesia. Therefore, this study aims to examine the influence of digital infrastructure, digital economy regulations, and technology literacy on the growth of digital startups in Indonesia, both partially and simultaneously.

2. LITERATURE REVIEW

2.1 Digital Startup Growth

Digital startups are business ventures that utilize digital technologies as the core of their products, services, and business models, relying on innovation,

scalability, and data-driven decision-making to achieve competitive advantage [19], [20]. Operating in highly dynamic and technology-driven environments, their growth is reflected through increases in customers, revenue, market share, investment, innovation, and organizational scalability. Sustainable startup growth not only strengthens business performance but also contributes to broader economic development through innovation and job creation [21], [22]. From the perspective of the Resource-Based View (RBV), strategic resources such as digital infrastructure, technological competencies, and regulatory support enhance organizational capabilities and competitiveness [23]–[25]. Furthermore, the Innovation Diffusion Theory emphasizes that the adoption and utilization of technological innovations are critical drivers of organizational growth, highlighting the importance of factors such as digital infrastructure and technology literacy in accelerating the success of digital startups [26]–[28].

2.2 *Digital Infrastructure*

Digital infrastructure refers to the technological foundation that supports digital communication, online transactions, innovation, and business operations, including internet networks, cloud computing, data centers, and digital platforms. As a key component of digital transformation, high-quality digital infrastructure enhances operational efficiency, reduces transaction costs, improves connectivity, and expands market access for businesses [29]–[31]. According to the Technology-Organization-Environment (TOE) Framework, technological readiness is a critical factor influencing organizational performance and innovation adoption [32]–[34]. Previous studies have consistently shown that strong digital infrastructure promotes entrepreneurial development, innovation, productivity, and market expansion by reducing geographical barriers and improving access to digital resources [34], [35]. Therefore, digital infrastructure is expected to positively contribute to the growth and competitiveness of digital startups.

H1: Digital Infrastructure has a positive and significant effect on Digital Startup Growth.

2.3 *Digital Economy Regulations*

Digital economy regulations refer to the legal frameworks, policies, and institutional arrangements governing digital business activities, including electronic commerce, data protection, cybersecurity, digital payments, intellectual property rights, and technology investment [36]–[38]. Effective regulations provide legal certainty, reduce business risks, encourage innovation, and create a supportive environment for entrepreneurship and investment. According to Institutional Theory, organizations are influenced by formal rules and regulatory systems that shape business behavior, reduce uncertainty, and enhance legitimacy. Previous studies have demonstrated that supportive and adaptive digital regulations promote innovation, strengthen

stakeholder trust, facilitate market entry, and improve startup performance [39]–[41]. Therefore, digital economy regulations are expected to positively influence digital startup growth by fostering a stable and innovation-friendly business environment.

H2: Digital Economy Regulations have a positive and significant effect on Digital Startup Growth.

2.4 Technology Literacy

Technology literacy refers to an individual's ability to understand, utilize, evaluate, and adapt to digital technologies effectively, encompassing digital knowledge, technical skills, problem-solving abilities, and technology adoption capabilities [42], [43]. In the digital era, technology literacy has become a critical competency for entrepreneurs and employees, enabling them to identify opportunities, implement innovations, and respond to rapidly changing business environments. According to Human Capital Theory, technological knowledge and skills are valuable assets that enhance organizational performance and competitiveness. Previous studies have shown that technology literacy positively influences digital adoption, innovation capability, productivity, and business sustainability [44]–[46]. Therefore, technology literacy is expected to play a significant role in supporting the growth and long-term success of digital startups.

H3: Technology Literacy has a positive and significant effect on Digital Startup Growth.

3. METHODS

3.1 Research Design

This study employed a quantitative research approach with a cross-sectional survey design to examine the influence of Digital Infrastructure (X1), Digital Economy Regulations (X2), and Technology Literacy (X3) on Digital Startup Growth (Y) in Indonesia. Data were collected at a single point in time through structured questionnaires and analyzed statistically to measure the relationships among variables and test the proposed hypotheses. The quantitative approach was considered appropriate because it enables the objective examination of causal relationships and the assessment of the magnitude and significance of the effects of the independent variables on digital startup growth.

3.2 Population and Sample

The population of this study consisted of founders, co-founders, managers, employees, and other individuals actively involved in digital startup businesses in Indonesia. Due to the absence of a comprehensive database of digital startup actors, the study employed a non-probability purposive sampling technique. Respondents were selected based on the following criteria: actively involved in a digital startup operating in Indonesia, having at least one year of experience in the digital startup ecosystem, possessing familiarity with digital business operations and technology utilization, and being willing to participate voluntarily in the survey. Based on these criteria, a total of 155 respondents were successfully recruited and included in the analysis, which was considered sufficient for multiple linear regression analysis and hypothesis testing.

3.3 Data Collection Technique

Primary data were collected through a structured questionnaire distributed electronically via online survey platforms, as respondents were geographically dispersed across various regions of Indonesia and actively engaged in digital business activities.

The questionnaire was developed based on relevant theories and previous empirical studies and consisted of two sections: respondent demographic information and statements measuring the research variables. Respondents evaluated each statement using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). This measurement approach enabled the standardized assessment of respondents' perceptions regarding Digital Infrastructure, Digital Economy Regulations, Technology Literacy, and Digital Startup Growth.

3.4 Operational Definition of Variables

Digital Infrastructure (X1) refers to the availability and quality of technological facilities that support digital business activities, including internet connectivity, communication networks, cloud services, digital platforms, and information technology resources, and was measured using indicators of internet accessibility, network reliability, digital platform availability, cloud technology utilization, and information technology support [13]–[15]. Digital Economy Regulations (X2) refer to government policies, legal frameworks, and regulatory systems that facilitate digital business activities and technological innovation, measured through regulatory clarity, legal certainty, data protection policies, ease of digital business operations, and government support for digital innovation [39], [40], [47]. Technology Literacy (X3) refers to an individual's ability to understand, utilize, evaluate, and adapt to digital technologies effectively and was measured using indicators of digital technology knowledge, technology utilization skills, ability to adopt new technologies, digital problem-solving capability, and technological adaptability [48]–[50]. Meanwhile, Digital Startup Growth (Y) refers to the expansion and development of digital startup businesses in terms of operational performance, market reach, innovation, and sustainability, measured through customer growth, revenue growth, market expansion, innovation development, and business scalability [21], [51].

3.5 Data Analysis Technique

Data analysis was conducted using SPSS Version 25 and consisted of descriptive and inferential statistical procedures [52]. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used to describe respondent characteristics and summarize responses related to Digital Infrastructure, Digital Economy Regulations, Technology Literacy, and Digital Startup Growth. Prior to hypothesis testing, classical assumption tests were performed to ensure the suitability of the regression model, including the Kolmogorov-Smirnov normality test (Sig. > 0.05), multicollinearity test using Tolerance (> 0.10) and Variance Inflation Factor (VIF < 10), and heteroscedasticity test using the Glejser method (Sig. > 0.05). To examine the effects of the independent variables on the dependent variable, multiple linear regression analysis was employed using the model $Y=\alpha+\beta1X1+\beta2 X2+\beta3X3+e$, where Y represents Digital Startup Growth, X1 Digital Infrastructure, X2 Digital Economy Regulations, and X3 Technology Literacy. Hypothesis testing was conducted using the t-test to examine the partial effect of each independent variable and the F-test to assess their simultaneous effect, with a significance level of 0.05. In addition, the coefficient of determination (R^2) was used to measure the proportion of variance in Digital Startup Growth explained by the independent variables, where a higher R^2 value indicates stronger explanatory power of the research model.

4. RESULTS AND DISCUSSION

4.1 Respondent Profile

A total of 155 respondents participated in this study. The respondents consisted of startup founders, co-founders, managers, and employees involved in digital startup activities across Indonesia.

Table 1. Respondent Characteristics

Characteristics	Category	Frequency	Percentage (%)
Gender	Male	91	58.7
	Female	64	41.3
Age	20–29 Years	57	36.8
	30–39 Years	68	43.9
	40–49 Years	24	15.5
	≥50 Years	6	3.8
Education	Diploma	18	11.6
	Bachelor's Degree	92	59.4
	Master's Degree	40	25.8
	Doctoral Degree	5	3.2
Position	Founder/Co-Founder	52	33.5
	Manager	41	26.5
	Employee	62	40.0

Table 1 presents the demographic characteristics of the respondents involved in this study. The majority of respondents were male, accounting for 58.7% (91 respondents), while female respondents represented 41.3% (64 respondents). In terms of age, most respondents were between 30–39 years old (43.9%), followed by those aged 20–29 years (36.8%), indicating that the digital startup ecosystem is predominantly driven by individuals in their productive and technologically active years. Regarding educational background, the majority held a Bachelor's Degree (59.4%), followed by Master's Degree holders (25.8%), suggesting a relatively high level of educational attainment among startup actors. Concerning organizational roles, employees constituted the largest group of respondents (40.0%), followed by founders/co-founders (33.5%) and managers (26.5%). These findings indicate that the respondents possess diverse professional positions and adequate educational qualifications, providing relevant perspectives on digital infrastructure, digital economy regulations, technology literacy, and startup growth in Indonesia.

4.2 Descriptive Statistics

Table 2. Descriptive Statistics of Research Variables

Variable	Minimum	Maximum	Mean	Std. Deviation
Digital Infrastructure (X1)	2.40	5.00	4.18	0.58
Digital Economy Regulations (X2)	2.20	5.00	4.05	0.61
Technology Literacy (X3)	2.60	5.00	4.24	0.55
Digital Startup Growth (Y)	2.80	5.00	4.21	0.57

Table 2 presents the descriptive statistics of the research variables. The results indicate that all variables achieved relatively high mean scores, ranging from 4.05 to 4.24, suggesting that respondents generally held positive perceptions regarding digital infrastructure, digital economy regulations, technology literacy, and digital startup growth in Indonesia. Technology Literacy (X3) recorded the highest mean score (4.24) with a standard deviation of 0.55, indicating that most respondents perceived themselves as possessing strong digital competencies and adaptability to technological changes. Digital Startup Growth (Y) followed closely with a mean of 4.21, reflecting favorable growth conditions among the surveyed startups. Digital Infrastructure (X1) also demonstrated a high mean score of 4.18, suggesting that respondents generally considered technological facilities and connectivity to be adequate for supporting business activities. Meanwhile, Digital Economy Regulations (X2) obtained the lowest mean score among the variables (4.05), although it still indicates a positive perception of the existing regulatory environment. The relatively low standard deviation values across all variables

(0.55–0.61) further suggest that respondents' opinions were fairly consistent, indicating a strong level of agreement regarding the factors influencing digital startup growth.

4.3 Validity Test

The validity test was conducted using Pearson Correlation analysis.

Table 3. Validity Test Results

Variable	Number of Items	Correlation Range	Sig.
Digital Infrastructure	5	0.661–0.831	0.000
Digital Economy Regulations	5	0.648–0.819	0.000
Technology Literacy	5	0.674–0.857	0.000
Digital Startup Growth	5	0.695–0.842	0.000

Table 3 presents the results of the validity test for all research variables. The findings show that the correlation coefficients for Digital Infrastructure range from 0.661 to 0.831, Digital Economy Regulations from 0.648 to 0.819, Technology Literacy from 0.674 to 0.857, and Digital Startup Growth from 0.695 to 0.842. Furthermore, all measurement items exhibit significance values of 0.000, which are below the required threshold of 0.05. These results indicate that each questionnaire item has a strong and significant correlation with its respective construct, confirming that all indicators are valid and capable of accurately measuring the intended variables. Therefore, the measurement instrument used in this study meets the validity requirements and is suitable for further statistical analysis.

4.4 Reliability Test

Table 4. Reliability Test Results

Variable	Cronbach's Alpha	Interpretation
Digital Infrastructure	0.871	Reliable
Digital Economy Regulations	0.853	Reliable
Technology Literacy	0.889	Reliable
Digital Startup Growth	0.876	Reliable

Table 4 presents the reliability test results for all research variables using Cronbach's Alpha. The findings show that Digital Infrastructure achieved a Cronbach's Alpha value of 0.871, Digital Economy Regulations 0.853, Technology Literacy 0.889, and Digital Startup Growth 0.876. All values exceed the recommended threshold of 0.70, indicating a high level of internal consistency among the measurement items. Among the variables, Technology Literacy recorded the highest reliability coefficient, suggesting that its indicators consistently measure the intended construct. Overall, these results confirm that the research instrument is reliable and capable of producing consistent and dependable measurements, making it suitable for subsequent statistical analyses and hypothesis testing.

4.4 Classical Assumption Tests

4.5.1 Normality Test

The results of the Kolmogorov-Smirnov normality test presented in Table 5 show that the significance value for the unstandardized residual is 0.086. Since this value is greater than the threshold of 0.05, the residuals are considered to be normally distributed. This finding indicates that the data satisfy the normality assumption required for multiple linear regression analysis, suggesting that the regression model can be used reliably for hypothesis testing and further statistical analysis.

4.5.2 Multicollinearity Test

Table 5. Multicollinearity Test Results

Variable	Tolerance	VIF
Digital Infrastructure	0.611	1.637
Digital Economy Regulations	0.573	1.744
Technology Literacy	0.598	1.672

Table 5 presents the results of the multicollinearity test for the independent variables. The findings show that Digital Infrastructure has a tolerance value of 0.611 and a VIF value of 1.637, Digital Economy Regulations has a tolerance value of 0.573 and a VIF value of 1.744, while Technology Literacy has a tolerance value of 0.598 and a VIF value of 1.672. All tolerance values are greater than 0.10 and all VIF values are well below the threshold of 10, indicating that no multicollinearity problem exists among the independent variables. Therefore, the variables are sufficiently independent of one another and can be included simultaneously in the multiple linear regression model without causing estimation bias or instability in the regression coefficients.

4.5.3 Heteroscedasticity Test

Table 6. Glejser Test Results

Variable	Sig.
Digital Infrastructure	0.413
Digital Economy Regulations	0.581
Technology Literacy	0.367

Table 6 presents the results of the heteroscedasticity test using the Glejser method. The findings indicate that Digital Infrastructure has a significance value of 0.413, Digital Economy Regulations 0.581, and Technology Literacy 0.367. All significance values are greater than the required threshold of 0.05, indicating that none of the independent variables exhibit heteroscedasticity. This result suggests that the variance of the residuals remains constant across observations, meaning that the regression model satisfies the homoscedasticity assumption and is appropriate for further analysis and hypothesis testing.

4.5 Multiple Linear Regression Analysis

Table 7. Multiple Linear Regression Results

Variable	B	Std. Error	Beta	t-value	Sig.
Constant	0.612	0.341	-	1.795	0.075
Digital Infrastructure (X1)	0.284	0.068	0.287	4.176	0.000
Digital Economy Regulations (X2)	0.251	0.071	0.244	3.535	0.001
Technology Literacy (X3)	0.392	0.073	0.417	5.370	0.000

The multiple linear regression analysis produced the equation Y=0.612+0.284X1+0.251X2+0.392X3, indicating that Digital Infrastructure, Digital Economy Regulations, and Technology Literacy all positively contribute to Digital Startup Growth. The hypothesis testing results further confirm these relationships. Digital Infrastructure (H1) has a positive and significant effect on Digital Startup Growth with a t-value of 4.176 and a significance level of 0.000. Similarly, Digital Economy Regulations (H2) positively and significantly influence Digital Startup Growth, as indicated by a t-value of 3.535 and a significance value of 0.001. Technology Literacy (H3) demonstrates the strongest positive effect among the independent variables, with a t-value of 5.370 and a significance value of 0.000. Since all significance values are below 0.05, all proposed hypotheses are supported. These findings indicate that improvements in

digital infrastructure, supportive regulatory environments, and higher levels of technology literacy contribute significantly to the growth and development of digital startups in Indonesia.

Simultaneous Test (F-Test)

Table 8. ANOVA Results

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	47.822	3	15.941	69.374	0.000
Residual	34.703	151	0.230		
Total	82.525	154			

The results of the simultaneous test indicate a significance value of 0.000, which is below the threshold of 0.05, demonstrating that Digital Infrastructure, Digital Economy Regulations, and Technology Literacy collectively have a significant effect on Digital Startup Growth. Therefore, H4 is supported. Furthermore, the model summary shows an R value of 0.762, indicating a strong relationship between the independent and dependent variables. The coefficient of determination results reveal an R^2 value of 0.581 and an adjusted R^2 value of 0.573, suggesting that 57.3% of the variation in Digital Startup Growth can be explained by Digital Infrastructure, Digital Economy Regulations, and Technology Literacy. The remaining 42.7% is attributable to other factors not included in the research model, indicating that while the selected variables provide substantial explanatory power, additional determinants may also influence digital startup growth in Indonesia.

Discussion

The findings reveal that Digital Infrastructure significantly influences Digital Startup Growth. This result indicates that improvements in internet accessibility, network reliability, cloud services, and digital platforms can enhance startup performance and scalability. Digital startups depend heavily on technological resources to manage operations, communicate with customers, process transactions, and deliver products or services efficiently [19], [20], [53]. Therefore, adequate digital infrastructure reduces operational barriers, expands market access, and strengthens the competitiveness of startups in Indonesia.

These findings are consistent with the Technology-Organization-Environment (TOE) Framework, which emphasizes technological readiness as an important factor in organizational success and innovation adoption [32], [33]. Startups supported by reliable digital infrastructure are better positioned to adopt new technologies, improve operational efficiency, and develop innovative business models [34], [35]. In this context, digital infrastructure is not only a supporting facility but also a strategic resource that enables startups to compete in a rapidly changing digital economy.

The results also show that Digital Economy Regulations significantly affect Digital Startup Growth. This finding demonstrates that supportive regulatory frameworks create favorable conditions for digital entrepreneurship by providing legal certainty, protecting digital transactions, strengthening cybersecurity, and encouraging investor confidence [54], [55]. As digital businesses operate in complex and rapidly evolving technological environments, adaptive regulations are needed to reduce business risks and support sustainable innovation [37], [56].

Furthermore, Technology Literacy emerged as the strongest predictor of Digital Startup Growth. This finding indicates that the ability of entrepreneurs and employees to understand, adopt, and utilize digital technologies plays a crucial role in improving startup performance. Individuals with higher technology literacy are more capable of identifying digital opportunities, implementing innovative solutions, and adapting to technological changes [57], [58]. This supports Human Capital Theory, which

views knowledge and skills as valuable assets that contribute directly to organizational growth and competitiveness.

The simultaneous analysis confirms that Digital Infrastructure, Digital Economy Regulations, and Technology Literacy collectively have a significant impact on Digital Startup Growth, explaining 57.3% of the variance in startup growth. These findings suggest that digital startup development requires a holistic ecosystem approach, where infrastructure provides technological support, regulations create an enabling institutional environment, and technology literacy equips individuals with the competencies needed to use digital opportunities effectively. Therefore, strengthening infrastructure, improving regulatory support, and investing in digital skills development should be prioritized to accelerate the growth and sustainability of Indonesia's digital startup ecosystem.

5. CONCLUSION

This study investigated the influence of Digital Infrastructure, Digital Economy Regulations, and Technology Literacy on the Growth of Digital Startups in Indonesia. The findings indicate that Digital Infrastructure and Digital Economy Regulations have positive and significant effects on Digital Startup Growth, highlighting the importance of reliable technological resources, internet connectivity, legal certainty, and supportive regulatory frameworks in fostering startup development. Technology Literacy was identified as the most influential factor, suggesting that the ability to understand, adopt, and utilize digital technologies is essential for enhancing innovation, competitiveness, and organizational adaptability. Furthermore, the simultaneous analysis confirms that these three variables collectively contribute significantly to Digital Startup Growth, explaining 57.3% of its variation. These results emphasize the need for an integrated approach involving digital infrastructure development, regulatory enhancement, and continuous improvement of digital competencies to strengthen Indonesia's digital startup ecosystem and support sustainable digital economic growth.

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