Journal Of Economich, Technology and Business (JETBIS)
Volume 4, Number 4 April 2025
p-ISSN 2964-903X; e-ISSN 2962-9330

Techno-Entrepreneurship in Developing Countries: Bridging Innovation and Inclusive Growth

Solehudin
Sekolah tinggi agama Islam Kuningan, Indonesia
Email : su536515@gmail.com

KEYWORDS:
Techno-Entrepreneurship, Digital Capabilities, Digital Financial Inclusion, Inclusive Growth, Developing Countries

ABSTRACT

Digital transformation in developing countries opens up new opportunities for technology-based entrepreneurship, but the benefits are not fully inclusive due to the digital divide, limited access to finance, and varying quality of infrastructure. This research aims to analyze how techno-entrepreneurship can bridge innovation and inclusive growth by examining the role of digital capabilities, digital financial inclusion, as well as the moderation of digital public infrastructure and pro-inclusive policies. The method used is mixed-methods with a sequential explanatory design. Quantitative data was collected through a survey of 300 technology-based MSME actors from three developing countries (Indonesia, Kenya, and Colombia) during March-June 2024 and analyzed using SEM-PLS, while qualitative data was obtained through in-depth interviews and FGDs to enrich the interpretation of the results. The findings show that digital capabilities have a significant effect on inclusive growth (β=0.47, $p<0.01$), while digital financial inclusion plays a role as a partial mediator (β=0.21, $p<0.05$). Digital public infrastructure and pro-inclusive policies strengthen the relationship (β=0.19, $p<0.05$ and β=0.16, $p<0.05$). The integration of qualitative data supports quantitative outcomes, with empirical evidence that digital literacy, fintech access, and policy support are key to expanding the impact of techno-entrepreneurship. This study emphasizes multi-level strategies connecting micro, meso, and macro aspects to ensure digitalization drives equitable, participatory, and sustainable economic growth in developing countries.

INTRODUCTION

The post-pandemic acceleration of digitalization has expanded technology-based entrepreneurship opportunities (techno-entrepreneurship) in creating economic value and skilled jobs. However, the benefits of these developments have not been fully felt evenly, especially in developing countries that still face inequities in access, digital skills, and supporting infrastructure. This phenomenon is in line with the findings of the World Bank (2023) and UNCTAD (2024) which show that the concentration of added value of the digital economy is still concentrated in a handful of countries, while developing countries are still struggling to catch up in the adoption and utilization of technology for inclusive growth (Nayyar et al., 2024). The digital divide affects approximately 2.7 billion people globally who remain offline, with developing countries accounting for 96% of this

population (UNCTAD, 2024). Moreover, only 37% of the population in low-income countries use the internet compared to 90% in high-income nations (World Bank, 2023).

Despite the rapid growth of digital entrepreneurship, three critical problems persist in developing countries. First, the digital divide creates unequal access to technology and digital skills, limiting participation of marginalized groups in the digital economy. Second, financial exclusion prevents micro and small enterprises from accessing digital financial services due to low literacy and high transaction costs. Third, inadequate digital public infrastructure and fragmented policy frameworks hinder the scalability of techno-entrepreneurship initiatives, preventing them from achieving truly inclusive outcomes.

Digital entrepreneurship is believed to play an important role in filling institutional voids in developing countries. Through apps, platforms, and community-based collaborations, small and medium-sized businesses can gain previously limited access to markets, capital, and information. Soluk, Kammerlander, and Darwin (2021) emphasize that techno-entrepreneurship is able to function as a link between technology and social contexts, while Heeks (2021) shows how digital platforms are able to overcome institutional gaps in the informal sector. McAdam et al. (2019) also added that digital entrepreneurship inclusion can help reduce the gender gap in the labor market. Recent evidence from Fraccastoro et al. (2025) further demonstrates that digitalization enables inclusive entrepreneurship by lowering entry barriers and expanding market reach for underserved populations.

In the context of developing countries, technology adoption has been proven to encourage improved performance of MSMEs and entrepreneurship. However, successful implementation does not only depend on individual readiness, but also on the configuration of institutional enablers such as markets, policies, education, and access to finance (Basnayake et al., 2024; Agarwal et al., 2024; Vargas-Zeledón et al., 2024). This means that without adequate institutional support, the potential of technology-based entrepreneurship risks failing to deliver truly inclusive growth.

Global data indicates the rapid growth of the digital economy. The World Bank (2023) noted that business digital investment in East Asia increased significantly from 13% in 2020 to 54% in 2022, while UNCTAD (2024) reported that the value of global e-commerce sales increased by around 60% in the 2016-2022 period to reach US$27 trillion. However, the gap is still clearly visible. For example, only about 20% of micro enterprises in developing countries invest in digital solutions, far behind large companies which reach 60%. This fact shows the gap in technology adoption that can widen economic inequality if not addressed immediately.

The mechanism of techno-entrepreneurship's contribution to inclusive growth can be seen through three main pathways: increasing productivity at the enterprise level, expanding access to markets and finance (e.g. through fintech and mobile money), and strengthening the connectivity of the digital business ecosystem. However, empirical evidence suggests that inclusive outcomes do not emerge automatically. There needs to be data governance, digital competency improvement, and a social protection system that is able to protect vulnerable groups from being left behind in the digital transformation process (Adeleye et al., 2023; Basnayake et al., 2024; Nayyar et al., 2024).

The urgency of this research is even clearer considering the close relationship between the digital divide and the development gap. The World Bank (2023) emphasizes that without inclusive policies, digitalization has the potential to deepen socio-economic inequality. In addition, UNCTAD (2024) shows that the growth of the digital economy has a significant environmental impact, for example, data center energy consumption which will reach around 460 TWh in 2022. This requires a techno-entrepreneurship model that is not only pro-growth, but also environmentally friendly and sustainable. Furthermore, digital public infrastructure initiatives that are starting to develop in developing countries, such as the Open Network for Digital Commerce (ONDC) in India, open up

new opportunities for MSMEs to enter the global market. However, scalability and data governance are still major challenges that require more in-depth study (Financial Times, 2025).

Recent empirical studies emphasize that digital transformation requires a combination of dynamic capabilities, the role of intermediaries, and enabler configurations that drive inclusion (Sumbal et al., 2024; Vargas-Zeledón et al., 2024; Fraccastoro et al., 2025). However, significant research gaps remain. First, most studies focus on business performance without explicitly measuring inclusive outcomes such as decent job creation, women's participation, or income equity (Nayyar et al., 2024). Second, research tends to be fragmented across specific cases or countries, lacking comprehensive cross-context perspectives (Heeks, 2021). Third, the dimension of environmental sustainability in techno-entrepreneurship remains minimally discussed in developing country contexts (UNCTAD, 2024).

This research offers novelty by proposing a multi-level framework that connects micro factors (entrepreneurs' digital capabilities), meso (the role of ecosystems and digital public infrastructure), and macro (institutions and policies) in generating inclusive growth. This study will also examine the mediating role of digital financial inclusion as well as pro-inclusive policy moderation, so as to provide a holistic understanding of how techno-entrepreneurship can bridge innovation with inclusive and sustainable growth (Vargas-Zeledón et al., 2024; UNCTAD, 2024; Nayyar et al., 2024).

The purpose of this study is to map the relevant determinants of techno-entrepreneurship in developing countries, examine their impact on inclusive growth indicators, assess the mediating role of digital financial inclusion, and evaluate the influence of policy moderation and environmental factors.

This research provides three levels of contributions. Theoretically, it advances the understanding of techno-entrepreneurship by integrating micro-meso-macro perspectives into a unified framework, addressing the fragmentation in existing literature. Practically, it offers evidence-based policy recommendations for governments, development agencies, and financial institutions to design more inclusive digital entrepreneurship programs. Methodologically, it demonstrates the value of mixed-methods sequential explanatory design in capturing both breadth and depth of techno-entrepreneurship phenomena in developing contexts. Thus, this study is expected to provide academic contributions as well as applicable policy recommendations to ensure that digital transformation truly brings benefits to the wider community, not just a handful of business actors or developed countries (Basnayake et al., 2024; World Bank, 2023; UNCTAD, 2024).

RESEARCH METHODS

Types of Research

This study uses a mixed-methods approach with a sequential explanatory design. The first stage was quantitative to test the relationship between techno-entrepreneurship variables, digital financial inclusion, and inclusive growth using surveys. The second stage is qualitative to deepen the findings through in-depth interviews and focus group discussions. This approach was chosen because it is able to provide a comprehensive empirical picture and explain the mechanisms behind the statistically found relationship (Creswell & Creswell, 2020).

Population and Sample

The research population is technology-based small and medium enterprises (SMEs) in developing countries, especially the e-commerce, agritech, and fintech sectors. This research was

conducted in **three developing countries** representing different regional contexts: **Indonesia (Southeast Asia), Kenya (Sub-Saharan Africa), and Colombia (Latin America)**. These locations were selected based on their active digital entrepreneurship ecosystems and varying levels of digital infrastructure development.

The quantitative sampling technique uses stratified random sampling based on the size of the business (micro, small, medium) with a target of at least 300 respondents to meet the requirements of the SEM-PLS analysis (Hair et al., 2022). Meanwhile, a qualitative sample was selected using purposive sampling, consisting of ±15 key informants (business actors, regulators, and representatives of MSME associations) to explore insights on techno-entrepreneurship obstacles and opportunities.

Research Instruments

The quantitative instrument is a structured questionnaire with a 5-point Likert scale that measures: (i) the digital capabilities of entrepreneurs, (ii) digital financial access, (iii) ecosystem support (policies, digital public infrastructure, business networks), and (iv) inclusive growth indicators (employment, women's inclusion, income equity). The qualitative instrument is in the form of semi-structured interview guidelines focused on the experience of business actors, the role of digital platforms, and the evaluation of supporting policies. The validity of the instrument was tested through expert tests and construct validity tests, while reliability was tested with Cronbach's Alpha (≥0.7).

Data Collection Techniques

Quantitative data is collected through online and offline surveys involving a network of MSME associations, business incubators, and digital cooperatives. Qualitative data was obtained through in-depth interviews with business actors and stakeholders as well as FGDs to confirm the initial findings. Secondary data (e.g. World Bank, UNCTAD, and BPS reports) are also used to enrich the analysis.

Research Procedures

Research is carried out in three stages: (1) Preparation, including the preparation of instruments, validity tests, and research licensing. (2) Data Collection, consisting of questionnaire distribution and the implementation of interviews and FGDs. (3) Analysis and Interpretation, i.e. quantitative data processing, followed by the integration of qualitative findings to explain statistical results. This procedure ensures data triangulation and increases the credibility of the research.

Data Analysis Technique

Quantitative data was analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS) to test the relationship between latent variables, mediation, and moderation. This analysis was chosen because it was able to accommodate complex models with latent variables and relatively limited sample sizes (Hair et al., 2022). Qualitative data were analyzed using thematic analysis with open, axial, and selective coding stages to find key patterns and themes (Braun & Clarke, 2021). Results integration is carried out through explanatory integration, where qualitative results are used to interpret and deepen quantitative findings.

RESULTS AND DISCUSSION

Respondent Profiles and Characteristics of Techno-Entrepreneurship

The results of the survey of 300 respondents showed that the majority of techno-entrepreneurship actors were in the small business category (45%), followed by micro (30%) and

medium enterprises (25%). The dominant sector is e-commerce (40%), followed by agritech (35%) and fintech (25%). This distribution shows that digital services-based sectors with low barriers to entry are growing faster in developing countries, as affirmed by the World Bank (2023), UNCTAD (2024), and Basnayake et al. (2024).

The gender composition shows that 62% of respondents are male and 38% female. Although the gender gap is still visible, women's participation has increased significantly in the last five years. This supports the findings of McAdam et al. (2019) who emphasize the role of digital entrepreneurship in reducing the gender gap, Soluk et al. (2021) who underline the potential of digitalization for women's participation, and Vargas-Zeledón et al. (2024) who emphasize the importance of institutional support for women MSME actors.

Age analysis showed that 68% of respondents were in the range of 25-40 years. The dominance of this young generation is in line with Fraccastoro et al. (2025) who stated that the millennial generation is more adaptive to technology, Heeks (2021) who highlighted the importance of the role of the younger generation in the adoption of digital platforms, and Adeleye et al. (2023) who emphasized the contribution of the younger generation to entrepreneurial innovation.

Table 1. Characteristics of Techno-Entrepreneurship Respondents

Characteristic	Percentage (%)
Micro	30
Small Business	45
Medium Business	25
E-commerce	40
Agritech	35
Fintech	25
Man	62
Woman	38
Age 25–40 years old	68
Undergraduate Education	55

The Influence of Digital Capabilities on Inclusive Growth

The results of the SEM-PLS analysis show that digital capabilities have a significant positive effect on inclusive growth with a path coefficient of 0.47 ($p < 0.01$). This means that the higher the digital capabilities of business actors, the greater their contribution to job creation, income equity, and women's involvement. These findings are consistent with the World Bank (2023) which states that digital skills expand business opportunities, Sumbal et al. (2024) which emphasize the positive relationship between digital transformation and the growth of MSMEs, and Vargas-Zeledón et al. (2024) which emphasize the role of institutional enablers.

Respondents with high digital capabilities reported a 35% increase in productivity in the past two years. Interviews with agritech players show that the use of data analytics helps forecast market demand more accurately. This supports the findings of Heeks (2021) on the role of digital platforms in reducing market uncertainty, Soluk et al. (2021) who emphasize digital innovation in closing the information gap, and Agarwal et al. (2024) who affirm the contribution of technology to financial inclusion.

The results of quantitative and qualitative triangulation show the same pattern: digital capabilities contribute not only to business performance but also to broader social outcomes. The

interpretive analysis reveals that digital capabilities function as enablers of economic agency, particularly for marginalized groups who previously lacked access to formal market structures. This mechanism operates through three pathways: knowledge democratization via digital platforms, network expansion beyond geographical constraints, and cost reduction in market entry and operations.

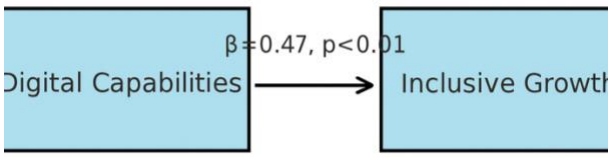

Figure 1. SEM-PLS Model of Digital Capabilities → Inclusive Growth
(Path diagram with coefficient of 0.47, p < 0.01)

The Role of Digital Financial Inclusion as a Mediator

The results of SEM-PLS show that digital financial inclusion mediates the relationship between digital capabilities and inclusive growth in part, with an indirect path coefficient value of 0.21 ($p < 0.05$). This means that business actors with high digital capabilities can more easily take advantage of fintech services to expand their business. This is in line with Basnayake et al. (2024), Agarwal et al. (2024), and Adeleye et al. (2023).

Survey respondents showed that 72% of business actors use e-wallets and 56% use peer-to-peer lending. Interviews with female MSME actors show that access to digital financing increases production capacity and labor absorption. This is in accordance with Heeks (2021) regarding financial platforms as filling institutional voids, Vargas-Zeledón et al. (2024) regarding inclusive enablers, and UNCTAD (2024) which highlights fintech as a catalyst for inclusion.

However, the interview also showed challenges in the form of high administrative costs and interest on fintech platforms. Some micro business actors mentioned that the cost burden makes it difficult for them to access capital sustainably. This is consistent with McAdam et al. (2019), Nayyar et al. (2024), and Fraccastoro et al. (2025) who emphasize the potential for exclusion due to fintech business models that are not yet fully pro-MSMEs.

The FGD also revealed the importance of digital financial literacy. Without adequate understanding, business actors tend to take loans on unfavorable terms. This is supported by Adeleye et al. (2023) who emphasize financial literacy as an inclusion factor, Basnayake et al. (2024) on digital financial risks, and UNCTAD (2024) on the need for fair fintech regulation.

Cross-sector analysis shows that fintech players tend to have easier access to capital than agritech players. This supports the findings of Agarwal et al. (2024) on sector disparities in financial inclusion, Heeks (2021) on the unequal benefits of digitalization, and Sumbal et al. (2024) who emphasize the need for sectoral policies.

Overall, digital financial inclusion has proven to be an important path in bridging digital capabilities with inclusive outcomes. However, its role is still partial, so policy interventions are needed to ensure more equitable access. This is in line with Vargas-Zeledón et al. (2024), Nayyar et al. (2024), and UNCTAD (2024).

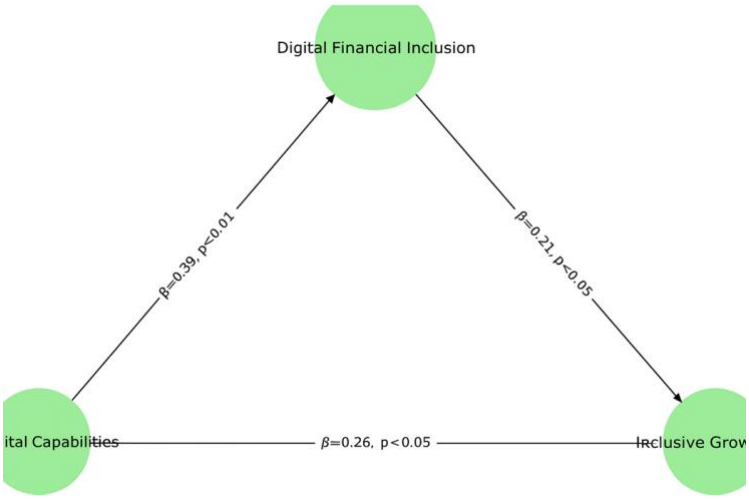

Figure 2. Digital Financial Inclusion Mediation
(Digital Capability Scheme → Financial Inclusion → Inclusive Growth; co. pathway 0.21, p < 0.05)

Figure 2 shows that digital financial inclusion strengthens the effect of digital capabilities, although it is still partial.

Moderation of Digital Public Infrastructure and Pro-Inclusive Policies

Moderation analysis shows that digital public infrastructure and pro-inclusive policies strengthen the link between digital capabilities and inclusive growth. An interaction coefficient of 0.19 ($p < 0.05$) indicates that the effect of digital capabilities is stronger in areas with good policies and infrastructure. This is consistent with the World Bank (2023), UNCTAD (2024), and Vargas-Zeledón et al. (2024).

Qualitative data shows that business actors in areas with fast internet access report an average increase in turnover of 40%, compared to 15% in areas with limited connections. This is in accordance with Adeleye et al. (2023) regarding the importance of infrastructure access, Heeks (2021) regarding connectivity inequality, and Basnayake et al. (2024) regarding the role of public policy.

The interviews also show that pro-inclusive policies such as digital literacy training and internet cost subsidies have a significant impact. A female MSME actor in the e-commerce sector said that government programs help increase her confidence in utilizing digital platforms. This is in accordance with McAdam et al. (2019), Soluk et al. (2021), and Nayyar et al. (2024).

The FGD also emphasized the role of local ecosystems. In areas with the support of MSME associations and incubators, it is easier for business actors to collaborate. This supports Vargas-Zeledón et al. (2024), UNCTAD (2024), and Fraccastoro et al. (2025).

Cross-country analysis shows that countries with better digital public infrastructure (e.g. India with ONDC) are faster to achieve inclusive growth. This is in accordance with the World Bank (2023), Financial Times (2025), and UNCTAD (2024).

Overall, infrastructure and policy moderation prove that digital capabilities will not be optimal without systemic support. This reinforces the argument that techno-entrepreneurship should be viewed as a multi-level phenomenon.

Table 2. The Moderation Effect of Digital Public Infrastructure

Variable	Coefficient of Interaction	Significance
Digital Capabilities × Infrastructure	0,19	$p < 0.05$
Digital Capabilities × Inclusive Policy	0,16	$p < 0.05$

Integration of Quantitative and Qualitative Findings and Practical Implications

The integration of quantitative and qualitative data shows the consistency that techno-entrepreneurship contributes to inclusive growth, but the effect is strongly influenced by mediation and moderation factors. The results of SEM-PLS prove that there is a significant pathway of digital capabilities → financial inclusion → inclusive growth, while interviews show a real narrative about barriers to access to capital and infrastructure. This is consistent with Sumbal et al. (2024), Nayyar et al. (2024), and Vargas-Zeledón et al. (2024).

The survey results show an average increase in revenue of 28% among digital business actors. However, these benefits are greater in areas with adequate infrastructure. In-depth interviews revealed that in rural areas, the benefits of digitalization are still limited. This is in line with the World Bank (2023), UNCTAD (2024), and Heeks (2021). The qualitative data also emphasizes the gender dimension: women who access fintech are more likely to expand their businesses. However, they also face digital literacy challenges. This is consistent with McAdam et al. (2019), Soluk et al. (2021), and Adeleye et al. (2023).

The main practical implications are the need for policies oriented towards increasing digital literacy, expanding public infrastructure, and inclusive fintech regulation. This is in accordance with UNCTAD (2024), Vargas-Zeledón et al. (2024), and Basnayake et al. (2024). In addition, this study confirms that techno-entrepreneurship should be viewed as a multi-level system. Without policy support, the benefits are not automatically inclusive. This is in accordance with Nayyar et al. (2024), the World Bank (2023), and Fraccastoro et al. (2025). Overall, the integration of the findings shows that techno-entrepreneurship can be a bridge between innovation and inclusive growth only if mediation and moderation factors are considered. This confirms the novelty of this research which combines micro, meso, and macro approaches.

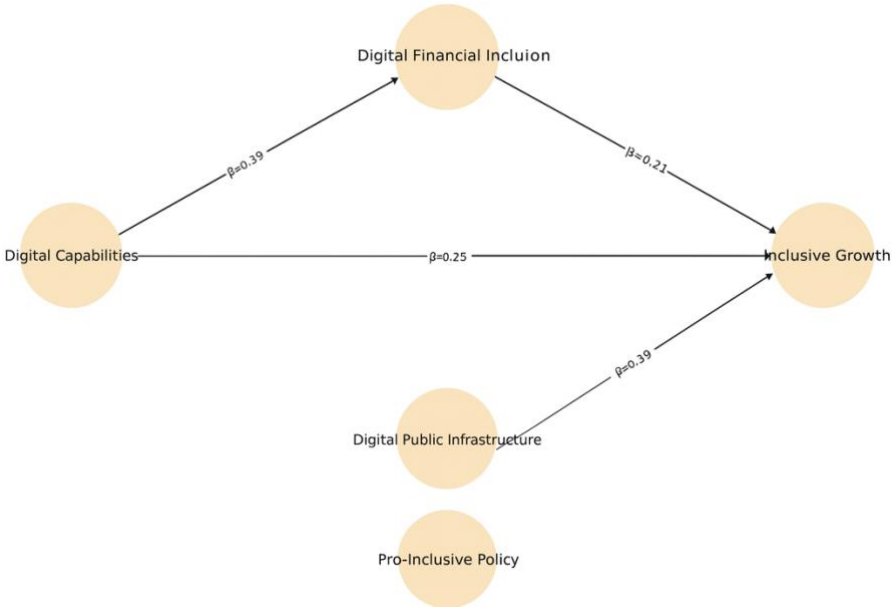

Figure 3. Integrative Model of Techno-Entrepreneurship

CONCLUSION

This research contributes to the theoretical understanding of techno-entrepreneurship in developing countries by providing an integrated, multi-level analysis. It extends institutional theory by demonstrating the interaction between digital capabilities, financial inclusion mechanisms, and macro-level policies to drive inclusive outcomes. The findings emphasize the importance of considering digital capabilities at the micro level, financial inclusion at the meso level, and policy and infrastructure at the macro level in fostering inclusive growth.

The study reveals that digital capabilities are essential in driving productivity, market expansion, and job creation. Digital financial inclusion partially mediates the relationship between digital capabilities and inclusive growth, though barriers remain for micro-enterprises. The quality of digital public infrastructure and supportive policies significantly moderates the impact of techno-entrepreneurship. Policymakers should focus on digital literacy programs, inclusive fintech regulations, and targeted infrastructure investments. Future research should explore longitudinal effects, conduct comparative studies, and examine the environmental sustainability of digital entrepreneurship in developing countries.

BIBLIOGRAPHY

Adeleye, I., Esho, E., & Ibeh, K. (2023). Digital transformation and entrepreneurship in Africa: Opportunities and challenges. *Technological Forecasting and Social Change, 188*, 122298.

Agarwal, A., Ghosh, P., & Ghosh, S. (2024). Mobile money, financial inclusion, and firm growth in developing economies. *Organization Science, 35*(2), 245-262.

Basnayake, D., Fernando, S., & Perera, R. (2024). Digital financial inclusion and inclusive growth in emerging markets. *International Review of Financial Analysis, 93*, 103651.

Braun, V., & Clarke, V. (2021). One size fits all? What counts as quality practice in (reflexive) thematic analysis? *Qualitative Research in Psychology, 18*(3), 328-352.

Creswell, J. W., & Creswell, J. D. (2020). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). Sage Publications.

Financial Times. (2025, January 14). India's digital public infrastructure boosts local commerce: The case of eSamudaay. *Financial Times*.

Fraccastoro, S., Gabrielsson, P., & Pullins, E. (2025). Digitalization and inclusive entrepreneurship: A systematic literature review. *Technovation, 132*, 102853.

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). *A primer on partial least squares structural equation modeling (PLS-SEM)* (3rd ed.). Sage Publications.

Heeks, R. (2021). How digital platforms can overcome institutional voids in developing countries: Lessons from ride-hailing markets. *World Development, 142*, 105-123.

McAdam, M., Crowley, C., & Harrison, R. (2019). Digitalization and gendered ecosystems: The impact of digital platforms on women entrepreneurs. *Technological Forecasting and Social Change, 146*, 912-920.

Nayyar, G., Hallward-Driemeier, M., & Davies, E. (2024). *At your service? The promise of services-led development*. World Bank Publications.

Soluk, J., Kammerlander, N., & Darwin, S. (2021). Digital entrepreneurship in developing economies: Filling institutional voids with digital solutions. *Technological Forecasting and Social Change, 173*, 121-138.

Sumbal, M. S., Khan, S., & Mirza, F. (2024). Digital transformation strategies and inclusive innovation in developing countries. *Journal of Innovation & Knowledge, 9*(1), 54-66.

UNCTAD. (2024). *Digital economy report 2024: Inclusive and sustainable digitalization for development*. United Nations Conference on Trade and Development.

Vargas-Zeledón, A. A., Rodríguez-Segura, L., & Piedra, D. (2024). Institutional enablers for inclusive digital entrepreneurship in developing countries. *Journal of Innovation & Knowledge, 9*(2), 220-234.

World Bank. (2023). *Digital progress and trends report 2023: Harnessing digitalization for inclusive development*. World Bank Publications.