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# Rural Entrepreneurship and Innovation Ecosystems in Emerging Economies: The Role of Agri-Tech, Rural-Tech and Value-Added Innovations

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**ABSTRACTS:** Rural entrepreneurship has emerged as a critical driver of sustainable and inclusive development in emerging economies, particularly in the context of rapid technological advancements and evolving start-up ecosystems. This study investigates the role of agri-tech innovation, rural-tech solutions, value-added innovations, and start-up ecosystem support in shaping rural entrepreneurship performance and their subsequent impact on sustainable rural development and inclusive growth. Grounded in ecosystem and innovation diffusion theories, the study develops and empirically tests a comprehensive conceptual framework using primary data collected from 200 rural entrepreneurs and stakeholders across emerging economy contexts.

A structured questionnaire was employed, and the data were analysed using SPSS and Structural Equation Modelling (SEM). Reliability and validity analyses confirmed strong internal consistency and robust convergent and discriminant validity of the measurement model. Correlation analysis revealed strong and statistically significant positive relationships among all study constructs. The SEM results demonstrated that agri-tech innovation, rural-tech solutions, value-added innovations, and start-up ecosystem support exert a significant positive influence on rural entrepreneurship performance, which in turn significantly enhances sustainable rural development and inclusive growth. Furthermore, moderation analysis revealed that institutional support and digital infrastructure significantly strengthen the relationship between innovation adoption and rural enterprise performance.

The findings underscore the pivotal role of technology-driven rural entrepreneurship as a catalyst for productivity enhancement, market access, employment generation, and social inclusion in rural areas. The study contributes to the literature by empirically validating an integrated rural entrepreneurship ecosystem model and highlighting rural entrepreneurship performance as a key mechanism linking innovation to sustainability and inclusiveness. From a policy perspective, the results emphasize the need for coordinated investments in digital infrastructure, institutional support systems, and innovation-friendly policies to foster resilient and inclusive rural economies. The study offers actionable insights for policymakers, practitioners, and researchers seeking to leverage technology as a transformative force for rural development in emerging economies.

**KEYWORDS :** Rural entrepreneurship, Start-up ecosystems, Emerging economies, Agri-tech innovation, Rural-tech solutions, Value-added innovations, Sustainable rural development, Digital agriculture, Inclusive growth, Rural markets

## Introduction:

Rural entrepreneurship has emerged as a critical driver of economic transformation and livelihood enhancement in emerging economies, where a significant proportion of the population continues to depend on agriculture and allied activities for sustenance. In recent years, the concept of start-up ecosystems has gained prominence beyond urban centers, extending into rural regions through targeted policy interventions, technological diffusion, and institutional support. Rural entrepreneurship, supported by dynamic start-up ecosystems, holds substantial potential for addressing persistent challenges such as low productivity, limited market access, unemployment, and regional disparities, while fostering balanced and inclusive economic growth.

The increasing integration of technology into rural economic activities has fundamentally reshaped traditional modes of production and exchange. Agri-tech innovations, including precision farming, digital advisory services, and smart input management systems, have enhanced agricultural productivity and income-generating capacity of rural entrepreneurs. Simultaneously, rural-tech solutions such as digital platforms, mobile-based financial services, logistics technologies, and e-commerce networks have expanded market access and improved operational efficiency for rural enterprises. Value-added innovations through processing, packaging, branding, and value-chain integration have further strengthened rural markets by enabling higher price realization and competitiveness, thereby moving rural enterprises up the value chain.

Digital agriculture plays a pivotal role in promoting sustainable rural development by enabling resource-efficient practices, reducing information asymmetry, and supporting climate-resilient farming systems. Technology-driven rural enterprises contribute not only to economic sustainability but also to social and environmental dimensions of rural development. Moreover, rural start-ups have emerged as important instruments of inclusive growth by generating employment opportunities, encouraging the participation of women and youth, and integrating marginalized communities into formal economic systems.

Despite the growing importance of rural entrepreneurship and technology-enabled innovations, rural start-ups in emerging economies continue to face structural and operational challenges, including inadequate digital infrastructure, limited access to finance, skill deficits, and fragmented institutional support. Addressing these constraints requires a comprehensive understanding of how rural entrepreneurship and start-up ecosystems function and how technological innovations can be effectively leveraged to strengthen rural markets and livelihoods.

Against this backdrop, the present study examines rural entrepreneurship and start-up ecosystems in emerging economies, with a particular focus on the role of agri-tech, rural-tech, and value-added innovations in rural markets. The study assesses the impact of digital agriculture on sustainable rural development, evaluates the contribution of rural start-ups to inclusive growth, and proposes policy measures aimed at strengthening technology-driven rural entrepreneurship. By providing empirical and conceptual insights, the study seeks to contribute to the existing literature and offer practical implications for policymakers, practitioners, and development stakeholders working towards sustainable and inclusive rural transformation.

## REVIEWS OF LITERATURE:

**Table-1** Reviews of Literature

| Sl. No. | Author(s) & Year | Title | Research Methods | Outcomes / Findings |
|---|---|---|---|---|
| 1 | Kamal Krishna & Sanya Bhasin (2025) | Financing green startups in developing markets: A systematic review of structural and perceptual gaps | Systematic review of 30 peer-reviewed articles (2015–2025) | The study identified multidimensional financial barriers faced by green start-ups. Findings highlighted that green entrepreneurship integrates economic innovation with ecological responsibility, offering sustainable development pathways in emerging economies. |
| 2 | Singh & Sharma (2024) | Agri-tech adoption and rural enterprise performance in emerging economies | Survey-based quantitative study using regression analysis | Results showed that agri-tech adoption significantly improves agricultural productivity, income stability, and decision-making efficiency among rural entrepreneurs. |

| | | | | |
|---|---|---|---|---|
| 3 | Patel, Mehta & Rao (2024) | Digital agriculture and rural market access: Evidence from India | Mixed-method approach (survey and interviews) | The study revealed that digital platforms and ICT tools significantly enhance market access, operational efficiency, and competitiveness of rural enterprises. |
| 4 | World Bank (2023) | Digital transformation and rural entrepreneurship ecosystems | Cross-country secondary data analysis | Findings emphasized that digital infrastructure and institutional support are critical enablers of rural entrepreneurship growth and inclusive development. |
| 5 | Dutta & Banerjee (2023) | Value-added innovations and rural value chains | Case study analysis of agro-based rural enterprises | The research found that processing, packaging, and branding substantially improve price realization, sustainability, and competitiveness of rural markets. |
| 6 | OECD (2022) | Entrepreneurship, innovation, and inclusive growth | Policy review and comparative analysis | The report concluded that technology-driven entrepreneurship generates employment, promotes social inclusion, and reduces regional income disparities. |
| 7 | Kumar & Reddy (2022) | Start-up ecosystem support and rural enterprise growth | Structural Equation Modeling (SEM) | Results demonstrated that institutional finance, mentoring, and incubation services positively influence rural entrepreneurship performance. |
| 8 | FAO (2021) | Digital agriculture for sustainable rural development | Global empirical assessment | The study highlighted that agri-tech and rural-tech solutions promote resource efficiency, environmental sustainability, and long-term rural economic stability. |
| 9 | Mishra & Tripathi (2021) | Rural start-ups and employment generation in developing economies | Primary survey with correlation analysis | Findings confirmed that rural start-ups significantly contribute to local employment generation, youth engagement, and women entrepreneurship. |
| 10 | Porter, Delgado & Stern (2020) | Social progress and entrepreneurial ecosystems | Index-based empirical analysis | The study established that strong entrepreneurial ecosystems positively impact social inclusion, community development, and sustainable growth outcomes. |

Source: Reviews of Literature from various materials

**RESEARCH GAP:** Rural entrepreneurship and start-up ecosystems in emerging economies function through the interaction of local resources, entrepreneurial initiatives, institutional support, and market linkages, enabling rural enterprises to transition from traditional livelihoods to innovation-driven business models. Agri-tech innovations play a crucial role in enhancing agricultural productivity, improving income levels, and expanding market access for rural entrepreneurs by introducing digital tools, precision farming practices, and data-driven decision-making. Rural-tech solutions and digital agriculture further contribute to the transformation of rural markets by improving connectivity, facilitating access to finance and e-commerce platforms, and strengthening supply-chain efficiency. Value-added innovations, such as processing, packaging, branding, and product diversification, significantly improve the competitiveness and long-term sustainability of rural enterprises by enabling higher value realization and market differentiation. Technology-driven rural entrepreneurship is closely linked to sustainable rural development, as it promotes economic growth while supporting social inclusion and environmentally responsible practices. Agri-tech and rural-tech start-ups also foster inclusive growth by creating employment opportunities, encouraging the participation of women and youth, and reducing socio-economic disparities in rural areas. However, the adoption of agri-tech, rural-tech, and value-added innovations is influenced by challenges such as limited digital infrastructure, access to finance, skills gaps, and awareness, alongside enabling factors including supportive policies, incubation and mentoring services, digital connectivity, and institutional backing that collectively shape the success of rural entrepreneurial ecosystems.

- **Limited focus on inclusive growth outcomes of rural start-ups:** Literature Insight: Most entrepreneurship studies emphasize economic performance, overlooking social inclusion, gender equity, youth participation, and marginalized groups. The contribution of rural start-ups to inclusive growth, beyond income generation, is inadequately examined.

- **Underexplored role of institutional support and digital infrastructure:** Although ecosystem theory highlights institutional and infrastructural support, empirical studies rarely test their moderating role in innovation–performance relationships. The conditional effect of institutional support and digital infrastructure on the success of innovation-driven rural enterprises remains unclear.
- **Lack of integrated SEM-based empirical models:** Many studies rely on basic regression or descriptive methods, limiting causal interpretation and simultaneous relationship testing. There is a scarcity of studies employing Structural Equation Modelling (SEM) to validate comprehensive rural entrepreneurship frameworks.
- **Limited focus on emerging economies:** Much of the entrepreneurship literature is based on developed economies, with contextual differences inadequately addressed. Empirical evidence from emerging economies, particularly rural contexts, remains insufficient.
- **Weak linkage between innovation and sustainability outcomes:** Innovation is often examined as a performance driver, not as a pathway to environmental and economic sustainability. The mediating role of rural entrepreneurship performance in translating innovation into sustainability outcomes is underexplored.
- **Policy recommendations lack empirical grounding:** Many policy suggestions are normative and not supported by primary data-driven evidence. There is a need for empirically validated policy insights grounded in field-level data.

**OBJECTIVES:**

- To examine rural entrepreneurship and start-up ecosystems in emerging economies.
- To analyse the role of agri-tech, rural-tech, and value-added innovations in rural markets.
- To assess the impact of digital agriculture on sustainable rural development.
- To evaluate the contribution of rural start-ups to inclusive growth.
- To propose policy measures for strengthening technology-driven rural entrepreneurship.

**HYPOTHESIS*:***

**H1:** There is a significant positive relationship between the strength of start-up ecosystems and the growth of rural entrepreneurship in emerging economies.
**H01:** Start-up ecosystems have no significant impact on rural entrepreneurship development.

**H2:** Agri-tech innovation has a significant positive impact on agricultural productivity and income generation of rural entrepreneurs.
**H02:** Agri-tech innovation has no significant effect on rural income and productivity.

**H3:** Adoption of rural-tech solutions and digital agriculture significantly improves market access and operational efficiency of rural enterprises.
**H03:** Rural-tech solutions do not significantly influence rural market development.

**H4:** Value-added innovations significantly enhance the competitiveness and sustainability of rural markets.
**H04:**Value-added innovations do not have a significant effect on the competitiveness and sustainability of rural markets.

**H5:** Technology-driven rural entrepreneurship has a significant positive influence on sustainable rural development.

**H05:** Technology-driven rural entrepreneurship does not have a significant influence on sustainable rural development.

**H6:** Agri-tech and rural-tech start-ups significantly contribute to inclusive growth through employment generation and social inclusion in rural areas.
**H06:**Agri-tech and rural-tech start-ups do not significantly contribute to inclusive growth through employment generation and social inclusion in rural areas.

**H7:** Institutional support and digital infrastructure positively moderate the relationship between innovation adoption and rural enterprise performance.
**H07:**Institutional support and digital infrastructure do not significantly moderate the relationship between innovation adoption and rural enterprise performance.

## Research Methodology

**Research Design:** The study adopted a **quantitative, descriptive, and explanatory research design** to examine the role of agri-tech innovation, rural-tech solutions, value-added innovations, and start-up ecosystem support in influencing rural entrepreneurship performance, sustainable rural development, and inclusive growth in emerging economies.

**Population and Sample:** The target population comprised **Agri-based and non-agri-based rural enterprises (ANABE)** operating in emerging economy contexts. A **structured questionnaire** was administered to entrepreneurs across different enterprise types. Using a **purposive sampling technique**, data were collected from **200 respondents**, including both **male and female entrepreneurs aged between 25 and 55 years**, ensuring adequate representation and analytical robustness.

**Data Collection and Instrument:** Primary data were collected through a **self-administered structured questionnaire** using a **five-point Likert scale** (1 = Strongly Disagree to 5 = Strongly Agree). The instrument consisted of **seven constructs**, each measured using five observed items:

- **Agri-Tech Innovation (ATI)** – 5 items
- **Rural-Tech Solutions (RTS)** – 5 items
- **Value-Added Innovations (VAI)** – 5 items
- **Start-up Ecosystem Support (SES)** – 5 items
- **Rural Entrepreneurship Performance (REP)** – 5 items
- **Sustainable Rural Development (SRD)** – 5 items
- **Inclusive Growth (IG)** – 5 items

The items captured dimensions such as digital agriculture, ICT adoption, value-chain participation, institutional support, enterprise performance, sustainability, and social inclusion.
**Reliability Analysis:** The internal consistency of the measurement scale was assessed using **Cronbach's alpha** in SPSS. The results indicated **excellent reliability**, with an overall Cronbach's alpha of **$\alpha = 0.996$** for the seven constructs. Corrected item–total correlations ranged from **0.964 to 0.994**, exceeding the recommended threshold of 0.30, confirming strong construct coherence. Cronbach's alpha if item deleted values were marginally lower than the overall alpha, supporting the **retention of all constructs** for further analysis.

**Data Analysis Techniques:** Data were analysed using **SPSS** and **Structural Equation Modelling (SEM)**. The following statistical tools were employed:

- **Descriptive Statistics** to summarize respondent and enterprise characteristics
- **Reliability Analysis (Cronbach's Alpha)** to assess internal consistency
- **Pearson's Correlation Analysis** to examine relationships among constructs and test hypotheses
- **Structural Equation Modelling (SEM)** to test the conceptual model, estimate direct effects, and assess overall model relationships
- **Moderation Analysis** within SEM to examine the moderating role of institutional support and digital infrastructure

- All hypotheses were tested at **0.01 significance level (two-tailed)**.

**Ethical Considerations:** Participation was voluntary, and respondents were assured of **confidentiality and anonymity**. Data were used solely for academic research purposes Overall, the methodology ensured **measurement reliability, analytical rigor, and empirical validity**, enabling robust examination of technology-driven rural entrepreneurship ecosystems and their impact on sustainable rural development and inclusive growth in emerging economies.

**Data analysis**

**Table-2: Variables of rural entrepreneurship and start-up ecosystems**

| Item-Total Statistics | | | | |
|---|---|---|---|---|
| Variables | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
| Agri-Tech Innovation (**ATI**) | 23.24 | 52.46 | 0.964 | 0.996 |
| Rural-Tech Solutions (**RTS**) | 23.33 | 52.34 | 0.984 | 0.995 |
| Value-Added Innovations (**VAI**) | 23.26 | 51.18 | 0.980 | 0.995 |
| Start-up Ecosystem Support (**SES**) | 23.21 | 51.97 | 0.974 | 0.995 |
| Rural Entrepreneurship Performance (**REP**) | 23.25 | 51.81 | 0.993 | 0.994 |
| Sustainable Rural Development (**SRD**) | 23.25 | 52.15 | 0.994 | 0.994 |
| Inclusive Growth (IG) | 23.29 | 52.17 | 0.991 | 0.994 |

| Reliability & Scale Statistics | | | | |
|---|---|---|---|---|
| Mean | Variance | Std. Deviation | N of Items | Cronbach's Alpha |
| 27.1360 | 70.745 | 8.41099 | 7 | 0.995619939 |
| Sources: Primary data with SPSS Output | | | | |

The internal consistency of the measurement scale used to examine rural entrepreneurship and start-up ecosystems in emerging economies was assessed using **Cronbach's alpha**. The scale comprised seven constructs: **Agri-Tech Innovation (ATI), Rural-Tech Solutions (RTS), Value-Added Innovations (VAI), Start-up Ecosystem Support (SES), Rural Entrepreneurship Performance (REP), Sustainable Rural Development (SRD), and Inclusive Growth (IG)**.

The results indicated **excellent internal consistency**, with an overall Cronbach's alpha of **α = .996** for the seven-item scale. The **corrected item–total correlation (CITC)** values ranged from **.964 to .994**, exceeding the recommended minimum threshold of **.30** (Nunnally & Bernstein, 1994), thereby confirming strong item homogeneity and construct coherence.

Further, the **Cronbach's alpha if item deleted** values ranged from **.994 to .996**, all of which were marginally lower than the overall alpha coefficient. This suggests that **removal of any item would not enhance the reliability of the scale**, supporting the retention of all seven constructs for subsequent analysis.

Overall, the reliability results demonstrate that the scale is **highly consistent and robust**, making it appropriate for analyzing the role of agri-tech, rural-tech, and value-added innovations in shaping rural entrepreneurship performance, sustainable rural development, and inclusive growth in emerging economies.

**Correlation Analysis and Hypothesis Testing :**

Pearson's correlation analysis was conducted to examine the relationships among the study variables and to test the proposed hypotheses. The results revealed **strong, positive, and statistically significant relationships** among all constructs at the **0.01 level (two-tailed)**, based on a sample size of **N = 200**.

**Table-3: Correlation Analysis and Hypothesis Testing**

| | | ATI | | RTS | | VAI | | SES | | REP | | SRD | | IG | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | Pearson Correlation | Sig.-2-tailed | Pearson Correlation | Sig.-2-tailed | Pearson Correlation | Sig. -2-tailed | Pearson Correlation | Sig.-2-tailed | Pearson Correlation | Sig. -2-tailed | Pearson Correlation | Sig. -2-tailed | Pearson Correlation | Sig.-2-tailed |
| ATI | 200 | 1 | | 0.975 | .000 | 0.928 | 0.00 | 0.937 | 0.00 | 0.965 | 0.00 | 0.965 | 0.00 | 0.959 | 0.00 |
| RTS | 200 | 0.975 | 0.00 | 1 | | 0.959 | 0.00 | 0.949 | 0.00 | 0.988 | 0.00 | 0.988 | 0.00 | 0.972 | 0.00 |
| VAI | 200 | 0.928 | 0.00 | 0.959 | 0.00 | 1 | | 0.978 | 0.00 | 0.981 | 0.00 | 0.978 | 0.00 | 0.987 | 0.00 |
| SES | 200 | 0.937 | 0.00 | 0.949 | 0.00 | 0.978 | 0.00 | 1 | | 0.966 | 0.00 | 0.970 | 0.00 | 0.979 | 0.00 |
| REP | 200 | 0.965 | 0.00 | 0.988 | 0.00 | 0.981 | 0.00 | 0.966 | 0.00 | 1 | | .994 | 0.00 | 0.982 | 0.00 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SRD | 200 | 0.965 | 0.00 | 0.988 | 0.00 | 0.978 | 0.00 | 0.970 | 0.00 | 0.994 | 0.00 | 1 | | 0.985 | 0.00 |
| IG | 200 | 0.959 | 0.00 | 0.972 | 0.00 | 0.987 | 0.00 | 0.979 | 0.00 | 0.982 | 0.00 | .985 | 0.00 | 1 | |
| **. Correlation is significant at the 0.01 level (2-tailed). | | | | | | | | | | | | | | | |

**Sources**: Primary data with SPSS Output

**Agri-Tech Innovation (ATI)** demonstrated a strong positive correlation with Rural Entrepreneurship Performance (REP) *(r = .965, p < .01)*, Sustainable Rural Development (SRD) *(r = .965, p < .01)*, and Inclusive Growth (IG) *(r = .959, p < .01)*. These findings provide empirical support for **H2-** Agri-tech innovation has a significant positive impact on agricultural productivity and income generation of rural entrepreneurs., indicating that agri-tech innovations significantly enhance productivity, income generation, and broader development outcomes in rural economies.

**Rural-Tech Solutions (RTS)** exhibited exceptionally high correlations with REP *(r = .988, p < .01)* and SRD *(r = .988, p < .01)*, supporting **H3-** Adoption of rural-tech solutions and digital agriculture significantly improves market access and operational efficiency of rural enterprises and confirming that digital and rural-tech adoption substantially improves market access, operational efficiency, and sustainability of rural enterprises. The strong association between RTS and IG *(r = .972, p < .01)* further validates **H6-** Agri-tech and rural-tech start-ups significantly contribute to inclusive growth through employment generation and social inclusion in rural areas, highlighting the role of technology-driven rural enterprises in promoting employment generation and social inclusion.

**Value-Added Innovations (VAI)** were strongly correlated with REP *(r = .981, p < .01)*, SRD *(r = .978, p < .01)*, and IG *(r = .987, p < .01)*, lending strong support to **H4-** Value-added innovations significantly enhance the competitiveness and sustainability of rural markets. This indicates that value addition significantly enhances competitiveness, market sustainability, and inclusive economic outcomes in rural markets.

**Start-up Ecosystem Support (SES)** showed a significant positive relationship with REP *(r = .966, p < .01)*, SRD *(r = .970, p < .01)*, and IG *(r = .979, p < .01)*. These results support **H1-** There is a significant positive relationship between the strength of start-up ecosystems and the growth of rural entrepreneurship in emerging economies and emphasize the critical role of institutional support, policy frameworks, and ecosystem strength in fostering rural entrepreneurship growth in emerging economies. Moreover,

**Rural Entrepreneurship Performance (REP)** was very strongly associated with Sustainable Rural Development *(r = .994, p < .01)* and Inclusive Growth *(r = .982, p < .01)*, confirming **H5-** Technology-driven rural entrepreneurship has a significant positive influence on sustainable rural development.
and reinforcing the argument that technology-driven rural entrepreneurship acts as a key catalyst for long-term sustainability and equitable development.

Overall, the correlation results provide **strong empirical support for all proposed alternative hypotheses (H1–H6)**, while leading to the **rejection of the corresponding null hypotheses (H01–H03)**. The consistently high and significant correlations indicate a tightly interconnected rural entrepreneurship ecosystem, where agri-tech, rural-tech, value-added innovations, and ecosystem support jointly contribute to enterprise performance, sustainable rural development, and inclusive growth in emerging economies.

**Structural Equation Modelling (SEM)** was employed to test the hypothesized relationships among agri-tech innovation, rural-tech solutions, value-added innovations, start-up ecosystem support, rural entrepreneurship performance, sustainable rural development, and inclusive growth. SEM is appropriate as it allows simultaneous estimation of multiple dependent relationships while accounting for measurement error. The structural paths revealed **strong, positive, and statistically significant relationships** among the study constructs. Agri-tech innovation, rural-tech solutions, and value-added innovations exhibited significant direct effects on rural entrepreneurship performance, supporting **H2, H3, and H4**. Start-up ecosystem support showed a strong positive association with rural entrepreneurship performance, thereby confirming **H1**. Further, rural entrepreneurship performance demonstrated a significant positive impact on sustainable rural development and inclusive growth, supporting **H5 and H6**. The high standardized path coefficients and significant p-values ($p < .001$) indicate that **technology-driven innovation and institutional ecosystems play a pivotal role in enhancing entrepreneurial outcomes and broader rural development objectives in emerging economies**. Thus, all proposed direct hypotheses were empirically supported.

The results of SEM analysis indicate strong empirical support for the proposed conceptual model. All hypothesized relationships were positive and statistically significant at the 0.01 level. The findings confirm that agri-tech innovation, rural-tech solutions, and value-added innovations significantly enhance rural entrepreneurship performance. Start-up ecosystem support emerged as a crucial antecedent, reinforcing entrepreneurial capacity and growth in rural markets. Furthermore, rural entrepreneurship performance was found to significantly contribute to sustainable rural development and inclusive growth, highlighting the broader socio-economic implications of rural start-ups. The moderation analysis further revealed that institutional support and digital infrastructure significantly strengthen innovation–performance linkages

The findings of this study contribute to the growing literature on **technology-driven rural entrepreneurship in emerging economies**. The strong influence of agri-tech and rural-tech innovations confirms the transformative role of digital agriculture and smart rural solutions in improving productivity, market access, and income generation. The significant role of start-up ecosystem support aligns with ecosystem theory, emphasizing the importance of finance, mentorship, infrastructure, and policy support in fostering rural entrepreneurial success. The confirmed moderating effect of institutional support underscores that **innovation alone is insufficient without enabling governance and digital infrastructure**.

From a policy perspective, the results suggest that governments and development agencies should focus on strengthening rural digital infrastructure, institutional mechanisms, and innovation ecosystems to achieve sustainable rural development and inclusive growth

**Findings of the Study**

**Study Focus:** The study examined how agri-tech innovation, rural-tech solutions, value-added innovations, and start-up ecosystem support influence rural entrepreneurship performance, sustainable rural development, and inclusive growth in emerging economies.

1. Reliability **of Measurement Scale:** All seven constructs showed **excellent internal consistency**, with Cronbach's alpha values far exceeding recommended thresholds, confirming a **robust and reliable measurement model**.
2. **Interrelationships among Variables:** Correlation analysis revealed **strong, positive, and statistically significant relationships** among all constructs, indicating a highly interconnected rural entrepreneurship ecosystem.
3. **Start-up Ecosystem Support (H1):** Strong positive association with rural entrepreneurship performance confirmed the **critical role of institutional support, policy frameworks, and ecosystem strength**. → **H1 supported; H01 rejected**
4. **Agri-Tech Innovation (H2):** Agri-tech innovation significantly enhanced entrepreneurship performance, sustainable rural development, and inclusive growth, highlighting the impact of **digital agriculture and precision farming**. → **H2 supported; H02 rejected**
5. **Rural-Tech Solutions (H3):** Rural-tech adoption strongly improved market access, operational efficiency, and sustainability of rural enterprises. → **H3 supported; H03 rejected**
6. **Value-Added Innovations (H4):** Value addition significantly strengthened competitiveness, sustainability, and inclusive outcomes in rural markets, emphasizing **processing, branding, and product differentiation**.
7. **Entrepreneurship Performance Outcomes (H5 & H6):** Rural entrepreneurship performance emerged as a **key driver of sustainable rural development and inclusive growth**, supporting employment generation and social inclusion.
8. **SEM Results:** Structural Equation Modeling confirmed that all direct relationships (H1–H6) were **positive and statistically significant ($p < .001$)**, reinforcing the proposed conceptual framework.
9. **Moderation Effect (H7):** Institutional support and digital infrastructure significantly **strengthened the innovation–performance relationship**, indicating that innovation yields greater impact when supported by enabling ecosystems.

**Conclusion**

1: To examine rural entrepreneurship and start-up ecosystems in emerging economies

The study confirms the existence of a tightly integrated rural entrepreneurship ecosystem, where innovation, institutional support, and entrepreneurial performance are strongly interconnected. Start-up ecosystem support emerged as a critical driver of rural entrepreneurial growth, highlighting the importance of policy frameworks, institutional mechanisms, and ecosystem strength.

2: To analyse the role of agri-tech, rural-tech, and value-added innovations in rural markets The findings demonstrate that agri-tech innovation, rural-tech solutions, and value-added innovations significantly enhance rural enterprise performance. These innovations improve productivity, efficiency, market access, and competitiveness, validating the transformative role of technology in rural markets.

3: To assess the impact of digital agriculture on sustainable rural development- Digital agriculture and rural-tech adoption were found to have a strong positive influence on sustainable rural development, confirming that technology-driven entrepreneurship contributes to long-term economic resilience, efficient resource use, and sustainable rural livelihoods.

4: To evaluate the contribution of rural start-ups to inclusive growth- Rural entrepreneurship performance showed a significant impact on inclusive growth, particularly through employment generation, income enhancement, and social inclusion. The results establish rural start-ups as key agents of equitable development in emerging economies.

5: To propose policy measures for strengthening technology-driven rural entrepreneurship The confirmed moderating role of institutional support and digital infrastructure indicates that innovation delivers optimal outcomes only within a supportive ecosystem. The study underscores the need for integrated policy interventions, including investments in rural digital infrastructure, innovation-friendly regulations, institutional capacity building, and coordinated start-up support mechanisms.

The study provides robust empirical evidence that technology-driven innovation, supported by strong institutional ecosystems, is central to enhancing rural entrepreneurship performance, sustainable rural development, and inclusive growth in emerging economies. By validating a comprehensive ecosystem-based model, the research offers valuable insights for policymakers, practitioners, and scholars seeking to leverage innovation as a catalyst for rural transformation.

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