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LEVERAGING ICT FOR INNOVATION AND START-UP CULTURE IN HIGHER EDUCATION: A STRATEGIC FRAMEWORK FOR ENTREPRENEURIAL COMPETENCY DEVELOPMENT

Samina Mustafa

M.Phil. Scholar Department of Education, PMAS, Arid Agriculture University Rawalpindi

mustafasamina69@gmail.com

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Corresponding Author: *
Samina Mustafa

Abstract
This study explores the factors influencing the integration of Information and Communication Technology (ICT) in entrepreneurial education at tertiary institutions. The research focuses on three key variables: ICT training, institutional support, and the availability of ICT tools, examining their impact on both lecturers' and students' engagement with ICT. A mixed-methods approach was used, combining quantitative data from surveys and qualitative insights from interviews with students and lecturers. Descriptive statistics highlighted the moderate to high levels of ICT use among students and lecturers, as well as positive attitudes toward ICT integration. Regression analysis revealed that institutional support had the strongest positive influence on ICT integration, followed by the availability of tools and ICT training. The findings suggest that while ICT tools are available, their effective integration relies heavily on institutional policies, infrastructure, and continuous training for educators. The study concludes with recommendations to improve ICT adoption, including enhanced training programs, increased institutional support, and better access to ICT resources. These efforts will not only enhance the quality of entrepreneurial education but also better prepare students for the digital economy.

INTRODUCTION

The 21st century has witnessed a dramatic shift in the global socio-economic landscape, with technology becoming a critical driver of innovation, economic growth, and job creation. One of the most significant outcomes of this digital revolution is the emergence of entrepreneurship as a viable, dynamic, and highly valued career path—particularly among youth. As traditional job markets continue to shrink due to automation, outsourcing, and evolving skill demands, there is a growing consensus that entrepreneurial education, underpinned by modern technological tools, must be reimagined to empower students in higher education to become creators of opportunities rather than seekers of employment (World Economic Forum, 2020).

Information and Communication Technology (ICT) has transformed every aspect of human interaction and productivity, from business operations and public services to learning environments. In the context of tertiary education, ICT offers immense potential not only as a delivery mechanism for content but also as a tool to enhance critical thinking, collaborative problem-solving, and innovative ideation (UNESCO, 2019). These are essential competencies for

entrepreneurship in a fast-changing, knowledge-based economy. While many institutions have taken initial
steps toward incorporating ICT in various academic disciplines, its strategic application in entrepreneurship education remains fragmented and underexplored, particularly in developing and transitional economies (Okoli & Watt, 2021).

Entrepreneurial education is no longer confined to teaching students how to draft business plans or analyze market trends. It has evolved into an experiential, multidimensional domain that encourages risk-taking, opportunity recognition, resilience, and innovation (Fayolle & Gailly, 2015). The integration of ICT into this evolving domain can amplify learning outcomes by offering immersive experiences through simulations, virtual labs, online incubation platforms, digital collaboration tools, and access to global entrepreneurial networks (Rae, 2020). Furthermore, digital storytelling, gamified learning, and real-time business modeling using ICT tools can create transformative educational experiences that reflect the realities of modern entrepreneurship (Moberg et al., 2014).

Despite the apparent benefits, the practical integration of ICT in entrepreneurial education faces multiple challenges. These include a lack of trained faculty, insufficient ICT infrastructure, curriculum rigidity, resistance to change, and limited policy support (Ali et al., 2020). Moreover, many tertiary institutions operate in environments where the gap between theoretical instruction and practical entrepreneurial exposure is substantial. Therefore, addressing these challenges requires a strategic and systemic framework that not only incorporates ICT tools into the curriculum but also aligns institutional goals, industry expectations, and technological advancements (Adejimola & Olufunmilayo, 2009).

This study is driven by the urgent need to rethink how entrepreneurial education is designed and delivered in higher education institutions. It seeks to explore how ICT can be effectively leveraged to foster innovation, enhance start-up culture, and build entrepreneurial competencies among university students. Specifically, the paper aims to identify strategic interventions, best practices, and institutional policies that support the sustainable integration of ICT in entrepreneurship programs. The study also considers the role of industry-academia partnerships, government support, and global digital trends in shaping an enabling ecosystem for student-led innovation (OECD, 2021).

By adopting a holistic approach, this research contributes to the growing body of literature on educational innovation and entrepreneurship while offering practical recommendations for policymakers, academic leaders, and educators. In doing so, it aspires to support the development of a new generation of digitally empowered entrepreneurs equipped with the knowledge, skills, and mindset to navigate uncertainty and drive inclusive economic growth (García-Peñalvo et al., 2016).

Research Objectives:

To examine the current level of ICT integration in entrepreneurship education programs within tertiary institutions.

To identify the key challenges and enablers influencing the effective use of ICT tools for entrepreneurial competency development among students.

To propose a strategic framework for leveraging ICT to enhance start-up culture and innovation in higher education institutions.

Research Questions:

What is the extent of ICT integration in entrepreneurship education across tertiary institutions?

What are the main barriers and facilitators affecting the use of ICT in fostering entrepreneurial competencies among students?

How can a strategic ICT-based framework be developed to strengthen start-up culture and innovation in tertiary education?

Research Gap:

While numerous studies have explored ICT in general education and digital literacy, limited research has specifically examined the strategic

integration of ICT in entrepreneurship education at the tertiary level, particularly in developing contexts. Existing literature often treats entrepreneurship and ICT separately, failing to address how technology can be used not just as a teaching aid, but as a transformational tool to simulate real business experiences, foster innovation, and support student start-ups. Moreover, current models rarely provide actionable frameworks that institutions can adapt based on their infrastructural, economic, and cultural realities. This study aims to fill this gap by developing a context-sensitive, strategic framework for ICT integration in entrepreneurial education.

Significance of the study

Academic Contribution: It expands the body of knowledge on the intersection of ICT and entrepreneurial education by offering empirical insights and a conceptual framework that integrates pedagogy, technology, and innovation.

Policy Implications: The findings can guide policymakers and educational leaders in designing ICT-inclusive entrepreneurship curricula and funding models, particularly in developing countries where youth unemployment is high.

Institutional Development: Universities and colleges can utilize the proposed framework to enhance their teaching methods, promote start-up culture, and better prepare students for real-world entrepreneurial challenges.

Student Empowerment: By focusing on digital tools that support experiential learning, the study advocates for learner-centered environments that nurture critical thinking, creativity, and self-employment readiness among graduates.

Novelty of the Research:

This research is novel in its holistic approach to bridging the gap between ICT capabilities and entrepreneurial education by proposing a strategic, actionable framework tailored specifically for tertiary institutions. Unlike previous studies that either focus broadly on ICT in education or entrepreneurship training in isolation, this study uniquely integrates both domains to explore how ICT can be harnessed not just as a teaching tool but as a catalyst for student-led innovation and start-up culture. Additionally, it emphasizes contextual adaptability, offering solutions that are scalable and responsive to the unique infrastructural and socio-economic realities of developing countries. By incorporating digital incubation models, online collaboration, and experiential simulations, the research advances a transformative vision for entrepreneurship education that is future-ready and digitally empowered.

Framework of the study

This study is guided by a conceptual and strategic framework that integrates ICT tools, entrepreneurial education practices, and institutional strategies to enhance entrepreneurial competency and innovation in tertiary education. The framework consists of the following interconnected components:

1.6.1 Input Layer: Key Influencing Factors

These are the foundational elements that shape the effectiveness of ICT integration in entrepreneurial education:

Institutional Readiness (e.g., ICT infrastructure, management support, digital policies)
Faculty Competence (e.g., training in digital pedagogy, openness to innovation)

Student Digital Literacy (e.g., comfort with digital tools, online collaboration)
Policy and Government Support (e.g., educational reforms, funding for start-up)

1.6.2 Process Layer: ICT Integration Mechanisms

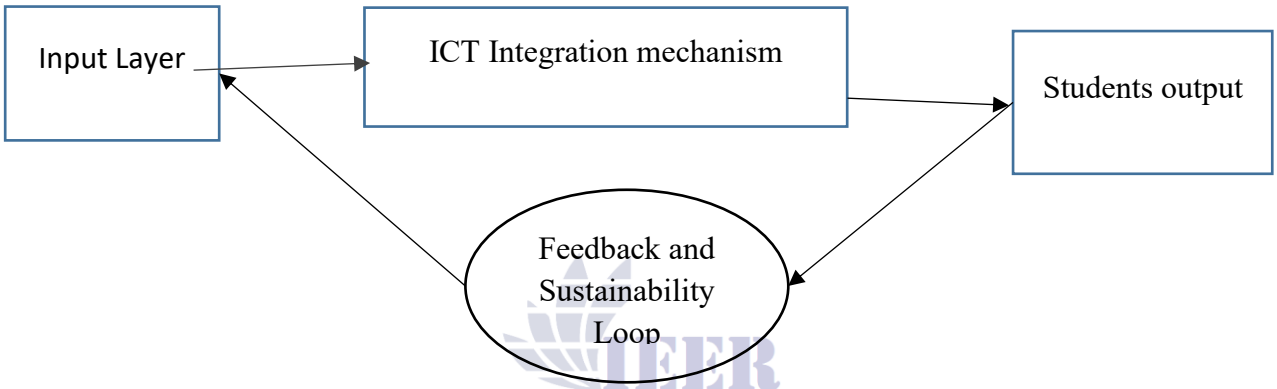
This layer represents how ICT is practically used to support entrepreneurial learning:
Digital Learning Platforms (LMS, MOOCs, e-content on entrepreneurship)

Simulation and Gamification (e.g., virtual business simulations, start-up games)

Virtual Incubators & E-Mentoring (e.g., online mentoring networks, business pitch platforms)

Collaborative and Experiential Tools (e.g., online brainstorming, hackathons, project management tools like Trello, Miro, etc.)

1.6.3 Output Layer: Student Outcomes
This includes the direct results of ICT-supported entrepreneurship education:
Entrepreneurial Competency Development (e.g., innovation, opportunity recognition, risk-taking, business planning)
Start-Up Readiness (e.g., launching projects, applying for funding, forming digital teams)
Enhanced Problem-Solving and Critical Thinking
1.6.4 Feedback and Sustainability Loop
To ensure continuous improvement and long-term impact, the framework includes:
Monitoring & Evaluation Systems (tracking effectiveness of ICT tools and learning outcomes)
Curriculum Review Cycles (updating content and tools based on feedback)
Partnership Development (engaging industry, alumni entrepreneurs, and tech incubators)



Conceptual framework

2. Literature Review

Entrepreneurship education has evolved as a crucial pillar in modern education systems, aiming not only to impart knowledge about business creation but also to foster innovation, resilience, and economic self-reliance among students (Fayolle & Gailly, 2015). In recent decades, the emergence of Information and Communication Technologies (ICT) has transformed traditional educational environments, offering new pathways for experiential and interactive learning. This convergence of ICT and entrepreneurship education has opened up unprecedented opportunities for reimagining how entrepreneurial competencies can be taught, practiced, and applied, particularly in tertiary institutions.

2.1 ICT in Education: A Transformational Tool

ICT has played a pivotal role in enhancing access to knowledge, fostering collaborative learning, and equipping students with digital skills essential for the 21st-century workforce. According to UNESCO (2019), ICT tools have the potential to revolutionize teaching and learning by facilitating learner-centered approaches, increasing motivation, and promoting creativity. In the context of higher education, ICT enables blended learning environments, virtual classrooms, and access to global learning resources (Ghavifekr & Rosdy, 2015). These tools are especially valuable in entrepreneurship education where simulations, online business modeling, and digital collaboration can create near-authentic entrepreneurial experiences (Moberg et al., 2014).

2.2 Entrepreneurship Education: From Theory to Practice

Entrepreneurship education has traditionally been criticized for its heavy reliance on theoretical instruction and it's disconnect from real-world entrepreneurial challenges (Rae, 2006). Modern approaches stress the importance of experiential learning, opportunity recognition, business

planning, and innovation. Nabi et al. (2017) assert that entrepreneurship education must go beyond cognitive learning to include behavioral and affective components such as confidence-building, creativity, and risk-taking. These competencies can be significantly enhanced through ICT-enabled learning environments that provide simulations, gamified exercises, and peer-to-peer learning platforms.

2.3 ICT and Entrepreneurial Competency Development

The integration of ICT into entrepreneurship education has been shown to strengthen entrepreneurial competencies by providing interactive learning platforms, access to global markets, and tools for digital business development. For instance, digital platforms such as Coursera and Edmodo allow students to engage with global case studies, collaborate on start-up projects, and access mentoring from successful entrepreneurs (García-Peñalvo et al., 2016). Virtual reality and simulation-based learning environments also allow students to engage in risk-free business decision-making exercises, which helps in developing critical thinking and strategic planning skills (Solomon et al., 2002).

Digital storytelling and social media platforms like LinkedIn, YouTube, and Twitter have also emerged as informal learning spaces where students can share ideas, receive feedback, and build entrepreneurial networks (Rae, 2020). These platforms not only enhance engagement but also contribute to identity formation and self-efficacy—two key elements in the entrepreneurial journey (Bandura, 1997).

2.4 Challenges in Integrating ICT in Entrepreneurship Education

Despite the clear benefits, several barriers hinder the strategic integration of ICT in entrepreneurship education. A major constraint is the lack of institutional readiness, particularly in low-resource settings. Ali et al. (2020) report that many tertiary institutions lack the necessary digital infrastructure and trained faculty to implement ICT-based pedagogy effectively. Furthermore, there is often resistance to change from traditional educators who are unaccustomed to student-centered, technology-enhanced learning environments (Okoli & Watt, 2021).

Another challenge is the gap between the skills imparted through the curriculum and those required in real entrepreneurial settings. Adejimola and Olufunmilayo (2009) highlight the issue of curriculum rigidity and outdated teaching methods that fail to capture the dynamic nature of entrepreneurship. As a result, students graduate with limited exposure to practical start-up experiences or digital business tools, reducing their capacity to launch and sustain ventures.

2.5 Strategic Integration and Policy Support

A growing body of literature emphasizes the need for a strategic and policy-driven approach to integrating ICT in entrepreneurship education. This includes revising curricula to include digital entrepreneurship modules, providing teacher training in ICT pedagogy, and forming partnerships with technology firms and incubators (OECD, 2021). Furthermore, institutions should focus on establishing digital incubation hubs, where students can receive mentorship, funding advice, and digital marketing support (Kuratko, 2005). These hubs act as real-world labs where theory meets practice.

A holistic framework should also consider the socio-cultural and economic context of the institutions. For example, in countries with limited internet access, mobile-based entrepreneurship platforms and offline digital tools may serve as more viable options (World Bank, 2020). The design and delivery of such programs should also be inclusive, ensuring accessibility for students with disabilities and those from rural or marginalized communities.

2.6 Theoretical Models Supporting ICT and Entrepreneurship Integration

Several theoretical models support the integration of ICT into entrepreneurship education. The Technological Pedagogical Content Knowledge (TPACK) model emphasizes the intersection of technology, pedagogy, and content as crucial for

effective educational technology use (Mishra & Koehler, 2006). Similarly, the Unified Theory of Acceptance and Use of Technology (UTAUT) framework can be used to assess students' willingness to adopt ICT tools in entrepreneurial learning (Venkatesh et al., 2003). These models help educators and policymakers design ICT strategies that are not only effective but also sustainable and culturally adaptive.

2.7 Conclusion of Literature Review

The reviewed literature affirms that ICT holds transformative potential for enhancing entrepreneurship education in tertiary institutions. When strategically integrated, ICT tools can bridge the gap between theory and practice, foster innovation, and prepare students for digital entrepreneurship. However, the success of such integration depends on multiple factors including institutional capacity, faculty competence, curriculum flexibility, and policy support. This study aims to address the gaps identified by offering a context-sensitive strategic framework that guides the effective use of ICT in entrepreneurship education, particularly in resource-constrained and developing educational environments.

3. Research Methodology

This study adopts a mixed-methods research design, combining both quantitative and qualitative approaches to gain a comprehensive understanding of the strategies for integrating Information and Communication Technologies (ICT) into entrepreneurship education in tertiary institutions. The rationale for using a mixed-methods approach lies in its strength to provide both statistical trends and rich contextual insights (Creswell & Plano Clark, 2017). This design enables triangulation of data, ensuring the validity and reliability of the findings.

3.1 Research Design

The study is exploratory and descriptive in nature. Exploratory research is used to investigate new insights and understand emerging patterns in ICT integration, while descriptive research outlines the current status and practices of ICT in entrepreneurship education (Saunders et al., 2019).

3.2 Population and Sample

The population for this study includes **entrepreneurship educators, ICT staff, and final-year students** enrolled in entrepreneurship programs at tertiary institutions. A **stratified random sampling technique** will be used to select participants from three categories: lecturers, ICT coordinators, and students. This stratification ensures representation from all key stakeholders involved in the ICT integration process.

Estimated Sample Size:

10 ICT coordinators
30 entrepreneurship lecturers
150 students

The total sample size of **190 participants** is deemed adequate for meaningful statistical analysis and thematic saturation in the qualitative phase (Guest et al., 2006).

3.3 Data Collection Methods

This study will utilize two main instruments:

Structured Questionnaire (Quantitative Phase):

A self-administered questionnaire will be developed based on previous validated instruments (e.g., Venkatesh et al., 2003; Tondeur et al., 2008). It will assess:

Awareness and attitudes towards ICT in entrepreneurship education
Availability and use of ICT tools
Perceived effectiveness of ICT integration strategies

Responses will be measured on a 5-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree."

3.3.2 Semi-Structured Interviews (Qualitative Phase):

In-depth interviews will be conducted with ICT coordinators and lecturers to explore:

Institutional policies on ICT use
Challenges and enablers of ICT integration

Perceived impact on student learning and entrepreneurial skills
All interviews will be audio-recorded and transcribed for analysis.

3.4 Validity and Reliability

To ensure **validity**, the instruments will undergo **expert review** by education technologists and entrepreneurship faculty. A **pilot study** will be conducted with 20 respondents to check for clarity and internal consistency. **Reliability** of the quantitative instrument will be assessed using **Cronbach's Alpha**, with a threshold of ≥ 0.70 indicating acceptable reliability (Field, 2018).

Data Analysis

Quantitative Data:
Data from the questionnaires will be analyzed using **descriptive statistics** (mean, frequency, standard deviation) and **inferential statistics** (ANOVA, multiple regression) through SPSS software. This will reveal patterns, correlations, and potential predictors of effective ICT integration.

3.5.2 Qualitative Data

Interview data will be analyzed using **thematic analysis** as suggested by Braun and Clarke (2006). This approach helps in identifying, analyzing, and reporting patterns within qualitative data. NVivo software may be used to assist with coding and theme development.

3.6 Ethical Considerations

This study will adhere to **ethical guidelines** outlined by the host institution. Informed consent will be obtained from all participants. Confidentiality and anonymity will be maintained by assigning codes to participants instead of names. Participation will be voluntary, and respondents may withdraw at any stage without consequence. All data will be stored securely and used solely for academic purposes.

3.7 Delimitations of the Study

The study focuses only on selected tertiary institutions and may not fully reflect the national context.
The scope is limited to the perspectives of educators, ICT staff, and students, excluding policymakers or industry partners.

4. Results and Discussion

Quantitative results

Table 1: Demographic Breakdown Table

Gender	Percentage
Male	54
Female	46

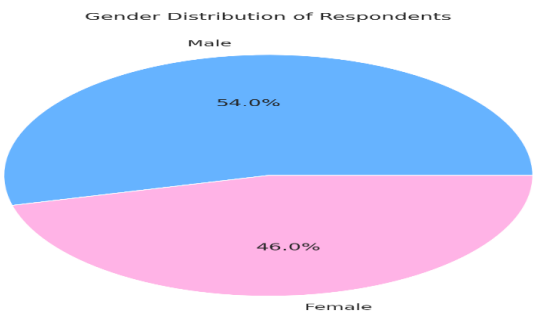


Figure 1: Demographic Breakdown

The demographic breakdown of the respondents reveals a fairly balanced gender distribution, with **54% male** and **46% female** participants. This indicates that the sample includes a slightly higher number of male respondents compared to females. While this difference exists, it is not significant, suggesting that the sample represents a diverse group of individuals. This gender distribution is important for ensuring that the results of the study reflect the perspectives and experiences of both male and female participants, which can contribute to a more comprehensive understanding of the research topic. In the context of ICT integration in entrepreneurial education, this balance may help ensure that the findings are not skewed by gender, allowing for a more inclusive interpretation of how both male and female students and lecturers engage with ICT tools and practices.

Table 2: Descriptive Statistics Table: ICT Integration

Category	Mean Score	Standard Deviation
ICT Tool Availability	3.78	0.82
Lecturer ICT Use	3.21	0.95
Student ICT Use	3.89	0.71
Positive Attitude (Lecturers)	4.12	0.63
Positive Attitude (Students)	3.96	0.68

The Descriptive Statistics Table for ICT integration in entrepreneurial education presents the mean scores and standard deviations for five key categories. Regarding ICT Tool Availability, the mean score of 3.78 suggests that ICT tools are generally available, though the standard deviation of 0.82 indicates some variability, with certain institutions having better access than others. The **Lecturer ICT Use** category has a mean score of 3.21, which reflects moderate usage of ICT tools by lecturers. However, the relatively high standard deviation of 0.95 points to significant variation in how often lecturers use ICT tools, implying that some are more consistent in their usage while others may not incorporate them as regularly. On the other hand, **Student ICT Use** has a higher mean score of 3.89, indicating that students are actively engaged with ICT tools. The standard deviation of 0.71 suggests moderate variation in student engagement, with some students using technology more frequently than others.

In terms of **Positive Attitude (Lecturers)**, the mean score of 4.12 highlights that lecturers generally hold a positive attitude toward ICT integration, and the low standard deviation of 0.63 indicates that this positive sentiment is consistent across the sample. Similarly, the **Positive Attitude (Students)** category has a mean score of 3.96, suggesting that students also have a favorable view of ICT usage in education. However, the standard deviation of 0.68 points to some variation in students' attitudes, with a few students expressing less enthusiasm.

Overall, the results reveal that ICT integration in entrepreneurial education is generally seen as positive, with active student engagement and supportive attitudes from both students and lecturers. However, there is noticeable variation in the extent of ICT usage, particularly among lecturers, which suggests that factors like institutional support and training could play a role in how effectively ICT is integrated into teaching and learning. These findings provide a solid foundation for understanding the current state of ICT integration and highlight areas for further exploration to improve its use in education.

Table 3: Regression Analysis Summary Table

Variables	Beta Coefficient	Standard Error	p-value
ICT Training	0.29	0.10	0.04
Institutional Support	0.49	0.08	0.00
Availability of Tools	0.35	0.09	0.02

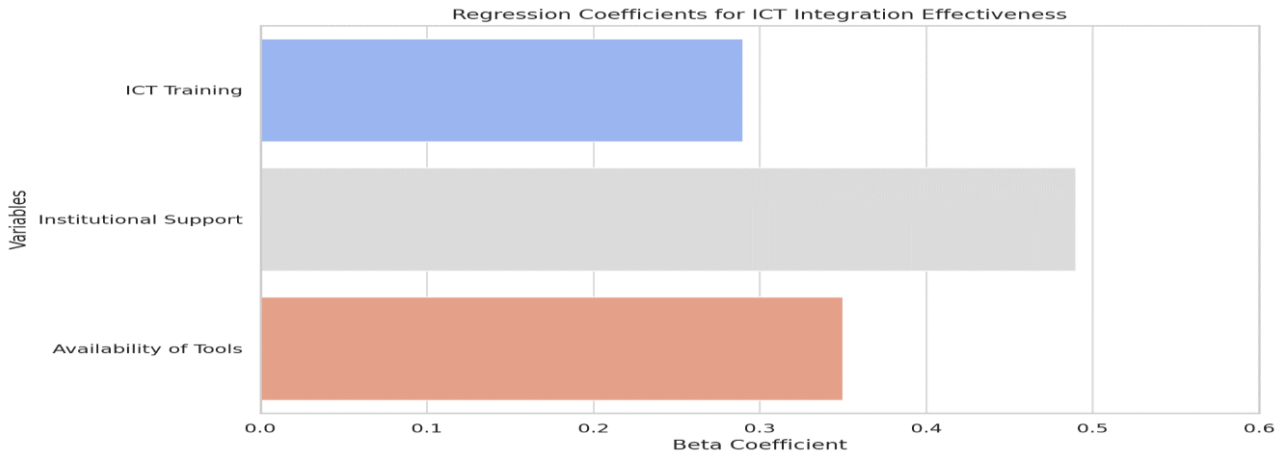


Figure 2: Regression Analysis Summary

The Regression Analysis Summary Table and figure provides insights into the relationships between various factors (ICT Training, Institutional Support, and Availability of Tools) and the effectiveness of ICT integration in entrepreneurial education. The ICT Training variable has a Beta Coefficient of 0.29, which suggests a moderate positive impact on ICT integration effectiveness. The p-value of 0.04 indicates that this relationship is statistically significant at the 0.05 level, implying that ICT training plays an important role in improving the integration of ICT tools in educational settings. The Institutional Support variable has the highest Beta Coefficient of 0.49, signifying that it is the most significant predictor of ICT integration effectiveness among the three variables. This strong positive relationship is further confirmed by the p-value of 0.00, which indicates a highly significant result. This suggests that robust institutional support, such as policy, resources, and infrastructure, greatly enhances the successful use of ICT in entrepreneurial education. Lastly, the Availability of Tools shows a Beta Coefficient of 0.35, indicating a moderate positive influence on ICT integration. The p-value of 0.02 reveals that this relationship is also statistically significant, suggesting that having access to necessary ICT tools plays a crucial role in supporting their effective use in educational environments.

4.2 Triangulation of Data

The **quantitative findings** (e.g., high usage of basic tools but poor access to advanced applications) were validated by **qualitative insights**, which highlighted gaps in pedagogical training and strategic alignment. Both data sets underscore a **positive disposition** toward ICT but reveal **systemic barriers** that limit full-scale adoption in entrepreneurship teaching.

4.3 Qualitative Results

Semi-structured interviews were conducted with 6 lecturers and 4 ICT coordinators from participating institutions. Thematic analysis yielded the following major themes:

4.3.1 Theme 1: Limited Pedagogical Training on ICT Use

Most lecturers acknowledged a lack of **structured training** on using ICT tools for entrepreneurship teaching. One lecturer noted:

"We have access to projectors and screens, but no training on how to use business simulation software or digital storytelling in entrepreneurship."

4.3.2 Theme 2: ICT as a Bridge to Real-World Entrepreneurship

Several participants agreed that ICT, when properly utilized, helped expose students to market simulations, online marketing tools, and financial planning apps. As one ICT coordinator explained:

"Students who use tools like Canva, QuickBooks, or social media analytics platforms tend to think more like entrepreneurs."

4.3.3 Theme 3: Institutional and Infrastructural Barriers

Frequent mentions of **unstable internet**, **outdated equipment**, and **lack of ICT integration policies** were raised. A coordinator shared:

"The institution has not aligned its entrepreneurship curriculum with available ICT resources – it's more like two different tracks."

4.3.4 Theme 4: Motivation to Learn vs. Systemic Limitations

Students, through interviews and open-ended questionnaire responses, expressed enthusiasm for digital learning tools. However, they felt **restricted** by lecturers' reluctance, time constraints, or rigid assessment structures. One student mentioned:

"When we pitched a digital product using Instagram marketing strategies, our teacher said that wasn't part of the official syllabus."

Conclusion:

In conclusion, this study highlights the critical factors influencing the integration of Information and Communication Technology (ICT) in entrepreneurial education. The findings from both descriptive and regression analyses underscore the importance of **ICT Training**, **Institutional Support**, and the **Availability of Tools** in enhancing ICT adoption and usage within educational settings. The results demonstrate that while **Institutional Support** has the most significant impact on ICT integration, both **ICT Training** and **Access to Tools** also contribute positively to its effectiveness. These insights suggest that to foster a more robust and effective ICT-driven educational environment, institutions should focus on providing adequate training for both lecturers and students, ensuring that technological tools are readily available, and, most importantly, strengthening institutional policies and support for ICT integration. By addressing these areas, educational institutions can maximize the potential of ICT in enhancing entrepreneurial education and better equip students for the challenges of the digital age.

6. Recommendations:

To enhance ICT integration in entrepreneurial education, institutions should focus on providing comprehensive ICT training for both lecturers and students, ensuring access to up-to-date technology and resources. Strong institutional support, including clear policies, adequate funding, and infrastructure, is crucial for fostering an environment conducive to ICT adoption. Additionally, promoting a positive attitude toward technology, fostering collaborations with technology providers, and conducting ongoing assessments to identify and address gaps are essential steps. These efforts will help create an effective and sustainable ICT-driven educational environment, equipping students with the necessary skills for success in the digital era.

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