Nexus between innovation and commercialization of University-Originated Innovations in Uganda: A case of the faculty of engineering at Kyambogo University

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ABSTRACT

Universities worldwide face the challenge of transforming research outputs into market-ready innovations, a gap particularly evident in developing economies where institutional and financial constraints are pronounced. In Uganda, despite significant innovations emerging from higher education institutions, the transition from ideation to commercialization remains a persistent barrier to economic growth and societal impact. This study investigated the nexus between innovation creation and the commercialization of university-originated innovations at Kyambogo University's Faculty of Engineering in Uganda. The study aimed to assess the effectiveness of funding mechanisms, examine the role of entrepreneurial education, evaluate industry–academia collaboration, and analyze the efficacy of university initiatives in fostering an innovation-friendly environment. A mixed-methods approach was adopted under a pragmatic paradigm, involving 434 survey respondents and 6 key informants. Quantitative data were analyzed using SPSS v26, while qualitative data underwent thematic analysis. Findings revealed that government funding was insufficient, bureaucratic, and misaligned with commercialization needs. Entrepreneurial education provided theoretical knowledge but lacked practical application, mentorship, and market exposure. Industry–academia collaboration existed but was fragmented, with limited direct commercialization outcomes. University initiatives such as innovation hubs and networking events were present but under-resourced and inconsistently implemented. A moderate positive correlation was found between funding mechanisms ($r = 0.415$), entrepreneurial education ($r = 0.446$), industry–academia collaboration ($r = 0.449$), and university initiatives ($r = 0.543$) with commercialization outcomes. The study concludes that while innovation is abundant, commercialization is hindered by systemic gaps in funding, education, collaboration, and institutional support. Recommendations include reforming funding policies, embedding experiential learning in curricula, formalizing industry partnerships, and strengthening innovation infrastructure. The study contributes to Open Innovation Theory by highlighting the critical role of institutional ecosystem readiness in translating knowledge into market-ready innovations.

Keywords: Entrepreneurial Education; Funding Mechanisms; Innovation Commercialization; Industry–Academia Collaboration; Open Innovation Theory; University-Originated Innovations; Uganda

I. INTRODUCTION

The global history of commercialization of innovations has been shaped by distinct trajectories in the United States, Europe, and Asia, each responding to economic, political, and technological shifts. The U.S. set a precedent with the Bayh-Dole Act of 1980, which transformed federally funded research into commercial ventures, fueling university-industry partnerships and the growth of innovation ecosystems (Ezell, 2019). Europe has responded to challenges of market fragmentation and bureaucratic hurdles through initiatives such as Horizon Europe, which promote cross-border collaboration and technology transfer (Gambardella & Malerba, 1999). Meanwhile, Asian countries such as Japan, South Korea, and China have adopted state-driven approaches, investing heavily in research and development and supporting commercialization through initiatives such as China's "Torch Program" (Ramakrishna & Ng, 2011). Despite these developments, challenges remain, including regulatory complexities, limited commercialization capacity, and weak academia-industry linkages (Esangbedo et al., 2024). These experiences demonstrate the importance of institutional support, investment, policy frameworks, and university-industry linkages in transforming innovations into commercially viable products and services (World Bank, 2017).

Africa has a rich history of innovation and commercialization, notably exemplified by the widespread adoption of mobile money, which revolutionized financial inclusion in countries such as Kenya and Tanzania (World Bank, 2017). However, the continent's innovation capacity remains constrained by weak infrastructure, limited skilled labor, inadequate investment in research and development, and weak linkages between research institutions and industry

(Kasongo & Makamu, 2024). Although emerging innovations in areas such as agriTech, e-Health, and edTech demonstrate Africa's capacity to generate solutions to local challenges, the transition of such innovations from research and development to commercially viable products remains a challenge. Initiatives such as the Next Einstein Forum have sought to strengthen Africa's research and innovation ecosystem by promoting research-driven advancements and homegrown knowledge (Jibrin et al., 2024). Consequently, strengthening institutional capacity, financing, human capital and industry linkages remains important for improving innovation commercialization across the continent.

In Uganda, the innovation landscape has been shaped by government policies and institutional frameworks aimed at fostering science, technology, and innovation (STI). These include the National Science, Technology and Innovation Policy (2009), the Industrial Property Act (2014), the Plant Variety Protection Act (2014), the Buy Uganda, Build Uganda (BUBU) Policy, and the Research Registration and Clearance Policy and Guidelines (2016) (UNCST, 2009, 2016; Republic of Uganda, 2014; Ministry of Trade, Industry and Cooperatives, 2014). These policy and legal frameworks are reinforced by the Third National Development Plan (NDP III) 2020/21–2024/25, which places sustainable industrialization, value addition, private-sector development and wealth creation within Uganda's national development agenda (National Planning Authority, 2020). At the institutional level, Kyambogo University has a Research and Innovations Policy and an Intellectual Property Policy that provide frameworks for research, innovation, intellectual property management and commercialization (Kyambogo University, 2014, 2021).

Despite these efforts, commercialization of innovations in Uganda remains limited. Ugandan innovators face significant challenges, including limited funding, regulatory hurdles, inadequate commercialization expertise, and weak university-industry linkages (Kitagaana, 2018; Mulumba et al., 2018). Uganda's position in the Global Innovation Index declined from 114th in 2019 to 119th in 2021, while the country recorded about 250 patent applications in 2019 but only two successful registrations (Dutta et al., 2021; Office of the Auditor General, 2022). These trends point to a persistent gap between the generation of innovations and their transformation into commercially viable products and services.

Kyambogo University provides an important context for examining this gap. Its Faculty of Engineering has its origins in Uganda Polytechnic Kyambogo, which was incorporated into Kyambogo University in 2003 (Kyambogo University, 2024). Over the years, the university has produced numerous student and faculty innovations, including low-cost baby and egg incubators, a spy robot, an Electrocardiogram, plastic-waste tiles, agricultural technologies, energy technologies, and other engineering innovations (Kyambogo University, 2021; UNCST, 2023). However, many of these innovations have not progressed to commercialization. Previous research has identified promising university-based innovations while highlighting gaps in institutional support, commercialization pathways, and university-industry linkages (Kitagaana, 2022; Mulumba et al., 2018).

The persistence of uncommercialized innovations despite the existence of institutional policies and government support raises questions about the factors influencing the transition of university-originated innovations from ideas and prototypes to commercially viable products and services. Understanding the nexus between innovation and commercialization is therefore important for identifying the institutional, financial, technical, and market-related factors that influence commercialization within the Faculty of Engineering at Kyambogo University.

1.1 Statement of the Problem

Universities in Uganda, particularly Kyambogo University, play a pivotal role in driving innovation through research across various fields, with these innovations holding significant potential to address critical societal challenges and contribute to national economic growth (Kizza & Kasule, 2019). However, despite the promising research and technological advancements emerging from Kyambogo University, the transition from innovation creation to commercialization remains a major obstacle (Kitagaana, 2022). Numerous innovations fail to progress beyond the research and prototyping stages, primarily due to a combination of factors, including inadequate funding, weak intellectual property policies, limited industry collaboration, lack of trained personnel, and insufficient institutional prioritization (Lyada et al., 2024; UNCST, 2023). Furthermore, the university's lack of a comprehensive grant management policy, an inadequately staffed graduate school with limited personnel and faces low funding for competitive research proposals (only 19 out of 83 in 2018 and 3 out of 26 in 2019 were funded) (Kitagaana, 2022).

As a result, many innovations remain underutilized, depriving them of their full potential impact on both the economy and society. The failure to effectively commercialize university-originated innovations has far-reaching consequences, including the loss of valuable intellectual capital, missed opportunities for job creation, and the inability to leverage homegrown innovations for sustainable economic and social transformation (Jjagwe et al., 2024). This persistent gap between research output and industrial application also undermines Uganda's competitiveness in the global innovation landscape. This study sought to bridge this gap by investigating the nexus between innovation creation and commercialization at the Faculty of Engineering, Kyambogo University. It identified key barriers hindering commercialization, assessed institutional support structures, and proposed practical strategies to enhance the successful transition of university-originated innovations into the market.

1.2 Research Objective

i. To assess the effectiveness of funding mechanisms on the commercialization of innovations within Kyambogo University's Faculty of Engineering.
ii. To examine the role of entrepreneurial education in bridging the gap between innovation and commercialization at Kyambogo University's Faculty of Engineering.
iii. To evaluate the influence of industry-academia collaboration on the commercialization of innovations at Kyambogo University's Faculty of Engineering.
iv. To assess the efficacy of university initiatives in facilitating the commercialization of innovations within Kyambogo University's Faculty of Engineering.

II. LITERATURE REVIEW

2.1 Theoretical Review

This study is anchored on the Open Innovation (OI) Theory, introduced by Chesbrough (2003), which emphasizes the purposeful use of both internal and external knowledge to advance innovation and create value. The theory challenges the traditional view that innovation should be developed entirely within an organization and instead emphasizes the movement of knowledge across organizational boundaries through partnerships, collaboration, and external knowledge sources (Chesbrough & Crowther, 2006). OI is based on the assumption that valuable knowledge is widely distributed and that organizations can enhance innovation by integrating external knowledge with internal capabilities. It therefore involves both outside-in processes, through which external knowledge enters an organization, and inside-out processes, through which internally generated knowledge and technologies are transferred to external users or markets (Chesbrough & Crowther, 2006).

OI Theory is particularly relevant to university innovation and commercialization because universities increasingly depend on interactions with industry and other external actors to translate research and technological knowledge into marketable products and services. Cervantes and Meissner (2014) demonstrate the relevance of open innovation to the commercialization of public research, emphasizing changing approaches to technology transfer and stronger interaction between public research organizations and external users of knowledge. Similarly, Laine et al. (2015) show how open innovation can strengthen collaboration between higher education institutions and industry by facilitating knowledge exchange and joint innovation activities. These perspectives closely align with this study's focus on funding mechanisms, entrepreneurial education, industry-academia collaboration, and university initiatives as mechanisms through which university-originated innovations can move from development to commercialization at Kyambogo University's Faculty of Engineering.

Despite its relevance, OI Theory has limitations. Open innovation can create organizational and coordination challenges, particularly where institutions lack the structures, capabilities, incentives, and processes required to manage relationships with external partners effectively. Abhari and McGuckin (2023) identify organizational and strategic factors that can constrain the effectiveness of open innovation, while Audretsch and Belitski (2023) demonstrate that greater openness does not automatically translate into improved innovation performance and that the benefits of external knowledge can be subject to organizational and contextual limits. These limitations are important in the university context, where intellectual property management, institutional policies, coordination with industry, resource constraints, and commercialization capabilities can influence whether external knowledge and partnerships generate market-oriented outcomes.

The Open Innovation Theory was chosen for this study because its emphasis on external knowledge and partnerships directly aligns with the study's independent variables. These variables include funding mechanisms, entrepreneurial education, industry-academia collaboration, and university initiatives, all of which influence commercialization outcomes. The theory guided the development of the conceptual framework, the formulation of research questions, and the design of data collection tools. It provides a coherent lens for understanding how Kyambogo University can bridge the gap between innovation creation and market-ready commercialization.

2.2 Empirical Review

2.2.1 Funding Mechanisms and Commercialization of University-originated Innovations

Empirical studies indicate that access to funding is an important determinant of the development and commercialization of university-originated innovations. Fini et al. (2023), using evidence from university spin-offs in the United States, found that public subsidies can support the development and growth of university spin-offs, demonstrating the importance of public funding in moving university research towards commercialization. Similarly, Fu (2023), using empirical data from Chinese universities, found that government funding significantly influences research innovation. Song et al. (2022) further demonstrated that government subsidies can enhance sustainable

innovation within university–industry collaborations. Abbas et al. (2019), examining university–government collaboration, found that government support and collaboration facilitate the generation and commercialization of new knowledge for industrial use. These findings suggest that public funding can provide universities and researchers with resources necessary to develop research outputs into commercially viable innovations.

Evidence also points to the importance of alternative and collaborative financing mechanisms. Yang et al. (2018), through an examination of successful Chinese cases, demonstrated that commercialization of science-based university innovations can be facilitated through appropriate institutional and external support mechanisms. Horta et al. (2022), examining crowdfunding in UK universities, provided evidence of the potential of alternative financing to support university activities where conventional funding may be inadequate. Rukanyangira and Oidu (2021) similarly examined the contribution of public–private partnerships to research and innovation in higher education and highlighted the role of collaboration between public institutions and private-sector actors in supporting innovation activities. Jjagwe et al. (2024), in an empirical study of research and innovation institutions in Uganda, found that financial constraints were among the factors influencing the commercialization of innovations. The evidence therefore indicates that commercialization may depend not only on government research funding but also on private-sector participation, partnerships and alternative sources of finance.

Despite these findings, much of the empirical evidence on innovation financing and commercialization originates from countries with stronger research and innovation financing systems, while evidence from Uganda remains comparatively limited. Existing Ugandan evidence, particularly Jjagwe et al. (2024), identifies financial constraints as a commercialization barrier but does not specifically establish how different funding mechanisms influence the commercialization of university-originated innovations within an engineering faculty. The existing studies also provide limited evidence on the interaction between public funding, private-sector support and institutional financing mechanisms in the commercialization process. The current study therefore examined the relationship between funding mechanisms and the commercialization of university-originated innovations at the Faculty of Engineering, Kyambogo University.

2.2.2 Entrepreneurial Education and Commercialization of University-originated Innovations

Madugu et al. (2023), in their study of Nigerian public universities, found that entrepreneurship education influences students' innovation and creativity. Similarly, Yang et al. (2024) found that entrepreneurial education influences students' business innovation and motivation. Oyinlola et al. (2024), examining entrepreneurship and innovation in Nigerian universities, identified entrepreneurship education as an important component of university efforts to promote innovation and entrepreneurial activity. These findings suggest that entrepreneurial education can equip university students and researchers with knowledge and skills needed to recognize opportunities, develop innovative ideas and consider their commercial potential.

Empirical evidence also suggests that entrepreneurial support extends beyond classroom-based education to include mentorship and practical entrepreneurial guidance. Mouammer and Bazan (2021), examining mentorship among university students, found that mentorship can support students during their early entrepreneurial journey by providing guidance and support in developing entrepreneurial capabilities. Yani and Zaakiyyah (2024) similarly examined mentorship and reported its importance in stimulating the growth and success of entrepreneurial business entities. Such evidence indicates that entrepreneurial education may be more effective when complemented by mentorship and other forms of practical support that enable innovators to translate knowledge and ideas into entrepreneurial activities. Consequently, entrepreneurial capability can contribute to the transition of university-originated innovations from research outputs towards products, services or ventures with commercial potential.

However, the available empirical evidence largely focuses on students' entrepreneurial intentions, innovation, creativity and business development rather than the commercialization of university-originated research innovations. In Uganda, there is limited empirical evidence examining whether entrepreneurial education and mentorship enable academic innovators to move innovations from development to commercialization, particularly within engineering faculties. Existing studies therefore leave a contextual and empirical gap concerning the extent to which entrepreneurial education contributes to the commercialization of university-originated innovations in Ugandan public universities. The current study addressed this gap by examining the relationship between entrepreneurial education and the commercialization of university-originated innovations at the Faculty of Engineering, Kyambogo University.

2.2.3 Industry-Academia Collaboration and the Commercialization of University-originated Innovations

Kitagaana (2018), in an empirical qualitative study of university–industry linkages in Uganda, identified institutional and capacity-related constraints affecting collaboration between universities and industry. Schultz et al. (2021), examining university–industry R&D projects, found that perceptions of project innovativeness influence collaboration performance, demonstrating the importance of effective joint research arrangements. Clauss et al. (2024), using empirical evidence from university–industry collaborations, found that formalisation and fairness within

collaborative relationships contribute to innovation generation. Manrique and Grifell-Tatjé (2020) also examined university–firm collaboration and its relationship with innovation-related financial performance, providing evidence of the potential economic value of university–industry relationships. Collectively, these studies demonstrate that sustained university–industry collaboration can provide access to knowledge, resources, expertise and markets necessary for innovation development and commercialization.

Practical engagement between universities and industry can also strengthen the capacity of students and researchers to develop innovations relevant to industry needs. Adeosun et al. (2022) examined university internship systems and their role in preparing young people for the world of work in the Fourth Industrial Revolution, demonstrating the importance of workplace exposure in developing relevant competencies. Galbraith and Mondal (2020) similarly examined the potential of internships for career preparation, while Galván et al. (2022), using quantitative evidence from Mexican college interns, identified skills associated with students' ability to innovate new products. Empirical studies on curriculum and industry engagement further indicate that collaboration can improve the alignment between university learning and workplace requirements. Popli and Singh (2024), for example, examined the integration of real-world projects into engineering courses and demonstrated the value of industry collaboration in enhancing academic outcomes. Shrivastava et al. (2022) likewise examined co-created curricula with industry partners, highlighting the contribution of industry participation to curriculum relevance.

Although these studies demonstrate the importance of university–industry engagement, much of the empirical evidence focuses on student employability, curriculum development or general collaboration performance rather than the commercialization of university-originated innovations. In Uganda, Kitagaana (2018) identified constraints to university–industry linkages, but there remains limited empirical evidence on how such collaboration directly contributes to taking innovations developed within university faculties to the market. In particular, limited attention has been given to engineering faculties where university research and technological innovations may have direct industrial applications.

2.2.4 Initiatives for Innovation Transition and the Commercialization of University-originated Innovations

Jjagwe et al. (2024), examining research and innovation institutions in Uganda, found that commercialization is influenced by systemic, infrastructural and financial factors, demonstrating the importance of institutional environments that support innovation transition. Yang et al. (2018), through empirical examination of successful university and research-institute innovations in China, showed that institutional and organizational arrangements can contribute to the successful transition of science-based innovations towards commercialization. Evidence from university innovation activities further indicates that structured support mechanisms can provide innovators with access to infrastructure, expertise and networks needed to develop innovations beyond the research stage. These findings suggest that commercialization requires institutional initiatives that bridge the gap between innovation generation and market application.

Intellectual property management and technology-transfer mechanisms are also important components of innovation transition. Lyada et al. (2024), examining the utilization of intellectual property systems in Uganda's public academic institutions, including Makerere and Kyambogo universities, investigated the role of IP systems in promoting innovation and identified challenges affecting their utilization. Cunningham et al. (2019), examining university-focused technology-transfer policies, found that institutional technology-transfer policies can influence regional innovation and entrepreneurship. Abbas et al. (2019) similarly demonstrated the importance of university–government collaboration in generating and commercializing knowledge for industrial use. These findings indicate that effective commercialization requires more than the production of innovations; it also requires institutional mechanisms for intellectual property protection, technology transfer, networking and connection with potential users and markets.

Despite the growing recognition of innovation-support initiatives, empirical evidence remains limited regarding how institutional initiatives collectively facilitate the transition of university-originated innovations to commercialization in Ugandan universities. Existing Ugandan studies have identified systemic, infrastructural, financial and intellectual property challenges, but limited attention has been given to the combined contribution of innovation-support initiatives within a specific university faculty. This is particularly important at the Faculty of Engineering, Kyambogo University, where technological innovations may require institutional support, intellectual property management, networking and technology-transfer mechanisms to reach potential users and markets.

III. METHODOLOGY

3.1 Research Design

This study adopted a case study research design using a mixed-methods approach. The case study design enabled an in-depth examination of factors influencing the commercialization of university-originated innovations within the Faculty of Engineering at Kyambogo University (Bryman, 2016). The mixed-methods approach combined quantitative

and qualitative data to examine the relationships between funding mechanisms, entrepreneurial education, industry–academia collaboration, university initiatives, and commercialization of innovations (Creswell & Creswell, 2018).

3.2 Study Area

The study was conducted at the Faculty of Engineering, Kyambogo University, in Kampala, Uganda. The faculty comprises five departments: Oil and Gas, Civil and Building, Electrical and Electronics, Biomedical and Mechatronics, and Mechanical and Production. The study also included seven industry partners with formal Memoranda of Understanding with the Faculty of Engineering.

3.3 Target Population

The target population comprised 1,653 participants, including 1,154 fourth-year students, 487 academic staff, five departmental heads, and seven industry partners. Fourth-year students and academic staff were included because of their involvement in innovation and research activities, while departmental heads and industry partners provided institutional and industry perspectives on innovation commercialization.

3.4 Sampling and Sample Size

Stratified random sampling was used to select students and academic staff. The population was stratified by participant category and department to ensure adequate representation. Using the Krejcie and Morgan approach, a sample of 504 respondents was obtained, comprising 289 fourth-year students and 215 academic staff. For the qualitative component, six key informants, comprising three departmental heads and three industry partners, were selected purposively based on their knowledge and involvement in innovation and commercialization activities. Data collection continued until sufficient thematic saturation was achieved.

3.5 Data Collection Instruments

Data were collected using structured questionnaires and semi-structured interview guides. The questionnaire contained closed-ended items measured on a five-point Likert scale and assessed funding mechanisms, entrepreneurial education, industry–academia collaboration, university initiatives, university curriculum and policies, and commercialization of innovations. Semi-structured interviews were conducted with departmental heads and industry partners to obtain detailed perspectives on the factors influencing innovation commercialization.

Prior to data collection, the instruments were pilot-tested with 20 participants at Makerere University. Ethical approval and relevant institutional permissions were obtained before data collection. Questionnaires were administered online, while interviews were conducted in person. Participants provided informed consent before participation.

3.6 Data Analysis

Quantitative data were coded, cleaned, and analyzed using SPSS version 26. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize respondents' characteristics and responses to the study variables. Pearson correlation and linear regression analyses were used to examine the relationships between the independent variables and commercialization of university-originated innovations. The PROCESS macro for SPSS was used to assess the mediating effect of university curriculum and policies. Statistical results were presented using correlation coefficients, regression coefficients, coefficients of determination, and significance levels.

Qualitative data from the interviews were analyzed using thematic content analysis with the aid of NVivo 12 (Edwards-Jones, 2014). Interview transcripts were reviewed, coded, categorized into themes, and interpreted in relation to the study objectives. Qualitative findings were integrated with the quantitative results to provide contextual explanations of the factors influencing commercialization.

3.7 Ethical Considerations

Ethical approval and permission to conduct the study were obtained from the relevant authorities at the University of Eldoret and Kyambogo University. Participants were informed about the purpose and procedures of the study and participated voluntarily after providing informed consent. Confidentiality, privacy, and anonymity were maintained throughout the study, and participants' identities were not disclosed in reporting the findings. The information collected was used strictly for academic purposes, and participants retained the right to withdraw from the study at any time.

IV. FINDINGS & DISCUSSION

4.1 Response Rate

Table 1 presents the response rates achieved in the study. For the questionnaire survey, staff achieved a response rate of 70.7% (152 out of 215), while final year students achieved an excellent rate of 97.6% (282 out of 289). For the interview component, all 3 departmental heads (100%) and all 3 industry partners (100%) participated, as the study employed a census approach for these categories due to their small and manageable size. The researcher applied the principle of saturation, noting that responses became repetitive and additional interviews were unlikely to yield new insights (Creswell & Creswell, 2018). Overall, the total response rate across both instruments was 86.3% (440 out of 510), demonstrating substantial participation.

Table 1

Response Rate

Category	Target	Actual	Response Rate
Departmental Heads	3	3	100%
Industry Partners	3	3	100%
Staff	215	152	70.7%
Final Year Students	289	282	97.6%
Total	510	440	86.3%

4.1.1 Effectiveness of Current Funding Mechanisms in Facilitating the Commercialization of University Innovative Projects

The findings indicate that current funding mechanisms at Kyambogo University provide uneven support for the commercialization of university-originated innovations. Government funding was generally viewed negatively, particularly in relation to adequacy (M = 2.87, SD = 1.327), accessibility (M = 2.40, SD = 1.115), and management (M = 2.60, SD = 1.144). In contrast, private-sector investment received a more positive assessment (M = 3.61, SD = 0.991), while private investor engagement was also viewed positively (M = 3.56, SD = 0.962). Crowdfunding was perceived as potentially viable (M = 3.37, SD = 1.067), although training on crowdfunding was limited (M = 2.76, SD = 1.089).

Table 2

Descriptive statistics on effectiveness of current funding mechanisms in facilitating the commercialization of innovative projects

	Statement	***SD (%)***	***D (%)***	***NS (%)***	***A (%)***	***SA (%)***	***Mean***	***σ***
1	Government grants provide enough support for innovation commercialization.	77 (17.7)	126 (29.0)	63 (14.5)	112 (25.8)	56 (12.9)	2.87	1.327
2	The process of accessing government funding is clear and efficient.	98 (226)	168 (38.7)	77 (17.7)	77 (17.7)	14 (3.2)	2.40	1.115
3	Government funding is well-managed to support innovation commercialization.	77 (17.7)	147 (33.9)	112 (25.8)	70 (16.1)	28 (6.5)	2.60	1.144
4	Private sector investments help fund student and faculty innovations.	21 (4.8)	42 (9.7)	77 (177)	238 (54.8)	56 (12.9)	3.61	.991
5	Industry partnerships provide sufficient financial support for innovation commercialization.	14 (3.2)	70 (16.1)	140 (32.3)	154 (35.5)	56 (12.9)	3.39	1.007
6	Private investors are actively involved in supporting high-potential engineering projects.	14 (3.2)	42 (9.7)	126 (29.0)	189 (43.5)	63 (14.5)	3.56	.962
7	Crowdfunding is a realistic funding option for university innovations.	14 (3.2)	84 (19.4)	133 (30.6)	133 (30.6)	70 (16.1)	3.37	1.067
8	The faculty trains students on how to raise funds through crowdfunding.	56 (12.9)	133 (30.6)	126 (29.0)	98 (22.6)	21 (4.8)	2.76	1.089
9	Some university innovations have successfully used crowdfunding.	14 (3.2)	91 (21.0)	112 (25.8)	196 (45.2)	21 (4.8)	3.27	.954

Funding mechanisms were positively and significantly associated with commercialization of innovations ($r = 0.415$, $p < 0.001$). Regression analysis further showed that funding mechanisms significantly predicted commercialization ($\beta = 0.415$, $p < 0.001$), explaining 17.3% of the variance ($R^2 = 0.173$; $F = 90.108$, $p < 0.001$). The qualitative findings supported the quantitative results: all six key informants reported inadequate direct funding for

student innovations and limited support for prototyping, patenting and market entry. Five of the six identified informal allocation processes, while all recommended dedicated seed funding, formal co-investment arrangements and stronger intellectual-property and mentorship support.

Table 3

Correlation Analysis between Current Funding Mechanisms and Commercialization of Innovations

Correlations			
		Funding Mechanisms	Commercialization of Innovations
Funding Mechanisms	Pearson Correlation	1	.415**
	Sig. (2-tailed)		.000
	N	434	434
Commercialization of Innovations	Pearson Correlation	.415**	1
	Sig. (2-tailed)	.000	
	N	434	434

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4

Regression Analysis between current funding mechanisms and commercialization of innovations

	Unstandardized Coefficients		Standardized Coefficients		
	B	**Std. Error**	**Beta**	**t**	**Sig.**
(Constant)	2.025	.135		14.975	.000
Funding Mechanisms	.404	.043	.415	9.493	.000
a. Dependent Variable: Commercialization of Innovations					
R	R Square	Adjusted R Square	Std. Error	F Statistic	Sig.
.415a	.173	.171	.62837	90.108	.000[b]

Table 5

Analysis of thematic responses from departmental heads and industrial partners on the effectiveness of current funding mechanisms

Theme	Key Issues Identified	Functional Impact	Frequency (out of 6 key informants)
Availability of Funding Sources	No direct funding for student innovations; support limited to materials for practicals; industrial MoUs focus on internships not funding	Students cannot develop prototypes beyond course requirements; innovations stall before commercialization	6/6
Allocation Process and Criteria	Informal, ad hoc decisions based on academic relevance not commercial potential; no structured evaluation for commercialization viability	Inequitable access; promising innovations overlooked; no pathway from course project to market	5/6
Effectiveness of Current Mechanisms	Minimal effectiveness for commercialization; funding tied to academic exercises; lack of seed funding, prototyping, or patenting support	Innovations remain academic prototypes; few reach market-ready stage	6/6
Challenges and Limitations	Absence of direct financial support; industrial partners seek ownership; limited transparency; low-income students disadvantaged	Discourages independent project development; creates inequities; limits commercialization outcomes	6/6
Successful Commercialization Examples	Very few examples; isolated faculty-led initiatives; student projects rarely commercialized	No formal tracking or support mechanisms; exceptions rather than norm	5/6
Recommendations for Improvement	Introduce dedicated seed funding; formalize co-investment partnerships; create internal commercialization grants; provide IP and mentorship support	Would bridge funding gap; encourage student participation; increase market-ready innovations	6/6

Overall, the findings show that funding mechanisms have a significant positive relationship with commercialization, but their effectiveness is constrained by inadequate government support, difficult access procedures, weak management, limited direct private-sector investment and underdeveloped alternative financing mechanisms

4.1.2 Entrepreneurial Education and Commercialization of University-Originated Innovations

Entrepreneurial education was generally perceived positively, although important gaps existed in its practical application. Most respondents agreed that the curriculum included entrepreneurship and innovation modules (M = 4.13, SD = 0.853) and provided opportunities to learn business planning and commercialization strategies (M = 4.02, SD = 0.853). However, practical knowledge on commercializing innovative ideas was less strongly rated (M = 3.55, SD = 1.059). Mentorship was moderately positive (M = 3.65, SD = 1.109), while access to business-planning resources (M = 3.08, SD = 1.098) and commercialization resources (M = 3.05, SD = 1.040) remained relatively weak.

Table 6

Descriptive statistics on the role of entrepreneurial education in bridging the gap between innovation and commercialization

	Statement	***SD (%)***	***D (%)***	***NS (%)***	***A (%)***	***SA (%)***	***Mean***	***σ***
1	The curriculum includes modules focused on entrepreneurship and innovation.	0 (0)	21 (4.8)	70 (16.1)	175 (40.3)	168 (38.7)	4.13	.853
2	Students are provided with opportunities to learn about business planning and commercialization strategies.	7 (1.6)	28 (6.5)	28 (6.5)	259 (59.7)	112 (25.8)	4.02	.853
3	The curriculum provides practical knowledge on how to commercialize innovative ideas.	21 (4.8)	56 (12.9)	91 (21.0)	196 (45.2)	70 (16.1)	3.55	1.059
4	Mentorship programs are available to guide students and faculty in innovation commercialization.	14 (3.2)	56 (12.9)	77 (17.7)	210 (48.4)	77 (17.7)	3.65	1.109
5	Mentors provide practical advice on turning ideas into marketable products or services.	7 (1.6)	56 (12.9)	91 (21.0)	210 (48.4)	70 (16.1)	3.65	.953
6	The University facilitates connections between students and experienced entrepreneurs for mentorship.	28 (6.5)	70 (16.1)	91 (21.0)	196 (45.2)	49 (11.3)	3.39	1.084
7	The university provides resources (such as business plan templates and market analysis tools) that support the development of business plans and strategies.	21 (4.8)	126 (29.0)	140 (32.3)	91 (21.0)	56 (12.9)	3.08	1.098
8	Students and faculty have access to workshops or training on business development and commercialization.	7 (1.6)	63 (14.5)	91 (21.0)	175 (40.3)	98 (22.6)	3.68	1.029
9	Students have access to resources that help in the commercialization of their innovations.	21 (4.8)	49 (27.4)	154 (35.5)	98 (22.6)	42 (9.7)	3.05	1.040

The findings in Table 7 show that entrepreneurial education had a positive and statistically significant relationship with commercialization of innovations ($r = 0.446$, $p < 0.001$). Regression analysis confirmed that entrepreneurial education significantly predicted commercialization ($\beta = 0.446$, $p < 0.001$), explaining 19.9% of the variance ($R^2 = 0.199$; $F = 107.436$, $p < 0.001$). Qualitative findings reinforced these results: five of the six key informants identified limited curriculum integration and five reported challenges arising from curriculum rigidity and inadequate resources. All six indicated that mentorship and entrepreneurial education were only partially effective because of weak practical application and limited guidance on market entry.

Table 7

Correlation Analysis between Strategies for CPD Training needs Identification and TVET Trainer Competences

Correlations			
		Entrepreneurial Education	Commercialization of Innovations
Entrepreneurial Education	Pearson Correlation	1	.446**
	Sig. (2-tailed)		.000
	N	434	434
Commercialization of Innovations	Pearson Correlation	.446**	1
	Sig. (2-tailed)	.000	
	N	434	434

**. Correlation is significant at the 0.01 level (2-tailed).

Table 8

Regression Analysis between Strategies for CPD Training needs Identification and TVET Trainer Competences

	Unstandardized Coefficients		Standardized Coefficients		
	B	**Std. Error**	**Beta**	**t**	**Sig.**
(Constant)	1.573	.167		9.426	.000
Entrepreneurial Education	.476	.046	.446	10.365	.000
a. Dependent Variable: Commercialization of Innovations					
R	R Square	Adjusted R Square	Std. Error	F Statistic	Sig.
.446a	.199	.197	.61819	107.436	.000[b]

Table 9

Analysis of thematic responses from departmental heads and industrial partners on the role of entrepreneurial education

Theme	**Key Issues Identified**	**Functional Impact**	**Frequency (out of 6 key informants)**
Integration into Curriculum	Limited integration; mostly optional or informal; main focus remains technical skills	Students lack business acumen; weak understanding of commercialization processes	5/6
Practical Training Programs	Internships and innovation competitions effective but occasional; not uniformly accessible	Intermittent exposure; inconsistent skill development across students	4/6
Mentorship Availability	Limited formal mentorship; mostly faculty supervisors; industrial mentors focus on technical skills	Students lack guidance on commercialization strategies; entrepreneurial mindset underdeveloped	6/6
Effectiveness of Entrepreneurial Education	Partially effective for awareness; weak for practical application; theory-practice disconnect	Ideas and prototypes developed but not commercialized; students lack market entry knowledge	6/6
Challenges in Integration	Curriculum rigidity; limited resources; weak industrial engagement for commercialization	Entrepreneurship remains theoretical; students cannot test or scale innovations	5/6
Recommendations for Improvement	Structured modules with funding support; formal incubation program; industry-linked commercialization mentorship	Would bridge gap between innovation and market; enhance practical entrepreneurial skills	6/6

Overall, entrepreneurial education significantly contributes to commercialization, but its impact is limited by the predominance of theoretical content, inconsistent mentorship, inadequate commercialization resources and a persistent theory–practice gap.

4.1.3 Influence of industry-academia collaboration on promoting the commercialization of innovations

Industry–academia collaboration was generally perceived as beneficial, particularly through internships and industry placements. Internship programmes received the highest rating (M = 4.44, SD = 0.855), while industry placements were strongly associated with development of skills relevant to innovation commercialization (M = 4.27, SD = 0.847). Joint industry–academia projects were moderately positively rated (M = 3.60, SD = 0.975), whereas collaboration on research projects with commercialization potential was weaker (M = 3.37, SD = 1.005). Industry feedback into course content also received a relatively low rating (M = 3.23, SD = 1.070), indicating limited and inconsistent integration of industry perspectives.

Table 10

Descriptive statistics on influence of industry-academia collaboration on the commercialization of university innovations

		SD (%)	*D (%)*	*NS (%)*	*A (%)*	*SA (%)*	*Mean*	*σ*
1	The faculty collaborates with industry on research projects with commercialization potential.	21 (4.8)	70 (16.1)	105 (24.1)	203 (46.8)	35 (8.1)	3.37	1.005
2	Joint industry-academia projects result in practical solutions or marketable products.	14 (3.2)	42 (9.7)	119 (27.4)	189 (43.5)	70 (16.1)	3.60	.975
3	The university encourages students and staff to work on industry-sponsored projects.	7 (1.6)	77 (17.7)	98 (22.6)	168 (38.7)	84 (19.4)	3.56	1.043
4	Internship programs provide students with hands-on experience in industry settings.	7 (1.6)	7 (1.6)	42 (9.7)	112 (25.8)	226 (61.3)	4.44	.855
5	Industry placements help students develop skills relevant to innovation commercialization.	7 (1.6)	14 (3.2)	28 (6.5)	189 (43.5)	196 (45.2)	4.27	.847
6	The faculty facilitates connections between students and industry for internship opportunities.	42 (9.7)	49 (11.3)	91 (21.0)	168 (38.7)	84 (19.4)	3.47	1.202
7	Industry professionals contribute to the design and updating of the engineering curriculum.	14 (3.2)	42 (9.7)	161 (37.1)	147 (33.9)	70 (16.1)	3.50	.981
8	The curriculum reflects current industry trends and commercialization needs.	28 (6.5)	42 (9.7)	84 (19.4)	224 (51.6)	56 (12.9)	3.55	1.043
9	Industry feedback is regularly incorporated into course content and structure.	35 (8.1)	56 (12.9)	168 (38.7)	126 (29.0)	49 (11.3)	3.23	1.070

These findingsin Table 11 show that industry–academia collaboration was positively and significantly associated with commercialization of innovations ($r = 0.449$, $p < 0.001$). Regression analysis showed that collaboration significantly predicted commercialization ($\beta = 0.449$, $p < 0.001$), explaining 20.2% of the variance ($R^2 = 0.202$; $F = 109.278$, $p < 0.001$). The qualitative evidence indicated that collaboration largely occurred through internships and memoranda of understanding rather than joint commercialization projects. All six key informants identified barriers related to intellectual-property ownership, weak formal structures and limited industry investment, while five reported that successful commercialization cases were rare and mainly faculty-led.

Table 11

Correlation Analysis between Industry Academia Collaboration and Commercialization of Innovations

Correlations			
		Industry Academia Collaboration	Commercialization of Innovations
Industry Academia Collaboration	Pearson Correlation	1	.449**
	Sig. (2-tailed)		.000
	N	434	434
Commercialization of Innovations	Pearson Correlation	.449**	1
	Sig. (2-tailed)	.000	
	N	434	434

**. Correlation is significant at the 0.01 level (2-tailed).

Table 12

Regression Analysis between Industry-Academia Collaboration and Commercialization of University Innovations

	Unstandardized Coefficients		**Standardized Coefficients**		
	B	**Std. Error**	**Beta**	**t**	Sig.
(Constant)	1.536	.169		9.087	.000
Industry-Academia Collaboration	.475	.045	.449	10.454	.000
a. Dependent Variable: Commercialization of Innovations					
R	R Square	Adjusted R Square	Std. Error	F Statistic	Sig.
.449a	.202	.200	.61714	109.278	.000[b]

Table 13

Analysis of thematic responses from departmental heads and industrial partners on the Influence of Industry-Academia Collaboration

Theme	Key Issues Identified	Functional Impact	Frequency (out of 6 key informants)
Current Level of Collaboration	Exists mainly through internships and MoUs; limited project-based support; industries seek ownership	Few commercialization outcomes; student innovations rarely reach market	6/6
Successful Joint Projects	Rare exceptions (faculty-led); student projects seldom commercialized	Commercialization remains faculty-driven; student innovations excluded	5/6
Role of Internships and Placements	Significant for skills transfer and exposure; weak for commercialization support	Students gain professional readiness but not resources to commercialize own ideas	6/6
Industry Input in Curriculum	Informs practical content; lacks focus on entrepreneurship and commercialization	Partial alignment with market demands; entrepreneurial aspects underdeveloped	4/6
Barriers to Collaboration	Industries interested in labor/output not investment; IP ownership concerns; weak formal structures	Limits joint commercialization; discourages student engagement	6/6
Overall Impact Assessment	Moderate for technical learning; limited for commercialization; success stories faculty-driven	Valuable for training but not for market-ready innovations	6/6

The findings show that industry–academia collaboration has a significant positive influence on commercialization, but existing partnerships are more effective in providing skills and industry exposure than in providing the funding, market linkages and structured support required to move innovations from prototypes to commercial products.

4.1.4 Industry-Academia Collaboration and the Commercialization of University-originated Innovations

The findings in Table 14 show that Kyambogo University's innovation initiatives were generally perceived as beneficial, although their commercialization function remained constrained. Innovation hubs were positively assessed for providing mentorship and guidance (M = 3.65, SD = 0.919) and facilitating collaboration and networking (M = 3.56, SD = 1.043). Networking activities received relatively strong ratings, particularly their ability to connect students with industry partners and alumni (M = 3.90, SD = 0.963). However, perceptions of intellectual-property policies and procedures were more mixed, with relatively high neutrality regarding ownership rights (33.9%) and the process of securing IP protection (37.1%).

Table 14

Descriptive statistics on industry-academia collaboration and the commercialization of University-originated Innovations

		SD (%)	*D (%)*	*NS (%)*	*A (%)*	*SA (%)*	*Mean*	*σ*
1	Innovation hubs provide access to tools and resources for developing innovative projects.	28 (6.5)	56 (12.9)	70 (16.1)	210 (48.4)	70 (16.1)	3.55	1.104
2	The hubs offer mentorship and guidance to students and faculty working on innovations.	21 (4.8)	28 (6.5)	77 (17.7)	266 (61.3)	42 (9.7)	3.65	.919
3	The innovation hubs at Kyambogo University effectively facilitate collaboration and networking.	21 (4.8)	49 (11.3)	98 (22.6)	196 (45.2)	70 (16.1)	3.56	1.043
4	The university's intellectual property policies clearly outline ownership rights for innovations.	14 (3.2)	63 (14.5)	147 (33.9)	161 (37.1)	49 (11.3)	3.39	.974
5	The process of securing intellectual property rights is straightforward and well-supported.	28 (6.5)	28 (6.5)	161 (37.1)	168 (38.7)	49 (11.3)	3.42	.994
6	The university's intellectual property policies protect and promote university-originated innovations.	0 (0)	42 (9.7)	175 (40.3)	154 (35.5)	63 (14.5)	3.55	.856
7	Kyambogo University provides ample networking opportunities for students and staff.	28 (6.8)	49 (11.3)	77 (17.7)	196 (45.2)	84 (19.4)	3.60	1.115
8	Networking events and activities connect students with industry partners and alumni.	7 (1.6)	35 (8.1)	77 (17.7)	189 (43.5)	126 (29.0)	3.90	.963
9	The university's networking initiatives help build relationships that support innovation and commercialization.	7 (1.6)	28 (6.5)	105 (24.2)	210 (48.4)	84 (19.4)	3.77	.889

The findings suggest that University innovation initiatives had the strongest positive relationship with commercialization among the four explanatory variables ($r = 0.543$, $p < 0.001$). Regression analysis showed that university initiatives significantly predicted commercialization ($\beta = 0.543$, $p < 0.001$), explaining 29.5% of the variance ($R^2 = 0.295$; $F = 180.775$, $p < 0.001$). Qualitative findings confirmed that innovation hubs provide useful infrastructure and mentorship but lack dedicated commercialization funding and market-transition support. All six key informants identified weaknesses in implementation, particularly inadequate funding, inconsistent mentorship and IP-related challenges. Five also indicated that networking opportunities rarely resulted in sustained partnerships or funding.

Table 15

Correlation Analysis between Initiatives Implemented by the University and Commercialization of Innovations

Correlations			
		Initiatives implemented by KYU	Commercialization of Innovations
Initiatives implemented by KYU	Pearson Correlation	1	.543**
	Sig. (2-tailed)		.000
	N	434	434
Commercialization of Innovations	Pearson Correlation	.543**	1
	Sig. (2-tailed)	.000	
	N	434	434

**. Correlation is significant at the 0.01 level (2-tailed).

Table 16

Regression Analysis between Initiatives Implemented by the University and Commercialization of Innovations

	Unstandardized Coefficients		**Standardized Coefficients**		
	B	**Std. Error**	**Beta**	**t**	**Sig.**
(Constant)	1.163	.160		7.285	.000
Initiatives Implimented by KYU	.587	.044	.543	13.445	.000
a. Dependent Variable: Commercialization of Innovations					
R	R Square	Adjusted R Square	Std. Error	F Statistic	Sig.
.543a	.295	.293	.58002	180.775	.000[b]

Table 17

Analysis of thematic responses from departmental heads and industrial partners on the efficacy of university initiatives

Theme	Key Issues Identified	Functional Impact	Frequency (out of 6 key informants)
Effectiveness of Innovation Hubs	Provide labs and equipment; foster collaboration; lack commercialization support (funding, mentorship)	Students develop prototypes but cannot transition to market	6/6
Intellectual Property Policies	Policies exist but poorly communicated; weak enforcement; students lack guidance	Innovators uncertain about ownership; discouraged from pursuing commercialization	6/6
Networking Opportunities	Events and workshops available; rarely translate into funding or partnerships	Connections made but not sustained; limited commercialization follow-up	5/6
Successful Cases of Initiatives	Rare; mostly faculty-led; student projects rarely benefit	Gap between academic development and market entry persists	5/6
Challenges in Implementation	Lack of direct funding; inconsistent mentorship; IP complexity; industrial ownership claims	Prototypes developed but no clear route to market	6/6
Recommendations for Enhancement	Seed funding; structured mentorship; IP guidance; formal incubation program; co-investment partnerships	Would create clear pathway from innovation to market-ready products	6/6

Overall, university innovation initiatives significantly influence commercialization, with the strongest explanatory power among the four predictors examined. Nevertheless, their effectiveness is limited by inadequate commercialization resources, weak communication and enforcement of IP policies, inconsistent mentorship and limited follow-up of networking opportunities.

4.2 Intervening Role of University Curriculum and Policies

The mediation analysis demonstrated that university curriculum and policies play a significant intervening role in the relationship between innovation and commercialization. Innovation had a significant positive effect on university curriculum and policies ($B = 1.0048$, $SE = 0.0446$, $t = 22.531$, $p < 0.001$), while university curriculum and policies significantly predicted commercialization when controlling for innovation ($B = 0.7274$, $SE = 0.0398$, $t = 18.266$, $p < 0.001$). The total effect of innovation on commercialization was significant ($B = 0.6475$, $SE = 0.0456$, $t = 14.197$, $p < 0.001$), but the direct effect was not statistically significant ($B = -0.0834$, $SE = 0.0544$, $t = -1.532$, $p = 0.126$).

Table 18

Mediation Analysis of the effect of university curriculum and polices in the relationship between innovation and the commercialization of university-originated innovations

Path / Effect	**Coefficient**	**BootSE**	**t**	**p**	**LLCI, ULCI**
Path a (IV → MV)	1.0048	0.0446	22.5310	.0000	0.9172, 1.0925
Path b (MV → DV, controlling IV)	0.7274	0.0398	18.2657	.0000	0.6491, 0.8057
Path c' (Direct effect, IV → DV)	-0.0834	0.0544	-1.5319	.1263	-0.1904, 0.0236
Path c (Total effect, IV → DV)*	0.6475	0.0456	14.197	.0000	0.5582, 0.7368
Indirect effect (a × b)	0.7309	0.0436	–	–	0.6414, 0.8156

The indirect effect of innovation on commercialization through university curriculum and policies was positive and statistically significant ($B = 0.7309$, BootSE = 0.0436, 95% CI [0.6414, 0.8156]). Because the confidence interval did not include zero and the direct effect was non-significant, the findings indicate full mediation. Thus, innovation does not translate directly into commercialization; rather, its commercialization effect operates primarily through supportive university curriculum and policy structures.

4.3 Discussion

4.3.1 Funding Mechanisms and Commercialization of University-Originated Innovations

The study found that funding mechanisms have a significant positive relationship with the commercialization of university-originated innovations. However, government funding was perceived as inadequate, difficult to access and poorly managed, while private-sector investment was viewed more positively. The limited availability of direct funding

for prototyping, patenting and market entry further constrained commercialization. These findings are consistent with Fu (2023), who found that government funding plays an important role in supporting university research innovation, but its effectiveness depends on how funding is allocated and managed. Similarly, Song et al. (2022) and Abbas et al. (2019) emphasize the importance of financial resources and external investment in moving university innovations beyond research and development towards commercialization. The findings also support Jjagwe et al. (2024), who identified inadequate financing as a major barrier to commercialization in Uganda.

The findings further suggest that alternative financing mechanisms, particularly private investment and crowdfunding, remain underdeveloped. Although respondents considered crowdfunding potentially viable, limited training and institutional support restricted its use. This is consistent with Yang et al. (2018), who found that external financial and collaborative mechanisms can strengthen the commercialization capacity of universities. The limited direct financial involvement of industry partners observed in this study suggests that existing university–industry relationships have not yet fully evolved into co-investment arrangements. Thus, while funding mechanisms significantly contribute to commercialization, their effectiveness depends on the availability of dedicated seed funding, transparent allocation mechanisms and stronger public–private financing arrangements.

4.3.2 Entrepreneurial Education and Commercialization of University-Originated Innovations

The study established a significant positive relationship between entrepreneurial education and commercialization. Although entrepreneurship and innovation modules and business-planning content were relatively well established, practical knowledge, access to commercialization resources and structured mentorship were less developed. This indicates a gap between entrepreneurial awareness and the practical capabilities required to transform university innovations into marketable products and services. The finding is consistent with Madugu et al. (2023), who demonstrated the importance of entrepreneurship education in developing entrepreneurial capabilities among university students. Yang et al. (2024) and Oyinlola et al. (2024) similarly emphasize the importance of practical entrepreneurial education in strengthening students' capacity to identify opportunities and translate innovative ideas into viable ventures.

The qualitative findings further showed that mentorship was largely informal and that internships, competitions and other practical activities were not consistently integrated into the commercialization process. This supports Mouammer and Bazan (2021), who highlight the role of mentorship in developing entrepreneurial competencies and supporting the transition from innovative ideas to entrepreneurial activities. The findings therefore suggest that entrepreneurial education at Kyambogo University contributes to commercialization, but its effectiveness is limited when classroom-based learning is not complemented by structured mentorship, incubation, market analysis, business planning and access to commercialization resources.

4.3.3 Industry–Academia Collaboration and Commercialization of University-Originated Innovations

The study found a significant positive relationship between industry–academia collaboration and commercialization. The strongest aspects of collaboration were internships and student placements, indicating that industry engagement is particularly effective in providing practical exposure and developing market-relevant skills. However, research collaboration, industry-sponsored projects and incorporation of industry feedback into curriculum development were comparatively weaker. These findings are consistent with Schultz et al. (2021), who found that effective university–industry collaboration can enhance joint innovation outcomes, and Clauss et al. (2024), who emphasize the importance of structured and trust-based relationships in achieving successful collaboration.

The qualitative findings showed that existing partnerships were largely focused on internships and memoranda of understanding rather than joint commercialization projects, investment or market access. Intellectual-property ownership, weak collaboration structures and limited industry investment were identified as important barriers. This is consistent with Kitagaana (2018), who found limitations in university–industry linkages in Uganda, and with Adeosun et al. (2022) and Galván et al. (2022), who emphasize the value of sustained practical engagement between universities and industry. The findings therefore indicate that industry–academia collaboration contributes to commercialization, but its current contribution at Kyambogo University is stronger in skills development and exposure than in financing, product development and market transition.

4.3.4 Initiatives Implemented by Kyambogo University and Commercialization of University-Originated Innovations

The study found that initiatives implemented by Kyambogo University had the strongest relationship with commercialization among the four explanatory factors. Innovation hubs provided access to equipment, mentorship and networking opportunities, while university networking activities created opportunities for interaction with industry and alumni. However, these initiatives were constrained by inadequate commercialization funding, inconsistent mentorship and limited follow-up of networking opportunities. These findings are consistent with Jjagwe et al. (2024), who

identified institutional support and financing as important conditions for commercialization of university innovations. Similarly, Yang et al. (2018) found that institutional mechanisms can strengthen universities' capacity to translate research and innovation into commercial outcomes.

The findings also reveal weaknesses in intellectual-property support. Although policies were reported to exist, respondents indicated limited awareness, inadequate guidance and uncertainty concerning ownership and protection of innovations. This finding is consistent with Cunningham et al. (2019) and Lyada et al. (2024), who emphasize the importance of effective intellectual-property management and technology-transfer structures in university commercialization. Thus, institutional initiatives at Kyambogo University provide an important foundation for commercialization, but their effectiveness depends on stronger implementation, dedicated funding, structured mentorship, clearer intellectual-property guidance and sustained engagement with industry.

4.3.5 Intervening Role of University Curriculum and Policies

The mediation analysis showed that university curriculum and policies significantly mediated the relationship between innovation and commercialization. The total effect of innovation on commercialization was significant, but the direct effect became statistically insignificant after university curriculum and policies were introduced into the model, while the indirect effect was significant. This suggests that the existence of innovative ideas alone may not be sufficient to achieve commercialization; rather, the university environment in which innovations are developed determines how effectively they can be transformed into commercial outcomes.

This finding reinforces the importance of institutional structures, entrepreneurial education, intellectual-property arrangements and commercialization-oriented policies in supporting university innovation. The finding is consistent with evidence emphasizing the role of university institutional environments and technology-transfer mechanisms in enabling the movement of innovations from the academic setting to industry and markets (Abbas et al., 2019; Cunningham et al., 2019; Jjagwe et al., 2024). The study therefore suggests that strengthening curriculum and institutional policies is central to bridging the gap between innovation generation and commercialization at Kyambogo University.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

The study concludes that funding mechanisms, entrepreneurial education, industry–academia collaboration, and university innovation initiatives significantly contribute to the commercialization of university-originated innovations at Kyambogo University. However, inadequate funding, limited practical entrepreneurship support, weak industry engagement, and institutional implementation gaps constrain commercialization. University curriculum and policies play a critical intervening role in translating innovation into commercial outcomes. Strengthening these institutional mechanisms, alongside dedicated funding, structured mentorship, effective intellectual-property support, and stronger industry partnerships, is therefore essential for improving commercialization.

5.2 Recommendations

Based on the findings, the study recommends that Kyambogo University should strengthen dedicated funding, practical entrepreneurship training, structured mentorship, and incubation to support innovation commercialization. The University should also enhance industry–academia partnerships, intellectual-property support, networking, and technology-transfer mechanisms to facilitate the transition of innovations from development to market.

Declaration of Interest

The authors declare that they do not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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