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Academic Collaboration and Technological Innovation in Kenyan Public Universities: An Innovation Intermediary Perspective

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Abstract
Kenya's public universities are central to the country's innovation agenda, yet weak linkages with industry continue to constrain technology transfer. This study examines how academic collaboration influences technological innovation and evaluates the dual role of innovation intermediaries as mediators and moderators in this relationship. A cross-sectional survey design was adopted, with a census of all 66 chartered universities and stratified random sampling of industry and intermediary respondents, yielding 212 participants. Data were analysed using covariance-based structural equation modelling (CB-SEM) in AMOS. Results indicate that academic collaboration exerts a significant positive effect on technological innovation. In contrast, innovation intermediaries both transmit collaborative inputs into outcomes (partial mediation) and strengthen the collaboration–innovation link (positive moderation). These findings highlight the need for universities to embed innovation more deliberately into collaborative structures by strengthening intermediary capacity. Policy implications include investment in incubation infrastructure, technology transfer mechanisms, and enabling frameworks that accelerate commercialisation and knowledge exchange. The study contributes to scholarship on university–industry collaboration by demonstrating that intermediaries serve a dual role in amplifying innovation outcomes in an emerging-economy context.

Key terms: Innovation intermediaries, knowledge transfer, technological innovation, triple helix, and university–industry collaboration.

INTRODUCTION

Kenya's development agenda has consistently emphasised science, technology, and innovation (STI) as central to economic transformation. Vision 2030 identifies STI as a foundational enabler across its economic, social, and political pillars, positioning the transition toward a knowledge-based economy as a national priority (Government of Kenya, 2007). This direction has been reinforced by the Science, Technology and Innovation Act of 2013 and the draft STI Policy 2020–2030, both of which call for stronger linkages between research institutions, industry, and government as a pathway for converting knowledge into productive use (National Commission for Science, Technology and Innovation [NACOSTI], 2020). Universities occupy a pivotal role in this agenda: as the principal sites of publicly funded research, they are expected not only to generate scientific and technical knowledge but also to translate that knowledge into technological innovation—the development, adoption, and commercialisation of new or improved products, processes, and services (Organisation for Economic Co-operation and Development [OECD] & Eurostat, 2018). Despite the expansion of technology transfer offices, innovation hubs, and industry liaison units across leading public universities, policy documents continue to highlight weak linkages between academia and industry as a persistent constraint on Kenya's innovation system (NACOSTI, 2020). The problem this study addresses is that the pathway from university research to usable technology remains inconsistent despite growing institutional investment.

Existing scholarship has established that academic collaboration—the formal and informal engagement of university researchers with industry, government, and other universities in joint research, consultancy, and knowledge co-production—is a principal driver of technological innovation because it combines complementary knowledge bases and allows risks and costs to be shared (Perkmann et al., 2013). Research has also shown that collaboration outcomes are often shaped by innovation intermediaries, such as technology transfer offices, incubators, science parks, and industry liaison units, which broker relationships, bridge institutional boundaries, and build capacity to move research toward application (Howells, 2006; Klerkx & Leeuwis, 2009). However, what remains unclear—and constitutes the research gap—is how these two mechanisms interact in practice. Studies in Kenya and sub-Saharan Africa (e.g., Munyoki et al., 2011; Mwenda et al., 2021) have tended to examine either the direct contribution of collaboration to innovation or the standalone role of intermediaries, but they rarely provide a coherent account of whether intermediaries act as transmission channels, amplifiers, or both. This fragmentation limits theoretical understanding of intermediary institutions and leaves policymakers without clear guidance on how to design them under the STI Policy 2020–2030 and Vision 2030 frameworks.

Therefore, this study investigates how innovation intermediaries shape the relationship between academic collaboration and technological innovation in Kenyan universities. By explicitly examining both mediation and moderation effects, it seeks to clarify whether intermediaries transmit collaborative inputs into innovation outcomes, strengthen the impact of collaboration, or perform a dual role. The remainder of the paper is structured as follows: it reviews the relevant theoretical and empirical literature, develops the study's hypotheses, outlines the adopted methodology, presents and discusses the findings, and concludes with implications for university administrators and STI policy in Kenya.

LITERATURE REVIEW

The relationship between academic collaboration and technological innovation is commonly anchored in the Triple Helix model, which conceptualises innovation as emerging from reciprocal relations among universities, industry, and government rather than from any single actor (Etzkowitz & Leydesdorff, 2000). Applied to Kenya, this model implies that technological output depends not only on research volume but also on how effectively knowledge crosses institutional boundaries—a role performed by innovation intermediaries. A complementary lens is absorptive capacity theory, which holds that an organisation's ability to recognise, assimilate, and apply external knowledge depends on its prior knowledge base and institutional capacity (Cohen & Levinthal, 1990). Together, these theories suggest that collaboration supplies the raw material for innovation, while conversion into usable technology depends on absorptive and intermediary structures.

Empirical evidence broadly supports the expectation that collaboration positively influences innovation. A systematic review confirmed that joint research and consultancy predict technology transfer (Perkmann et al., 2013). Yet collaboration alone does not guarantee outcomes. Howells (2006) emphasised intermediaries as essential translators, while Klerkx and Leeuwis (2009) demonstrated that brokers actively shape success by building trust and bridging institutional boundaries. These findings converge on the importance of intermediaries but differ in methodology: quantitative reviews report consistent positive effects, whereas qualitative studies highlight conditional effects.

Based on this evidence, the study advances the following hypotheses: H1: Academic collaboration has a significant positive effect on technological innovation. H2: Academic collaboration has a significant positive effect on innovation intermediary engagement. H3: Innovation intermediary engagement has a significant positive effect on technological innovation. H4: Innovation intermediary engagement mediates the relationship between academic collaboration and technological innovation. H5: Innovation intermediary capacity moderates the relationship between academic collaboration and technological innovation; such that the relationship is stronger where intermediary capacity is higher.

African evidence adds important conditionality to this debate. Munyoki et al. (2011) found weak intermediary structures in Kenya's manufacturing sector, while Mwenda et al. (2021) highlighted the role of dynamic capabilities in shaping collaboration outcomes. Mafu (2023) noted gaps in intellectual property expertise in Botswana, and Ethiopian studies diverge: Hailu (2024) emphasised structural weaknesses, whereas Gebrekidan et al. (2025) highlighted human capital and institutional barriers. Nigerian evidence reinforced that stronger transfer capacity yields higher commercialisation (Fadeyi et al., 2019). Taken together, these findings suggest that while collaboration contributes to innovation, its strength depends on intermediary capacity—including staffing, funding, and institutional authority. Accordingly, the study proposes a final hypothesis: H5: Innovation intermediary capacity moderates the relationship between academic collaboration and technological innovation, such that the relationship is stronger where intermediary capacity is higher.

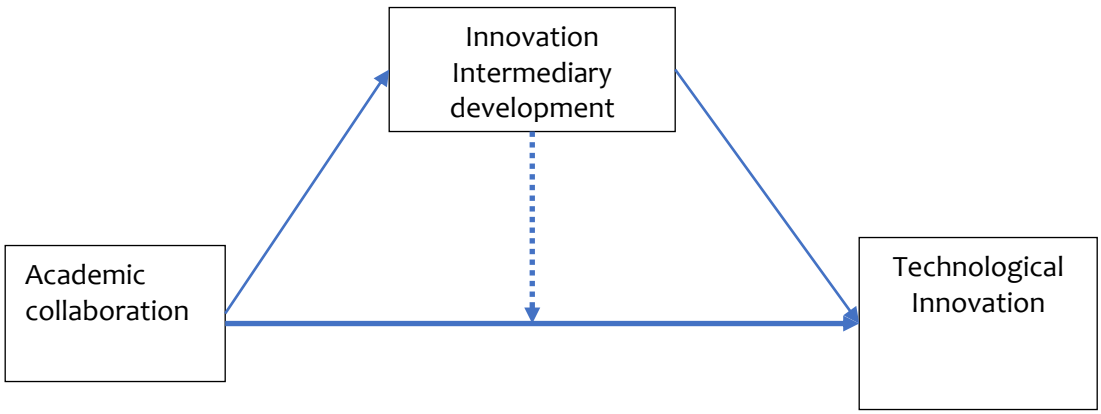

Figure 1. Conceptual Framework Showing Innovation Intermediaries as Mediators and Moderators.

METHODOLOGY

This study adopted a cross-sectional survey design, which was appropriate for examining mediation and moderation effects because it enabled the simultaneous measurement of academic collaboration, intermediary engagement, and technological innovation among diverse institutional actors. The target population comprised three categories of university–industry collaboration (UIC) stakeholders: university respondents, including senior staff in research and technology transfer offices and senior

academics; industry respondents, such as managers, R&D officers, and technical staff; and intermediary respondents, including staff in incubation centres, science parks, and innovation offices. A census of all 66 chartered Kenyan public universities was undertaken to ensure full coverage of the academic population. Industry and intermediary respondents were selected using stratified random sampling proportionate to category size, yielding a final sample of 212 participants (99 university, 72 industry, and 41 intermediary). This distribution ensured representation across all three stakeholder groups.

The sample size was adequate for covariance-based structural equation modelling (CB-SEM), as recommended thresholds were met. Specifically, the minimum requirement of 200 cases was met, and the sample-to-parameter ratio exceeded the 10:1 guideline (Kline, 2016). Measurement items for academic collaboration, intermediary engagement, and technological innovation were adapted from established instruments in prior studies. Innovation intermediary capacity was explicitly measured to test the moderation hypothesis, ensuring alignment between the conceptual framework and the empirical design.

Reliability and validity were assessed using Cronbach's alpha, composite reliability (CR), and confirmatory factor analysis. Cronbach's alpha coefficients exceeded the .70 threshold, complementing CR values above .70 and average variance extracted (AVE) values above .50. Model fit was evaluated using CMIN/df, CFI, TLI, GFI, and RMSEA indices, following Anderson and Gerbing's (1988) two-step approach. Ethical approval was obtained from the relevant university research ethics committee. All participants provided informed consent, and confidentiality was safeguarded through anonymisation and aggregate reporting.

FINDINGS AND DISCUSSION

The analysis began with descriptive statistics to establish the distribution of respondents across stakeholder categories. **Table 1** shows that university staff accounted for nearly half of the sample (46.7%), industry respondents comprised 34.0 per cent, and intermediaries represented 19.3 per cent, yielding a total of 212 participants. This distribution confirms balanced representation across the university–industry collaboration (UIC) ecosystem.

Table 1. Distribution of Respondents

Category	Description of Respondents	Frequency (n)	Percentage (%)
Universities	Staff in research offices, TTOs, senior academics	99	46.7
Industry	Managers, R&D officers, technical staff	72	34.0
Intermediaries	Senior staff in TTOs, incubators, science parks and innovation offices	41	19.3
Total	**All respondents across UIC collaborations**	**212**	**100.0**

Note. TTOs = technology transfer offices; UIC = university–industry collaboration.

Model fit was evaluated using absolute, incremental, and parsimony-adjusted indices. The measurement model exhibited excellent fit: $\chi^2(23) = 25.61$, $p = .320$, CMIN/df = 1.11. Incremental fit exceeded thresholds (CFI = .999), while absolute fit indices confirmed strong specification (SRMR = .023; RMSEA = .017; PCLOSE = .969). These values are consistent with recommended criteria (Hu & Bentler, 1999; Hair et al., 2019), indicating that the model is well-specified.

Table 2. Model Fit Indices for the Structural/Measurement Model

Fit Index	Observed Value	Threshold Criteria	Interpretation
Chi-Square (CMIN)	25.61	—	—
Degrees of Freedom (df)	23	—	—
***p*-value**	.320	> .05	Non-significant
CMIN/DF	1.11	Between 1.0 and 3.0	Excellent fit
CFI	.999	> .95	Excellent fit
SRMR	.023	< .08	Excellent fit
RMSEA	.017	< .06	Excellent fit
PCLOSE	.969	> .05	Excellent fit

Note. CMIN = Chi-Square; df = Degrees of Freedom; CFI = Comparative Fit Index; SRMR = Standardized Root Mean Square Residual; RMSEA = Root Mean Square Error of Approximation; PCLOSE = p-value for test of close fit (RMSEA < .05).

Construct reliability and validity were confirmed. All composite reliability (CR) values exceeded .70, with MaxR(H) ranging from .781 to .954. Convergent validity was established, with average variance extracted (AVE) values above .50. Discriminant validity was supported by AVE > MSV and square roots of AVE exceeding inter-construct correlations (Fornell & Larcker, 1981; Hair et al., 2019). These results confirm that the measurement model is robust.

Table 3. Construct Reliability, Convergent Validity, and Fornell–Larcker Discriminant Validity

Construct	CR	AVE	MSV	MaxR(H)	Intm	TI	Academic
Intm	.922	.798	.206	.954	(.893)		
TI	.878	.706	.206	.881	.454***	(.840)	
Academic	.776	.537	.097	.781	.258***	.312***	(.733)

Note. CR = Composite Reliability; AVE = Average Variance Extracted; MSV = Maximum Shared Variance; MaxR(H) = Maximum Reliability; Intm = Innovation intermediaries; TI = Technological innovation; Academic = Academic collaboration. Values in parentheses represent square root of AVE. ***p < .001.

Structural path estimates supported all five hypotheses. Academic collaboration had a significant positive direct effect on technological innovation (β = .121, p = .025), confirming **H1**. Collaboration also enhanced intermediary engagement (β = .231, p < .001), supporting **H2**. Intermediaries exerted a strong positive effect on innovation (β = .352, p < .001), supporting **H3**. The indirect effect of collaboration through intermediaries was significant (β = .088, p = .003), confirming partial mediation (**H4**). Finally, the interaction term was significant (β = .261, p < .001), supporting **H5** and demonstrating that intermediary capacity strengthens the collaboration–innovation relationship.

Table 4. Structural Path Estimates and Hypothesis Testing

Hypothesis	Path	Estimate	S.E.	C.R.	*p*	Decision
H1	TI ← AC (direct effect)	.121	.054	2.246	.025	Accepted
H2	IID ← AC	.231	.053	4.325	***	Accepted
H3	TI ← IID	.352	.057	6.158	***	Accepted
H5	TI ← AC × IID (interaction)	.261	.039	6.622	***	Accepted
H4	TI ← IID ← AC (indirect effect)	.088	.025	3.536	.003	Accepted

Note. AC = Academic collaboration; IID = Innovation intermediaries; TI = Technological innovation. S.E. = Standard error; C.R. = Critical ratio. ***p < .001.

The structural model explained 27 per cent of the variance in technological innovation (R^2 = .27), indicating that exogenous variables accounted for a moderate proportion of outcome variation. This suggests that while collaboration and intermediary engagement are important drivers, other contextual factors may also influence innovation outcomes in Kenyan universities.

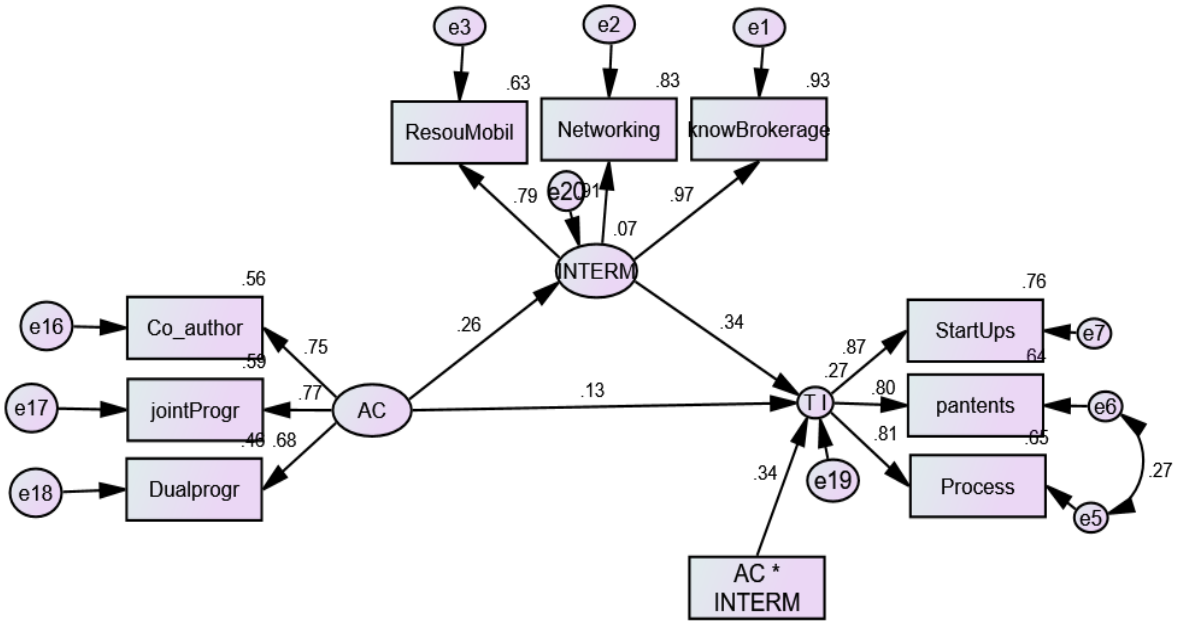

Figure 2. Standardised Structural Model with Measurement Loadings and Path Estimates (AMOS output)

Discussion

The findings provide a layered theoretical explanation of how academic collaboration drives technological innovation—including startup creation, process improvements, and patent outputs—while shaping talent mobility through intermediary structures. The direct relationship between collaboration and intermediary engagement reinforces the Triple Helix model by positioning universities as entrepreneurial actors rather than passive knowledge producers (Etzkowitz & Leydesdorff, 2000; Mwenda et al., 2021). Public universities increasingly leverage collaborative networks to establish incubators, technology transfer offices, and joint innovation hubs, thereby formalising the interface between academia, industry, and government. The confirmation of H1 and H2 demonstrates that collaboration not only directly contributes to innovation but also strengthens intermediary engagement, thereby validating the model's emphasis on reciprocal institutional roles.

The partial mediating role of intermediaries extends Open Innovation theory (Chesbrough, 2003) to higher education by showing that intermediaries facilitate knowledge flows, reduce transaction costs, and support commercialisation of intellectual property. In this study, the direct path from collaboration to innovation remained significant (β = .121, p = .025), while the indirect path through intermediaries was also significant (β = .088, p = .003). This confirms H4, meaning that intermediaries transmit collaborative inputs into innovation outcomes while collaboration itself continues to exert an independent effect. The validation of H3 further underscores the centrality of intermediary institutions in shaping innovation outcomes.

Institutional Theory provides a useful lens for interpreting the moderating effect of intermediary capacity. Commercialisation pathways depend on governance stability, intellectual property protocols, and administrative mechanisms (Scott, 2014; Adegu et al., 2026). The significant interaction effect (β = .261, p < .001) demonstrates that intermediary capacity strengthens the collaboration–innovation link, confirming H5 and underscoring the importance of institutional adaptation. Where governance structures are weak, innovation outcomes are undermined; where they are robust, intermediaries amplify collaborative potential.

Finally, the Resource-Based View (RBV) (Barney, 2001) and Dynamic Capabilities perspective (Teece et al., 1997) clarify how relational capital and organisational mechanisms interact. Collaborative networks represent non-substitutable capital, but raw partnerships require dynamic organisational capabilities to realise their potential. Intermediaries provide this capability by deploying, transforming, and commercialising collaborative knowledge. At the same time, researchers embedded in robust intermediary environments accumulate dynamic capabilities that expand their external agency, underscoring the need for universities to complement structural investments with strategic retention practices. Together, these findings highlight that innovation outcomes in Kenyan universities depend not only on collaboration but also on the institutional strength of intermediary structures.

CONCLUSION AND RECOMMENDATIONS

Conclusion: This study examined how innovation intermediaries shape the relationship between academic collaboration and technological innovation in Kenyan public universities. The results confirmed that collaboration exerts a significant direct effect on innovation outcomes, while intermediary engagement both mediates and moderates this relationship. The findings highlight the dual role of intermediaries: they transmit collaborative inputs into usable technology and amplify the strength of collaboration where institutional capacity is robust. Together, these insights extend the Triple Helix, Open Innovation, and Institutional Theory frameworks by demonstrating that innovation outcomes depend not only on collaborative networks but also on intermediary governance, resources, and dynamic capabilities.

Recommendations: First, universities should strengthen intermediary institutions—including technology transfer offices, incubators, and science parks—by investing in staffing, funding, and intellectual property expertise. Second, policy frameworks under the STI Policy 2020–2030 and Vision 2030 should prioritise intermediary governance reforms to ensure clear mandates, accountability structures, and sustainable financing. Third, industry partners should be incentivised to co-invest in intermediary platforms, thereby sharing risks and enhancing commercialisation pathways. Fourth, universities should complement structural investments with strategic retention practices, ensuring that researchers embedded in intermediary environments accumulate dynamic capabilities that expand their external agency. Finally, national innovation policy should integrate intermediary development into broader economic transformation strategies, positioning universities as entrepreneurial actors within Kenya's knowledge-based economy.

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