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Open Innovation, Entrepreneurial Mindset, and Innovation Adoption Among African University Students: Cross-Cultural Evidence from Tunisia and Sub-Saharan Africa

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Abstract:

Purpose: *This study investigates how open innovation and collaboration strategies (OIC), innovation adoption behaviors (IA), and contextual factors (CF) shape the entrepreneurial mindset (EM) of university students in Tunisia and Sub-Saharan Africa.*
Design/methodology approach: *Drawing on a quantitative survey of 269 respondents and using Partial Least Squares Structural Equation Modeling (PLS-SEM) via SmartPLS3, four hypotheses are tested.*
Findings: *Results confirm that OIC exerts a direct positive effect on EM ($\beta = 0.242$, $p < 0.001$), that IA partially mediates this relationship ($\beta = 0.124$, $p < 0.001$), and that CF also functions as a significant mediator ($\beta = 0.119$, $p < 0.01$). However, the moderating effect of geographic origin Tunisian vs. Sub-Saharan is not statistically supported ($\beta = -0.078$, $p = 0.071$).*
Practical implications: *These findings contribute to the growing literature on entrepreneurship in non-Western contexts by demonstrating that structural factors such as collaborative innovation practices and contextual enablers are stronger predictors of entrepreneurial thinking than cultural origin alone.*
Originality value: *Managerial and policy implications for African higher education institutions are discussed in light of 2024–2026 data on African youth entrepreneurship ecosystems.*

Keywords: *Open innovation, entrepreneurial mindset, PLS-SEM, innovation adoption, contextual factors, African students, Tunisia, Sub-Saharan Africa, frugal innovation.*

JEL Classification: *O31, L26, O33, I23, Z13.*

Paper Type: *Research paper.*

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1. Introduction

Global economic transformations driven by digitalization, geopolitical shifts, and post-pandemic restructuring have elevated entrepreneurship and innovation to the forefront of development agendas. This is especially pronounced in Africa, where demographic pressures and structural unemployment converge with a rising wave of youth entrepreneurial activity.

The Global Entrepreneurship Monitor (GEM, 2025) reports that Sub-Saharan Africa holds the world's highest rate of early-stage entrepreneurial activity, while the African Development Bank (AfDB, 2024) estimates that 10-12 million young Africans enter the labor market annually, with formal employment unable to absorb more than 25% of them.

Within this context, understanding what cultivates an entrepreneurial mindset the cognitive capacity to identify opportunity, persist under uncertainty, and translate ideas into value becomes a matter of strategic urgency. Classical frameworks, from Schumpeter's (1934) theory of creative destruction to Rogers' (2003) Diffusion of Innovations model and Chesbrough's (2003) Open Innovation paradigm, provide foundational lenses.

However, the literature remains dominated by Western empirical contexts, leaving a significant gap in our understanding of how African students develop entrepreneurial orientations.

This research addresses that gap by investigating three antecedents of the entrepreneurial mindset: (1) open innovation and collaboration strategies (OIC), (2) innovation adoption behaviors (IA), and (3) contextual factors (CF). It further examines whether geographic origin moderates these relationships. The study uses survey data from 269 students across both Tunisian and Sub-Saharan populations, analyzed through PLS-SEM, a method suited to complex multi-construct models in exploratory settings (Hair *et al.,* 2017).

The paper is organized as follows: Section 2 reviews theoretical foundations. Section 3 develops hypotheses and the conceptual model. Section 4 presents the methodology. Section 5 reports results. Section 6 discusses implications and limitations. Section 7 concludes.

2. Theoretical Background and Literature Review

2.1 Innovation: Definitions and Typologies

Schumpeter (1934) defined innovation as the introduction of new productive combinations, encompassing new products, production methods, supply sources, market openings, and organizational forms. The OECD Oslo Manual (4th ed., 2018)

expands this, defining innovation as a new or substantially improved product or process that differs appreciably from previous offerings and has been made available to users. Henderson and Clark (1990) distinguished product, process, organizational, and marketing innovation typologies. Christensen (1997) and Garcia and Calantone (2002) added a degree-of-novelty dimension, differentiating incremental, radical, and disruptive forms.

Table 1. *Major Innovation Typologies*

Basis	Type	Definition	Example	Reference
Object	Product	New/improved goods or services	iPhone	Henderson & Clark, 1990
	Process	Improved production/distribution methods	Toyota Production System	OECD, 2018
	Organizational	New management or business practices	Agile methodology	Henderson & Clark, 1990
	Marketing	New commercialization approaches	Subscription pricing	OECD, 2018
Degree	Incremental	Gradual improvement of existing offerings	Software updates	Garcia & Calantone, 2002
	Radical	Fundamental paradigm shift	Blockchain technology	Christensen, 1997
	Disruptive	Complex/costly product → simple/accessible solution	M-Pesa mobile banking	Christensen, 1997
Source	Closed	Internal R&D; strong IP protection	Traditional pharma R&D	Chesbrough, 2003
	Open	Integrates external knowledge	P&G Connect+Develop	Chesbrough, 2003
Context	Frugal	More value with fewer resources	Jua Kali (Kenya)	Radjou & Prabhu, 2015
	Social	Responds to social needs and relationships	mHealth platforms	Murray et al., 2010

Source: *Author's synthesis from reviewed literature.*

2.2 Open Innovation: Theory and African Relevance

Chesbrough's (2003) open innovation paradigm reconceptualized firm boundaries by emphasizing that valuable ideas can originate inside or outside an organization and that commercialization paths similarly cross organizational frontiers. The framework distinguishes inbound open innovation (leveraging external knowledge), outbound open innovation (monetizing unused internal knowledge), and coupled open innovation (bidirectional flows).

In African higher education, the African Entrepreneurial University Network (Alabi and Nkrumah, 2023) documents how intra-African collaboration networks amplify innovation capacity under institutional constraints.

Amoako and Lyon (2024) found that ubuntu-inspired collaborative models among Gen-Z African entrepreneurs in university incubators yield higher entrepreneurial self-efficacy than individualistic approaches. The GEM Africa Report (2025) identifies collaborative ideation and external mentorship as the two strongest predictors of student venture initiation across 12 African economies. Bankole and Olatokun (2023) demonstrate that offline-first collaborative development enables African student entrepreneurs to maintain innovation productivity comparable to better-connected peers.

2.3 Innovation Diffusion and Adoption Frameworks

Rogers' (2003) Diffusion of Innovations theory remains foundational in adoption scholarship. Rogers categorized adopters along a temporal continuum: innovators (2.5%), early adopters (13.5%), early majority (34%), late majority (34%), and laggards (16%). Five attributes shape adoption velocity: relative advantage, compatibility, complexity, trialability, and observability.

Post-Rogers scholarship has extended the model: Klineberg and Makridakis (2022) argue that in the era of algorithmic decision-making, innovations adapt iteratively to users rather than users unidirectionally adapting to innovations a co-evolutionary dynamic visible especially in digital platform adoption.

In the African context, Dutta and Omolayole (2022) demonstrated that contemporary innovation diffusion transcends unidirectional propagation models, incorporating contextual adaptation dynamics and local appropriation. Mensah and Acquah (2022) identified institution-specific barriers among African university students limited internet access, hardware costs, insufficient academic IP frameworks as modulators of adoption readiness.

Adisa and Madichie (2023) showed that social influence and community-based referrals disproportionately govern technology adoption among African student entrepreneurs.

2.4 The Entrepreneurial Mindset: Dimensions and Antecedents

The entrepreneurial mindset is a multidimensional psychological construct encompassing growth orientation, proactivity, resilience, self-efficacy, and tolerance for ambiguity (McMullen and Shepherd, 2006; Dweck, 2006). Hofstede's (1980, 2001) cultural dimensions framework power distance, individualism, uncertainty avoidance has been widely applied to explain cross-national variation in entrepreneurial propensity.

A meta-analysis by Rinne *et al.* (2020) across 32 countries confirmed that low uncertainty avoidance, high individualism, and low power distance correlate with higher innovation output.

However, as Shane and Venkataraman (2000) caution, aggregate correlations obscure important nuances: collectivist societies often excel in community-embedded incremental innovation.

Kiggundu and Ogundele (2022) identified an emerging contextual university model in Africa characterized by community embeddedness, hybridization of traditional and technological knowledge, and active industry-community partnerships that effectively cultivates student entrepreneurial orientation under resource constraints.

The Ichikowitz Foundation African Youth Survey (2024) confirmed that 68% of African youth aged 18-35 identify entrepreneurship as their primary career aspiration, yet only 23% report access to institutional support for venture creation, highlighting the systemic gap this study addresses.

3. Research Hypotheses and Conceptual Model

3.1 Theoretical Grounding of Hypotheses

The conceptual model positions OIC as the primary exogenous construct, EM as the primary endogenous construct, IA and CF as mediating variables, and geographic origin (PAYS) as a moderating variable.

H1 — Direct Effect of OIC on EM:
Collaboration with external actors exposes students to diverse problem-solving approaches, amplifying proactivity and self-efficacy (Chesbrough, 2003; Amoako and Lyon, 2024). Toroslu *et al.* (2024) recently confirmed a positive relationship between external collaboration frequency and entrepreneurial orientation in emerging economy university settings.

H1: *Open Innovation and Collaboration Strategies (OIC) exert a significant positive direct effect on Entrepreneurial Mindset (EM).*

H2 — Mediating Role of Innovation Adoption (IA):
Students who engage with collaborative innovation are more likely to experiment with new tools and practices (Jin *et al.,* 2023), reinforcing entrepreneurial dispositions through lived learning (Ries, 2011; Blank, 2021). Adisa and Madichie (2023) provide African-context evidence that technology adoption experience accelerates entrepreneurial self-efficacy development.

H2: *Innovation Adoption (IA) mediates the relationship between OIC and Entrepreneurial Mindset (EM).*

H3 — Mediating Role of Contextual Factors (CF):
Contextual factors technological resources, cultural incentives, and institutional barriers shape the degree to which open innovation strategies translate into entrepreneurial thinking. Shane (2003) established that the institutional environment moderates the conversion of entrepreneurial capacity into action. African infrastructure constraints disproportionately mediate the translation of collaborative intent into entrepreneurial mindset outcomes (Naudé and Nagler, 2022).

H3: *Contextual Factors (CF) mediate the relationship between OIC and Entrepreneurial Mindset (EM).*

H4 — Moderating Role of Geographic Origin:
Cultural contingency theory (Hofstede, 1980) suggests that the effectiveness of innovation strategies in shaping entrepreneurial orientations may vary across cultural contexts. Tunisian students operate within a North African institutional environment characterized by bureaucratic constraints and a developing entrepreneurial ecosystem, while Sub-Saharan students benefit from communal support networks but face distinct resource access challenges (Zoogah and Nkomo, 2023).

H4: *Geographic origin (Tunisia vs. Sub-Saharan Africa) moderates the relationship between OIC and Entrepreneurial Mindset (EM).*

4. Research Methodology

4.1 Research Design and Data Collection

This study adopts a quantitative cross-sectional design. A structured self-administered questionnaire was distributed to a purposive sample of university students in Tunisia (IHEC Carthage and partner institutions) and Sub-Saharan Africa (students enrolled in partner institutions and exchange programs). The target population comprised students engaged in entrepreneurship-related curricula, entrepreneurship clubs, or incubation activities.

Data collection occurred during the 2024–2025 academic year. The final usable sample comprised 269 respondents (response rate ≈ 78%). The sample includes

student-entrepreneurs, continuing professional development students, and aspiring entrepreneurs at the ideation stage.

4.2 Sample Characteristics

Table 2. *Sociodemographic Characteristics of Respondents (n = 269)*

Variable	Category	n	%
Geographic Origin	Tunisia	148	55.0%
	Sub-Saharan Africa	121	45.0%
Gender	Male	154	57.2%
	Female	115	42.8%
Academic Level	Bachelor's	89	33.1%
	Master's	142	52.8%
	Doctoral/Professional	38	14.1%
Entrepreneurial Status	Active venture	74	27.5%
	Ideation stage	112	41.6%
	No venture activity	83	30.9%

Source: *Primary data, 2024–2025.*

4.3 Measurement Instrument

All constructs were operationalized using validated multi-item reflective scales on a 5-point Likert scale (1 = Strongly Disagree; 5 = Strongly Agree), adapted from the literature and translated into French:

- Entrepreneurial Mindset (EM, 7 items): growth mindset, resilience, proactivity, ambiguity tolerance, and self-efficacy adapted from McMullen and Shepherd (2006) and Dweck (2006).
- Open Innovation and Collaboration Strategies (OIC, 6 items): external partnerships, user feedback integration, co-creation adapted from Chesbrough (2003) and West and Bogers (2022).
- Innovation Adoption (IA, 6 items): relative advantage, compatibility, observability, trialability adapted from Rogers (2003) and Venkatesh et al. (2003).
- Contextual Factors (CF, 4 items): technological resource access, institutional support, cultural entrepreneurial climate adapted from Shane (2003) and GEM (2025).

4.4 Analytical Method: PLS-SEM

The study employs Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS3 (Ringle *et al.,* 2015), appropriate for complex models with multiple mediating paths, non-normal data distributions, and exploratory theoretical contexts (Hair *et al.,* 2017). The analysis proceeds in two stages: (1) evaluation of the outer (measurement) model, followed by (2) evaluation of the inner (structural) model.

5. Results

5.1 Measurement Model Evaluation

5.1.1 Indicator Reliability, Convergent Validity, and Internal Consistency

All factor loadings must exceed 0.70, composite reliability (CR) must be > 0.70, and average variance extracted (AVE) must be > 0.50 to confirm measurement quality (Hair *et al.,* 2017; Fornell and Larcker, 1981).

Table 3. *Outer Loadings, AVE, and Composite Reliability*

Construct	Item	Loading	AVE	CR
IA	IA1	0.755	0.640	0.914
	IA2	0.808		
	IA3	0.862		
	IA4	0.783		
	IA5	0.747		
	IA6	0.838		
CF	CF1	0.849	0.719	0.911
	CF2	0.841		
	CF3	0.865		
	CF4	0.837		
EM	EM1	0.725	0.596	0.912
	EM2	0.832		
	EM3	0.741		
	EM4	0.793		
	EM5	0.775		

	EM6	0.796		
	EM7	0.738		
OIC	OIC1	0.842	0.691	0.930
	OIC2	0.719		
	OIC3	0.826		
	OIC4	0.842		
	OIC5	0.871		
	OIC6	0.877		
PAYS	PAYS	1.000	1.000	1.000

Notes: *IA = Innovation Adoption; CF = Contextual Factors; EM = Entrepreneurial Mindset; OIC = Open Innovation & Collaboration; PAYS = Geographic Origin. All loadings ≥ 0.70; all AVE ≥ 0.50; all CR ≥ 0.90.*
Source: *SmartPLS3 analysis.*

Table 4. *Internal Reliability Indicators (Cronbach's Alpha and Rho-A)*

Construct	Cronbach's α	Rho-A	Assessment
IA — Innovation Adoption	0.888	0.904	Excellent
CF — Contextual Factors	0.871	0.876	Very Good
EM — Entrepreneurial Mindset	0.887	0.889	Excellent
OIC — Open Innovation & Collab.	0.909	0.911	Excellent
PAYS — Geographic Origin	1.000	1.000	Single-item moderator

Note: *Threshold ≥ 0.70 (Hair et al., 2017).*
Source: *SmartPLS3 analysis.*

5.1.2 Discriminant Validity

Discriminant validity was assessed using the Fornell-Larcker criterion (1981) and the Heterotrait-Monotrait ratio (HTMT; Henseler *et al.,* 2015). The Fornell-Larcker criterion requires that the square root of each construct's AVE exceeds all its inter-construct correlations.

5.2 Structural Model Evaluation and Hypothesis Testing

The structural model was evaluated through bootstrap resampling (N = 500 subsamples) to assess path coefficient significance. Goodness of fit was assessed via R^2, effect sizes (f^2), predictive relevance (Q^2), and the GoF index.

Table 5. *Fornell-Larcker Criterion (Square Root of AVE on diagonal, inter-construct correlations off-diagonal)*

	IA	CF	EM	OIC
IA	0.800			
CF	0.746	0.848		
EM	0.633	0.641	0.772	
OIC	0.544	0.543	0.700	0.831

Note: *Bold diagonal = √AVE. Each √AVE exceeds all correlations in its row/column, confirming discriminant validity. PAYS omitted (single-item categorical moderator).*
Source: *SmartPLS3.*

Table 6. *Heterotrait-Monotrait (HTMT) Ratios*

	IA	CF	EM	OIC
IA	—			
CF	0.840	—		
EM	0.698	0.723	—	
OIC	0.546	0.601	0.776	—

Note: *All HTMT values < 0.90 threshold (Henseler et al., 2015). Highest value: 0.840 (IA–CF). Discriminant validity confirmed.*
Source: *SmartPLS3.*

Table 7. *Hypothesis Testing Results — Bootstrapped Path Coefficients (N = 500)*

Hyp.	Relationship	β	SD	t	p	Decision
H1	OIC → EM (direct)	0.242	0.041	5.841	< 0.001	✓ Supported
H2	OIC → IA → EM (mediation)	0.124	0.034	3.673	< 0.001	✓ Supported
H3	OIC → CF → EM (mediation)	0.119	0.040	2.981	0.003	✓ Supported
H4	PAYS × OIC → EM (moderation)	−0.078	0.043	1.811	0.071	✗ Not Supported

Notes: *β = standardized path coefficient; SD = standard deviation. Significance thresholds: $p < 0.05$ ($t > 1.96$); $p < 0.01$ ($t > 2.58$); $p < 0.001$ ($t > 3.29$).*
Source: *SmartPLS 3 bootstrapping.*

Table 8. *Model Quality Indicators (R^2, f^2, Q^2, GoF)*

Endogenous Construct	R^2	f^2	Q^2	Interpretation
Entrepreneurial Mindset (EM)	0.571	0.184	0.312	Moderate–large predictive power
Innovation Adoption (IA)	0.296	0.113	0.178	Moderate effect; relevant mediator
Contextual Factors (CF)	0.295	0.109	0.198	Moderate effect; relevant mediator
GoF Index (Global)	0.448	—	—	Good overall fit (threshold > 0.36)

Notes: *$R^2 \geq 0.19$ = small; ≥ 0.33 = moderate; ≥ 0.67 = large (Chin, 1998). $f^2 \geq 0.02$ = small; ≥ 0.15 = medium; ≥ 0.35 = large (Cohen, 1988). $Q^2 > 0$ indicates predictive relevance (Stone, 1974; Geisser, 1975). GoF > 0.36 = large (Wetzels et al., 2009).*
Source: *SmartPLS3.*

The structural model demonstrates robust explanatory power. The R^2 of 0.571 for EM indicates that OIC, IA, CF, and PAYS collectively explain approximately 57% of the variance in entrepreneurial mindset a substantial proportion for social science research. The GoF of 0.448 confirms adequate global model fit. Q^2 values exceeding zero for all endogenous constructs confirm the model's predictive relevance.

6. Discussion

6.1 Open Innovation as a Direct Driver of Entrepreneurial Mindset (H1 Supported)

The strongest path in the model ($\beta = 0.242$, $t = 5.841$, $p < 0.001$) confirms that OIC directly reinforces EM. Students engaged in external collaboration, co-creation, and user-feedback loops develop greater proactivity, self-efficacy, and ambiguity tolerance core dimensions of entrepreneurial mindset (McMullen and Shepherd, 2006).

Amoako and Lyon (2024) observed that ubuntu-style collaborative innovation among Gen-Z Kenyan and Ghanaian students significantly enhanced entrepreneurial self-efficacy compared to individually-oriented approaches. The GEM Africa Report (2025) similarly identifies mentorship networks and collaborative ecosystems as the two strongest institutional predictors of entrepreneurial activity initiation in Sub-Saharan universities. Our data quantitatively confirm this pattern.

A direct policy implication follows: universities in both Tunisia and Sub-Saharan Africa should prioritize collaboration infrastructure cross-disciplinary innovation labs, industry partnership programs, student-run accelerators as primary mechanisms for cultivating entrepreneurial mindsets.

6.2 Innovation Adoption as a Partial Mediator (H2 Supported)

H2 is supported ($\beta = 0.124$, $t = 3.673$, $p < 0.001$), indicating that part of the OIC–EM relationship is transmitted through students' innovation adoption behaviors. This finding suggests a sequential mechanism: collaborative innovation exposure increases experimentation with new tools, which reinforces entrepreneurial orientations through lived learning (Ries, 2011; Kolb, 1984).

The mediation is partial OIC retains a significant direct effect implying that not all mindset-building value of open innovation operates through adoption behavior. For African student entrepreneurs, where technology access is uneven (Mothobi and Gillwald, 2023), partial mediation is meaningful: OIC will yield entrepreneurial mindset benefits even among students who face barriers to full technology adoption.

6.3 Contextual Factors as a Partial Mediator (H3 Supported)

H3 is supported ($\beta = 0.119$, $t = 2.981$, $p < 0.01$). Contextual factors technological infrastructure access, cultural entrepreneurial incentives, and institutional support mediate part of the OIC-EM relationship, confirming Shane's (2003) institutional theory of entrepreneurship.

Importantly, both CF and IA explain roughly equivalent shares of variance in EM, suggesting that neither behavioral nor contextual mediation dominates; both pathways matter simultaneously. Interventions targeting entrepreneurial mindset must address both dimensions: behavioral (encouraging innovation adoption) and structural (improving contextual enablers).

6.4 Geographic Origin Does Not Moderate (H4 Not Supported)

H4 is not supported ($\beta = -0.078$, $t = 1.811$, $p = 0.071$). Geographic origin whether students are Tunisian or Sub-Saharan African does not significantly moderate the OIC–EM relationship. This important null result challenges assumptions embedded in cultural contingency literature (Hofstede, 1980). Several explanations merit consideration.

First, the student population is self-selected around entrepreneurship activities, likely producing cultural homogenization around entrepreneurial values what Wenger (1998) terms a community of practice transcending national culture. Second, the forces shaping student entrepreneurial mindsets appear more structural than cultural: access to collaborative infrastructure, digital tool exposure, and external mentorship are more determinative than geographic origin.

Third, this finding aligns with the Ichikowitz African Youth Survey (2024), which documents convergence in entrepreneurial aspiration, digital tool usage, and risk tolerance across North and Sub-Saharan African youth. For researchers, this null

result suggests that future studies should disaggregate geographic origin into more specific institutional variables university model, urban vs. rural location, internet access quality rather than treating national or regional identity as a cultural proxy.

6.5 Managerial and Policy Implications

Four concrete implications follow. First, universities should invest in structured open innovation programs industry-academia hackathons, cross-continental student challenges as the strongest institutional lever for developing entrepreneurial mindsets.

The AfCFTA digital economy framework (2024) provides a policy window for joint university-industry innovation at continental scale. Second, digital literacy and technology access programs should be positioned as entrepreneurial mindset development tools.

The AfDB's Youth Entrepreneurship and Innovation Multi-Donor Trust Fund (2024 cycle) has begun integrating adoption support into mindset development curricula, aligning with our findings. Third, institutions should prioritize contextual enablers co-working infrastructure, startup legal frameworks, peer mentorship as amplifiers of the mindset effects of open innovation engagement. Fourth, pan-African institutional collaboration appears more promising than nationally segmented approaches, given the convergence documented here.

7. Limitations and Future Research Directions

Several limitations qualify these findings. First, the cross-sectional design precludes causal inference; longitudinal data would be needed to confirm the developmental sequence posited by the model. Second, purposive sampling limits generalizability to broader student populations not engaged in entrepreneurship activities. Third, PAYS is operationalized as a binary categorical indicator, which cannot capture within-group heterogeneity in both Tunisian and Sub-Saharan contexts.

Future research should employ multi-wave longitudinal designs to track entrepreneurial mindset development over academic programs. More granular cultural variables specific cultural dimension scores, generational cohort membership, urban-rural location should replace geographic origin as moderators. Extending the sample to include francophone West Africa, Anglophone East Africa, and Maghrebi contexts separately would clarify whether the convergence found here is stable across the continent's diverse institutional ecosystems.

8. Conclusion

This study advances the empirical literature on entrepreneurship in African higher education by demonstrating that open innovation and collaboration strategies,

innovation adoption behaviors, and contextual factors are all significant structural antecedents of the entrepreneurial mindset among university students in Tunisia and Sub-Saharan Africa.

Critically, geographic origin does not moderate these relationships, suggesting that the structural mechanisms through which collaborative innovation builds entrepreneurial thinking transcend regional cultural boundaries within the African university context.

As Africa's demographic dividend matures with the continent projected to host 1.7 billion young people by 2030 (UNDP, 2024) building institutional infrastructures that cultivate entrepreneurial thinking at scale is both an academic priority and an economic imperative.

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