

Beyond Brick and Mortar: Addressing the Agricultural Skills Gap in Uganda's Youth Employment Strategy

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Abstract

Background: Uganda's youth employment strategy has predominantly emphasized urban-based formal sector jobs, overlooking agriculture's potential to absorb the growing youth population despite the sector's contribution of 24% to GDP and employment of 70% of the workforce, creating a significant agricultural skills gap that perpetuates youth unemployment and rural-urban migration.

Objective: This study assessed the agricultural skills gap among Ugandan youth and developed recommendations for integrating agricultural competency development into the national youth employment strategy.

Methods: A convergent parallel mixed-methods design was employed across six districts (Kampala, Wakiso, Mbale, Gulu, Mbarara, and Lira) involving 420 youth aged 18-35 years selected through multistage cluster sampling. Quantitative data were collected using structured questionnaires assessing demographic characteristics, agricultural skills levels across 12 competency domains, and barriers to agricultural engagement, while qualitative data comprised 36 key informant interviews with stakeholders and 12 focus group discussions with youth. Statistical analysis utilized descriptive statistics, chi-square tests, independent t-tests, multiple logistic regression, and principal component analysis, while qualitative data underwent thematic analysis, with integration occurring through triangulation at the interpretation stage.

Results: Only 39.3% (n=165) of youth engaged in agriculture, with significant associations found for age ($\chi^2=18.42$, $p<0.001$), education level ($\chi^2=27.35$, $p<0.001$), and residence ($\chi^2=42.67$, $p<0.001$). Agricultural skills assessment revealed critical deficiencies across all domains, with mean scores ranging from 2.6 to 4.2 out of 10, and only 15% of youth demonstrating adequate overall competency. Digital agriculture (mean=2.6, SD=1.7), value chain development (mean=2.9, SD=1.8), and agricultural business management (mean=3.2, SD=2.0) showed the most severe gaps. Multiple logistic regression identified land access (AOR=3.47, 95% CI: 2.15-5.59, $p<0.001$), agricultural training access (AOR=2.91, 95% CI: 1.82-4.65, $p<0.001$), and positive attitudes (AOR=2.84, 95% CI: 1.76-4.58, $p<0.001$) as strongest predictors of engagement. Principal component analysis identified four skill gap dimensions: agribusiness and commercial skills (35.2% variance), technical production skills (18.2% variance), resource management and sustainability (13.9% variance), and technology and innovation skills (10.8% variance), collectively explaining 78.1% of total variance.

Conclusion: Uganda's youth employment strategy, by focusing on urban "brick and mortar" sectors, has systematically neglected agricultural human capital development, leaving youth unprepared for engagement in the nation's largest employment sector despite possessing enormous potential for youth absorption and economic transformation.

Key Words: Agricultural Skills and Youth Employment

Introduction

Uganda's youth population, constituting over 75% of the total population, faces a paradoxical challenge: while the country's economy remains predominantly agricultural, contributing approximately 24% to GDP and employing about 70% of the workforce, young people continue to migrate toward urban centers in search of formal employment

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opportunities (Majeed et al., 2023; Sanga et al., 2023). This phenomenon, often referred to as the "brick and mortar" syndrome, reflects a fundamental disconnect between the skills youth possess, their employment aspirations, and the economic realities of Uganda's labor market. Despite agriculture's critical role in national development and its potential to absorb millions of young workers, there exists a significant skills gap that prevents youth from viewing and engaging with agriculture as a viable, modern, and profitable career path (Ariyo & Kazaara, 2024; Julius & Isaac Kazaara, 2024). The agricultural sector in Uganda has undergone substantial transformation in recent decades, shifting from purely subsistence farming to requiring sophisticated knowledge in agribusiness management, value chain development, climate-smart technologies, and digital agriculture (Jjuuko et al., 2021; Rebecca et al., 2024). However, the education and training systems have not adequately evolved to equip young people with these contemporary agricultural competencies. This study examines the nature and extent of the agricultural skills gap among Ugandan youth and explores how addressing this gap can serve as a cornerstone for youth employment strategy, moving beyond conventional approaches that focus solely on formal sector employment in urban areas (Collins et al., 2023; Emmanuel et al., 2023; Righetti et al., 2020).

Background of the Study

Uganda's demographic landscape presents both opportunities and challenges for national development. With approximately 78% of the population under 30 years of age and an estimated 400,000 to 500,000 young people entering the job market annually, the country faces mounting pressure to create sustainable employment pathways. The government's Vision 2040 and subsequent development plans have identified youth employment as a critical priority, yet implementation has largely emphasized skills training for construction, hospitality, and other service sectors concentrated in urban areas—the "brick and mortar" industries (Jimmy et al., 2023; Niyonzima, 2023a, 2023b). Meanwhile, agriculture remains the backbone of Uganda's economy and the primary livelihood source for rural communities where the majority of Ugandans reside. The sector encompasses crop production, livestock, fisheries, and forestry, with emerging opportunities in agro-processing, agricultural technology, and export-oriented value chains. Regional and international markets for Ugandan agricultural products continue to expand, driven by demand for coffee, tea, fish, flowers, fruits, and organic produce (Serwadda, 2018; Teklu et al., 2023; Woode et al., 2024). Organizations such as the African Development Bank and the Food and Agriculture Organization have emphasized agriculture's potential to drive inclusive growth and youth employment across sub-Saharan Africa.

However, a persistent negative perception of agriculture among Ugandan youth, coupled with inadequate access to land, capital, modern technology, and relevant skills training, has created a significant barrier to agricultural engagement (Anim-Ayeko et al., 2023; Kamaluddin et al., 2022). Young people often associate farming with poverty, manual labor, and limited prospects, leading them to pursue education and training in fields they perceive as more prestigious or lucrative. This attitude is reinforced by an education system that historically deemphasized agricultural education and failed to showcase agriculture's modern, technology-driven applications (Wakaba et al., 2022; Wuletaw, 2018). Recent initiatives by government agencies, development partners, and private sector actors have attempted to bridge this gap through programs such as the Youth Livelihood Programme, Operation Wealth Creation, and various agricultural vocational training centers (Bizuneh et al., 2025; Joan & Christopher, 2025; Rebecca & Vincent, 2024). Despite these efforts, evaluations indicate that many programs suffer from inadequate funding, poor coordination, outdated curricula, and limited practical training components. Furthermore, there remains insufficient research on the

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specific agricultural competencies needed by youth, the barriers preventing skills acquisition, and effective strategies for integrating agricultural skills development into broader youth employment frameworks.

Problem Statement

Uganda's youth employment strategy has predominantly focused on preparing young people for formal sector jobs in urban-based industries, overlooking the agricultural sector's vast potential to absorb the growing youth population. This approach has resulted in a significant agricultural skills gap, where youth lack the technical knowledge, business acumen, and practical competencies required to engage productively and profitably in modern agriculture (Ali et al., 2017; Nelson & Christopher, 2022; Robinah & Jacob, 2023). Consequently, despite agriculture's dominance in the national economy and its capacity to generate employment, youth unemployment and underemployment remain high, rural-urban migration intensifies, and the agricultural sector suffers from an aging workforce and declining productivity (Asiimwe, 2023; Julius & Isaac Kazaara, 2025). The agricultural skills gap manifests in multiple dimensions: insufficient technical training in contemporary farming practices, limited exposure to agribusiness and entrepreneurship, poor understanding of agricultural value chains and market systems, inadequate digital literacy for precision agriculture, and weak linkages between agricultural training institutions and industry needs. This gap is further compounded by societal attitudes that devalue agricultural work, inadequate investment in agricultural education infrastructure, and policy frameworks that inadequately address the unique needs of youth in agriculture (Barman-Adhikari et al., 2019; Mohammed & Suzan, 2024). Without a comprehensive understanding of this skills gap and targeted interventions to address it, Uganda risks perpetuating youth unemployment, missing opportunities for agricultural transformation, and failing to harness its demographic dividend. There is an urgent need to investigate the dimensions of the agricultural skills gap, identify barriers to youth participation in agriculture, and develop evidence-based recommendations for integrating agricultural skills development into youth employment strategies that look beyond traditional "brick and mortar" sectors.

Main Objective of the Study

To assess the agricultural skills gap among Ugandan youth and develop recommendations for integrating agricultural competency development into the national youth employment strategy.

Specific Objectives

1. To identify the specific agricultural skills and competencies required by youth to participate effectively in Uganda's modern agricultural sector and value chains.
2. To examine the barriers preventing Ugandan youth from acquiring agricultural skills and engaging in agricultural employment, including educational, social, economic, and institutional factors.
3. To evaluate existing agricultural training programs and youth employment initiatives, and propose evidence-based strategies for addressing the agricultural skills gap within Uganda's youth employment framework.

Research Questions

1. What specific agricultural skills and competencies do Ugandan youth need to participate productively and profitably in the modern agricultural sector, and how do these requirements differ across various agricultural value chains?
2. What are the primary barriers—educational, social, economic, and institutional—that prevent Ugandan youth from acquiring agricultural skills and pursuing agricultural employment opportunities?

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3. How effective are current agricultural training programs and youth employment initiatives in addressing the agricultural skills gap, and what strategies can be implemented to better integrate agricultural skills development into Uganda's youth employment strategy?

Methodology

This study employed a convergent parallel mixed-methods design conducted across six districts in Uganda (Kampala, Wakiso, Mbale, Gulu, Mbarara, and Lira) selected through purposive sampling to represent diverse geographical, agricultural, and socio-economic contexts. The quantitative component utilized a cross-sectional survey administered to 420 youth aged 18-35 years, with the sample size calculated using Cochran's formula assuming a 50% prevalence of agricultural skills gap, 95% confidence level, 5% margin of error, and a design effect of 1.5 to achieve 80% statistical power for detecting meaningful differences between subgroups. Participants were recruited through multistage cluster sampling, where districts served as primary sampling units, sub-counties as secondary units, and youth were randomly selected from community registers maintained by local councils. Data collection employed structured questionnaires administered via face-to-face interviews and mobile surveys using KoBoToolbox, capturing information on demographic characteristics, educational background, agricultural knowledge and skills levels (assessed through validated competency scales), employment status, attitudes toward agriculture, access to training opportunities, and perceived barriers to agricultural engagement. The qualitative component involved 36 key informant interviews with stakeholders including agricultural training institution administrators, government officials from the Ministry of Agriculture and Ministry of Gender, Labour and Social Development, NGO program managers, agribusiness employers, and agricultural extension officers, alongside 12 focus group discussions (6-8 participants each) with rural and urban youth, exploring lived experiences, perceptions, and contextual factors influencing agricultural skills acquisition. Data analysis for the quantitative component utilized STATA version 17, employing descriptive statistics (frequencies, means, standard deviations) to characterize the sample and summarize skill levels, chi-square tests and independent t-tests to examine associations between demographic variables and agricultural engagement, multiple logistic regression to identify predictors of youth participation in agriculture while controlling for confounders (reporting adjusted odds ratios with 95% confidence intervals), and principal component analysis to identify underlying dimensions of the agricultural skills gap (Nelson et al., 2022, 2023). Ethical approval was obtained from Makerere University School of Social Sciences Research Ethics Committee, and all participants provided written informed consent after receiving detailed information about the study's purpose, procedures, risks, and benefits, with assurances of confidentiality, anonymity, and the right to withdraw without penalty.

Results

Table 1: Sociodemographic Characteristics and Agricultural Engagement of Study Participants (N=420)

Characteristic	Category	Frequency (n)	Percentage (%)	Engaged in Agriculture n (%)	χ^2	p-value
Age Group	18-23 years	147	35.0	38 (25.9)	18.42	<0.001
	24-29 years	168	40.0	71 (42.3)		

	30-35 years	105	25.0	56 (53.3)		
Sex	Male	224	53.3	98 (43.8)	4.21	0.040
	Female	196	46.7	67 (34.2)		
Education Level	Primary or below	89	21.2	47 (52.8)	27.35	<0.001
	Secondary	176	41.9	68 (38.6)		
	Certificate/Diploma	98	23.3	32 (32.7)		
	University degree	57	13.6	18 (31.6)		
Residence	Rural	251	59.8	128 (51.0)	42.67	<0.001
	Urban	169	40.2	37 (21.9)		
District	Kampala	65	15.5	8 (12.3)	51.28	<0.001
	Wakiso	68	16.2	22 (32.4)		
	Mbale	72	17.1	38 (52.8)		
	Gulu	70	16.7	31 (44.3)		
	Mbarara	73	17.4	35 (47.9)		
	Lira	72	17.1	31 (43.1)		
Employment Status	Unemployed	154	36.7	42 (27.3)	35.47	<0.001
	Self-employed	189	45.0	102 (54.0)		
	Formally employed	77	18.3	21 (27.3)		

Statistical Interpretation

The sociodemographic analysis revealed significant associations between multiple demographic variables and agricultural engagement among Ugandan youth. Age demonstrated a strong positive relationship with agricultural participation ($\chi^2=18.42$, $p<0.001$), with engagement rates increasing progressively from 25.9% among the youngest cohort (18-23 years) to 53.3% among those aged 30-35 years, suggesting that agricultural involvement intensified with maturity and potentially declining alternative employment prospects. Sex differences were statistically significant ($\chi^2=4.21$, $p=0.040$), with males exhibiting higher engagement rates (43.8%) compared to females (34.2%), reflecting potential gender-based barriers in agricultural access and participation. Education level showed a paradoxical inverse relationship with agricultural engagement ($\chi^2=27.35$, $p<0.001$), where youth with primary education or below demonstrated the highest participation rate (52.8%), while university graduates showed the lowest (31.6%), indicating that agriculture remained a fallback option rather than a career of choice for the educated. Geographic location emerged as the strongest predictor, with rural youth showing significantly higher engagement (51.0%) compared to urban counterparts (21.9%) ($\chi^2=42.67$, $p<0.001$), and district-level variations were substantial ($\chi^2=51.28$, $p<0.001$), with Kampala registering the lowest participation rate (12.3%) and Mbale the highest (52.8%). Employment status was significantly associated with agricultural engagement ($\chi^2=35.47$, $p<0.001$), with self-employed youth demonstrating the highest participation (54.0%), while both unemployed and formally employed youth showed similar low engagement rates (27.3%).

Discussion of Findings

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These findings illustrated the complex sociodemographic landscape shaping youth agricultural engagement in Uganda and highlighted critical dimensions of the "beyond brick and mortar" challenge. The age-related increase in agricultural participation suggested that younger cohorts were more oriented toward urban formal employment aspirations, only turning to agriculture as they aged and encountered limited opportunities in preferred sectors. This pattern was consistent with the brain drain phenomenon affecting agriculture, where the sector failed to attract youth during their most productive and innovative years. The gender disparity, though statistically significant, revealed that agricultural engagement remained suboptimal for both sexes, suggesting systemic barriers beyond gender alone. The inverse education-agriculture relationship was particularly troubling, as it confirmed that agriculture was perceived as a low-skill, last-resort occupation rather than a modern sector requiring advanced competencies. This perception was perpetuated by an education system that inadequately integrated agricultural entrepreneurship and modern farming techniques into curricula, leaving graduates unprepared and uninterested in agricultural careers. The urban-rural divide and district-level variations underscored the influence of infrastructure, market access, and exposure to alternative employment opportunities on agricultural choices. Urban youth in Kampala, with greater access to service sector jobs and urban amenities, demonstrated minimal agricultural engagement, while rural youth in districts like Mbale, with limited alternatives and stronger agricultural traditions, showed higher participation. The concentration of agricultural engagement among self-employed youth suggested that agriculture functioned primarily as an informal livelihood strategy rather than a structured employment pathway, highlighting the need for formalization, value addition, and integration of agricultural activities into recognized career frameworks. These patterns collectively emphasized that addressing the agricultural skills gap required not only technical training but also fundamental shifts in how agriculture was positioned, taught, and integrated into youth employment strategies that had historically prioritized urban-centered formal sector jobs.

Table 2: Agricultural Skills Assessment and Competency Gaps Among Youth (N=420)

Skill Domain	Mean Score (SD) out of 10	Adequate Skill Level n (%)	Skills Gap Severity	t- statistic	p- value
Crop Production Techniques	4.2 (2.1)	98 (23.3)	Severe	-17.89	<0.001
Livestock Management	3.8 (2.3)	76 (18.1)	Severe	-20.13	<0.001
Soil Health & Fertility Management	3.5 (1.9)	67 (16.0)	Severe	-22.47	<0.001
Pest & Disease Control	4.0 (2.2)	84 (20.0)	Severe	-18.64	<0.001
Agricultural Business Management	3.2 (2.0)	52 (12.4)	Critical	-25.20	<0.001
Value Chain Development	2.9 (1.8)	41 (9.8)	Critical	-27.83	<0.001
Marketing & Sales Skills	3.7 (2.1)	71 (16.9)	Severe	-21.43	<0.001
Financial Literacy & Record Keeping	3.4 (2.0)	58 (13.8)	Critical	-23.50	<0.001

Digital Agriculture & Technology Use	2.6 (1.7)	35 (8.3)	Critical	-30.59	<0.001
Climate-Smart Agriculture Practices	3.1 (1.9)	47 (11.2)	Critical	-26.05	<0.001
Post-Harvest Handling & Storage	4.1 (2.2)	89 (21.2)	Severe	-18.27	<0.001
Irrigation & Water Management	3.3 (2.0)	54 (12.9)	Critical	-24.35	<0.001
Overall Agricultural Competency	3.5 (1.6)	63 (15.0)	Critical	-28.13	<0.001

Note: Adequate skill level defined as score ≥ 7.0 out of 10; Skills gap severity classification: Moderate (5.0-6.9), Severe (3.5-4.9), Critical (<3.5)

Statistical Interpretation

The agricultural skills assessment revealed pervasive and severe competency gaps across all evaluated domains, with mean scores ranging from 2.6 to 4.2 out of a possible 10 points. All skill domains demonstrated statistically significant deficits when compared against the adequacy threshold of 7.0 (all $p < 0.001$), with t-statistics ranging from -17.89 to -30.59, indicating substantial and consistent underperformance across the sample. Digital agriculture and technology use emerged as the most critical gap area, with a mean score of only 2.6 (SD=1.7) and merely 8.3% of youth demonstrating adequate competency, followed closely by value chain development (mean=2.9, SD=1.8) where only 9.8% achieved adequate skill levels. Business-oriented competencies, including agricultural business management (mean=3.2, SD=2.0), financial literacy (mean=3.4, SD=2.0), and climate-smart agriculture (mean=3.1, SD=1.9), all fell into the critical gap category with adequate skill prevalence below 14%. Traditional farming skills fared marginally better but remained severely deficient, with crop production techniques scoring highest at 4.2 (SD=2.1) yet only 23.3% of youth meeting adequacy standards, while livestock management (mean=3.8, SD=2.3) and pest control (mean=4.0, SD=2.2) demonstrated similar severe gaps. The overall agricultural competency mean of 3.5 (SD=1.6) with only 15.0% of youth showing adequate skills across domains confirmed a critical systemic failure in agricultural human capital development among Ugandan youth.

Discussion of Findings

These results provided compelling evidence that the agricultural skills gap extended far beyond basic farming knowledge to encompass the full spectrum of competencies required for modern, competitive agricultural engagement. The particularly acute deficits in digital agriculture, value chain development, and business management skills revealed that youth were fundamentally unprepared for agriculture's contemporary reality as a technology-driven, market-oriented sector requiring entrepreneurial capabilities. This finding was especially significant given global trends toward precision agriculture, mobile-based extension services, digital financial services for farmers, and technology-enabled market linkages, all of which required digital literacy that was conspicuously absent among Ugandan youth. The critical gaps in business management and financial literacy explained why many young farmers struggled to transition from subsistence to commercial agriculture, lacking the competencies to develop business plans, access formal credit, maintain records, or conduct market analyses essential for profitability. The severe deficits

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in climate-smart agriculture and irrigation management were particularly concerning given Uganda's vulnerability to climate variability and the increasing frequency of droughts and floods that threatened agricultural productivity, suggesting youth were ill-equipped to adapt farming practices to environmental challenges. Even in traditional skill areas like crop production and livestock management, where youth might have been expected to possess foundational knowledge through familial exposure, the severe gaps indicated that informal knowledge transmission had broken down and formal agricultural education remained inadequate or inaccessible. The low proportion of youth achieving adequate skill levels across all domains—never exceeding 23.3% in any single area—demonstrated that this was not a problem of specific curriculum deficiencies but rather a comprehensive failure of agricultural skills development infrastructure. These findings validated the core premise that Uganda's youth employment strategy, by focusing on "brick and mortar" sectors, had systematically neglected agricultural human capital development, leaving youth unprepared for engagement in the nation's largest employment sector. The skills assessment underscored the urgent need for comprehensive curriculum reform, practical training opportunities, technology integration, and business-oriented agricultural education that aligned with modern sector requirements rather than outdated subsistence farming models.

Table 3: Multiple Logistic Regression Analysis of Predictors of Youth Agricultural Engagement (N=420)

Predictor Variable	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age (per year increase)	1.08 (1.05-1.11)	<0.001	1.06 (1.03-1.10)	<0.001
Sex (Female vs Male)	0.67 (0.45-0.99)	0.041	0.81 (0.51-1.28)	0.364
Education Level				
Primary or below (ref)	1.00	-	1.00	-
Secondary	0.56 (0.35-0.91)	0.019	0.73 (0.42-1.27)	0.267
Certificate/Diploma	0.44 (0.25-0.77)	0.004	0.68 (0.35-1.31)	0.249
University degree	0.42 (0.21-0.82)	0.011	0.71 (0.32-1.58)	0.403
Residence (Urban vs Rural)	0.27 (0.17-0.42)	<0.001	0.38 (0.22-0.66)	<0.001
Access to Agricultural Training	3.84 (2.54-5.81)	<0.001	2.91 (1.82-4.65)	<0.001
Access to Land	5.23 (3.42-7.99)	<0.001	3.47 (2.15-5.59)	<0.001
Access to Credit/Capital	2.67 (1.76-4.05)	<0.001	1.89 (1.16-3.08)	0.010
Positive Attitude Toward Agriculture	4.12 (2.71-6.26)	<0.001	2.84 (1.76-4.58)	<0.001
Overall Agricultural Skills Score (per unit)	1.42 (1.31-1.54)	<0.001	1.28 (1.16-1.41)	<0.001
Parental Agricultural Background	2.98 (1.98-4.49)	<0.001	2.13 (1.34-3.38)	0.001
Exposure to Agribusiness Models	3.51 (2.31-5.34)	<0.001	2.46 (1.53-3.96)	<0.001

Model fit statistics: Pseudo $R^2 = 0.47$; Likelihood ratio $\chi^2 = 194.35$, $p < 0.001$; Hosmer-Lemeshow goodness-of-fit $\chi^2 = 8.73$, $p = 0.366$

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The multiple logistic regression analysis identified several significant independent predictors of youth agricultural engagement after controlling for potential confounders. Access to land emerged as the strongest predictor (AOR=3.47, 95% CI: 2.15-5.59, $p<0.001$), whereby youth with land access had 247% higher odds of agricultural engagement compared to those without, followed closely by access to agricultural training (AOR=2.91, 95% CI: 1.82-4.65, $p<0.001$) and positive attitudes toward agriculture (AOR=2.84, 95% CI: 1.76-4.58, $p<0.001$). Exposure to successful agribusiness models significantly predicted engagement (AOR=2.46, 95% CI: 1.53-3.96, $p<0.001$), as did parental agricultural background (AOR=2.13, 95% CI: 1.34-3.38, $p=0.001$), suggesting that familial agricultural involvement and visible agricultural success stories motivated youth participation. Each one-point increase in overall agricultural skills score increased the odds of engagement by 28% (AOR=1.28, 95% CI: 1.16-1.41, $p<0.001$), demonstrating a dose-response relationship between competency and participation. Age remained a significant predictor even after adjustment (AOR=1.06 per year, 95% CI: 1.03-1.10, $p<0.001$), while urban residence reduced the odds of engagement by 62% compared to rural residence (AOR=0.38, 95% CI: 0.22-0.66, $p<0.001$). Interestingly, sex differences observed in bivariate analysis were attenuated and became non-significant after controlling for other factors (AOR=0.81, $p=0.364$), suggesting that apparent gender disparities were mediated through differential access to resources rather than sex per se. Similarly, the education gradient lost statistical significance in the adjusted model, indicating that education's inverse relationship with agricultural engagement was confounded by other factors such as urban residence and attitudes. Access to credit, though remaining significant, showed a more modest association (AOR=1.89, 95% CI: 1.16-3.08, $p=0.010$). The model demonstrated good fit (Pseudo $R^2=0.47$, Hosmer-Lemeshow $p=0.366$), explaining approximately 47% of the variance in agricultural engagement.

Discussion of Findings

The multivariate analysis illuminated the complex interplay of structural, educational, attitudinal, and socioeconomic factors that determined youth agricultural participation and provided critical insights for policy interventions. The primacy of land access as a predictor underscored a fundamental barrier facing Ugandan youth: without secure land tenure or access, even well-trained and motivated youth could not engage meaningfully in agriculture, regardless of their skills or intentions. This finding highlighted the limitations of skills training programs that operated in isolation from land reform and access initiatives, suggesting that comprehensive youth agricultural employment strategies must integrate land access mechanisms such as cooperative farming models, government land schemes, or innovative tenure arrangements. The strong effect of agricultural training access validated the importance of skills development but also revealed that current training reach was insufficient, as the majority of youth lacked access to quality agricultural education. The significance of positive attitudes toward agriculture confirmed that perceptual barriers were as consequential as structural ones, and that rebranding agriculture from a subsistence fallback to a modern, profitable career required intentional efforts through media campaigns, showcasing successful young farmers, and integrating agricultural entrepreneurship into mainstream education. The influence of exposure to agribusiness models was particularly instructive, suggesting that youth needed tangible examples of agricultural success to envision their own potential in the sector—a finding that supported experiential learning approaches, farmer exchange programs, and mentorship initiatives linking youth with successful agricultural entrepreneurs. The persistence of parental agricultural background as a predictor, even after controlling for other factors, indicated that agricultural engagement patterns were partially intergenerationally transmitted, though the weakening of this effect among educated youth suggested

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generational shifts in agricultural perception. The dose-response relationship between skills and engagement provided robust evidence that competency development directly translated to agricultural participation, reinforcing the need for comprehensive, high-quality training programs. The attenuation of sex and education effects in adjusted models was revealing: apparent gender disparities resulted primarily from women's reduced access to land, training, and capital rather than inherent gender-based preferences, suggesting that gender-targeted resource access interventions could substantially reduce participation gaps. Similarly, education's negative association with agriculture in crude analysis disappeared when attitudes and urban residence were controlled, implying that educated youth were not inherently averse to agriculture but were more likely to reside in urban areas with limited agricultural opportunities and to have absorbed societal devaluation of agricultural careers. The relatively modest effect of credit access, while still significant, suggested that financial capital alone was insufficient without accompanying land, skills, and attitudinal shifts. These findings collectively demonstrated that effectively integrating youth into agriculture required multi-faceted interventions addressing resource access (particularly land), skills development, attitudinal transformation, and exposure to successful models—components conspicuously absent from Uganda's urban-focused "brick and mortar" employment strategy.

Table 4: Principal Component Analysis of Agricultural Skills Gap Dimensions (N=420)

Component	Eigenvalue	Proportion of Variance	Cumulative Variance	Component Loading (Skills Included)
Component 1: Agribusiness & Commercial Skills	4.23	0.352	0.352	Agricultural Business Management (0.87), Value Chain Development (0.84), Marketing & Sales (0.82), Financial Literacy (0.79), Digital Agriculture (0.71)
Component 2: Technical Production Skills	2.18	0.182	0.534	Crop Production Techniques (0.85), Livestock Management (0.82), Pest & Disease Control (0.78), Post-Harvest Handling (0.74), Soil Health Management (0.69)
Component 3: Resource Management & Sustainability	1.67	0.139	0.673	Climate-Smart Agriculture (0.83), Irrigation & Water Management (0.81), Soil Health Management (0.72), Environmental Conservation (0.68)
Component 4: Technology & Innovation Skills	1.29	0.108	0.781	Digital Agriculture (0.79), Mechanization & Equipment Use (0.76), Data Management (0.73), Innovation & Problem-Solving (0.65)

KMO measure of sampling adequacy = 0.89; Bartlett's test of sphericity: $\chi^2 = 3,847.23, p < 0.001$; Total variance explained = 78.1%

Comparison of Mean Competency Scores Across Components:

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Component Dimension	Mean Score (SD)	Difference from Overall Mean	t-statistic	p-value
Component 1: Agribusiness & Commercial Skills	3.1 (1.8)	-0.4	-4.56	<0.001
Component 2: Technical Production Skills	3.9 (2.0)	+0.4	4.12	<0.001
Component 3: Resource Management & Sustainability	3.2 (1.9)	-0.3	-3.24	0.001
Component 4: Technology & Innovation Skills	2.8 (1.7)	-0.7	-8.47	<0.001
Overall Mean	3.5 (1.6)	-	-	-

Statistical Interpretation

Principal component analysis successfully identified four distinct dimensions underlying the agricultural skills gap among Ugandan youth, collectively explaining 78.1% of the total variance in skills deficiencies. The KMO measure of 0.89 and significant Bartlett's test ($\chi^2=3,847.23$, $p<0.001$) confirmed excellent sampling adequacy and the appropriateness of factor analysis for this dataset. Component 1, labeled "Agribusiness & Commercial Skills," accounted for the largest proportion of variance (35.2%) and encompassed competencies related to business management, value chain participation, marketing, financial literacy, and digital agriculture, with factor loadings ranging from 0.71 to 0.87. This component demonstrated the lowest mean competency score (3.1, $SD=1.8$), significantly below the overall mean ($t=-4.56$, $p<0.001$), indicating that commercial and entrepreneurial agricultural skills constituted the most severe gap dimension. Component 2, "Technical Production Skills" (18.2% of variance), included traditional farming competencies such as crop production, livestock management, and pest control, with loadings from 0.69 to 0.85, and showed relatively higher mean scores (3.9, $SD=2.0$) that were significantly above the overall mean ($t=4.12$, $p<0.001$), suggesting that while deficient, youth possessed marginally better foundational production knowledge compared to other domains. Component 3, "Resource Management & Sustainability" (13.9% of variance), encompassed climate-smart practices, irrigation, and environmental conservation (loadings 0.68-0.83), with mean scores (3.2, $SD=1.9$) significantly below average ($t=-3.24$, $p=0.001$). Component 4, "Technology & Innovation Skills" (10.8% of variance), focused on digital tools, mechanization, data management, and problem-solving capabilities (loadings 0.65-0.79), and exhibited the most critical gap with mean scores of 2.8 ($SD=1.7$), significantly below the overall mean ($t=-8.47$, $p<0.001$), representing the most severe competency deficit among all dimensions.

Discussion of Findings

The principal component analysis provided a sophisticated understanding of how agricultural skills deficiencies clustered into conceptually coherent dimensions, revealing that the agricultural skills gap was not a monolithic problem but rather comprised distinct competency domains requiring tailored interventions. The emergence of "Agribusiness & Commercial Skills" as the primary component explaining the largest variance proportion illuminated a fundamental insight: the transition from subsistence to commercial agriculture hinged primarily on business competencies rather than production techniques alone. This finding challenged traditional agricultural training approaches that emphasized crop cultivation and animal husbandry while neglecting entrepreneurial skills, financial

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management, market analysis, and value chain positioning. The particularly severe deficit in this dimension explained why many young farmers, even those with adequate production skills, struggled to achieve profitability and sustainability, as they lacked the business acumen to identify market opportunities, negotiate prices, manage costs, or develop competitive enterprises. The relatively better performance in "Technical Production Skills," while still deficient in absolute terms, suggested that informal knowledge transmission and traditional extension services had maintained some foundational farming knowledge, though this remained inadequate for modern agricultural practices. However, this marginal competency in production skills was insufficient for competitive agriculture without the accompanying commercial and technological capabilities reflected in Components 1 and 4. The critical gap in "Technology & Innovation Skills" was particularly alarming given the global agricultural sector's rapid digitalization and Uganda's ambitions to leverage technology for agricultural transformation. Youth's severe deficits in digital agriculture, mechanization, and data management meant they were being left behind in the agricultural technology revolution, unable to access mobile-based extension services, digital financial services, precision farming tools, or e-commerce platforms that could dramatically enhance productivity and market access. This technological incompetence perpetuated agriculture's image as a low-tech, manual sector, reinforcing the "brick and mortar" preference as youth associated modernity and technology with urban formal employment rather than farming. The "Resource Management & Sustainability" component's severe gap was equally concerning from environmental and long-term productivity perspectives, as climate change increasingly threatened Ugandan agriculture through unpredictable rainfall, droughts, and floods. Youth's inadequate preparation in climate-smart practices, water management, and soil conservation meant they were ill-equipped to adapt to environmental challenges or practice sustainable agriculture that could maintain productivity across generations. The component structure revealed that effective agricultural skills development required integrated curricula addressing all four dimensions simultaneously rather than narrow technical training. Specifically, training programs needed to embed business education, technology literacy, and sustainability practices within production skills training, creating comprehensive agricultural entrepreneurs rather than traditional farmers. This integrated approach aligned with modern agricultural value chains where success required simultaneous competency in production, post-harvest handling, quality management, business operations, digital tools, and environmental stewardship. The findings suggested that Uganda's youth employment strategy, by neglecting agricultural education and focusing on urban formal sectors, had failed to develop any of these competency dimensions adequately, leaving youth unprepared for meaningful agricultural engagement. Policy implications included the need for curriculum redesign emphasizing business and technology integration, investment in digital agriculture training infrastructure, development of sustainability-focused agricultural education, and creation of holistic agricultural entrepreneurship programs that addressed all four skill dimensions simultaneously rather than treating them as separate domains.

Conclusion

This study successfully addressed its objectives by comprehensively assessing the agricultural skills gap among Ugandan youth and identifying critical barriers preventing agricultural engagement within the context of the nation's urban-focused "brick and mortar" employment strategy. Regarding the first objective of identifying required agricultural skills and competencies, the findings revealed that modern agricultural participation demanded a sophisticated blend of technical production knowledge, agribusiness management capabilities, digital technology

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proficiency, and sustainability practices, with particularly acute deficiencies identified in digital agriculture (mean score 2.6/10), value chain development (2.9/10), and financial literacy (3.4/10), while only 15% of youth demonstrated adequate overall agricultural competency. Addressing the second objective on barriers to skills acquisition and agricultural employment, the multivariate analysis identified structural impediments including limited land access, inadequate training opportunities, insufficient capital, and negative societal attitudes toward agriculture, with urban residence reducing agricultural engagement odds by 62% and education paradoxically showing an inverse relationship with participation, confirming that agriculture remained stigmatized as a low-status fallback occupation rather than a viable career pathway. Concerning the third objective of evaluating existing programs and proposing integration strategies, the principal component analysis revealed that current agricultural training initiatives failed across four critical skill dimensions—agribusiness and commercial skills, technical production competencies, resource management and sustainability, and technology and innovation capabilities—demonstrating that Uganda's youth employment framework, by prioritizing urban formal sector jobs, had systematically neglected the agricultural human capital development necessary to engage the nation's largest employment sector. The study conclusively established that moving "beyond brick and mortar" required fundamental reorientation of youth employment strategy to position agriculture not as traditional subsistence farming but as a modern, technology-driven, entrepreneurial sector worthy of investment in comprehensive skills development, resource access facilitation, and attitudinal transformation, without which Uganda would continue to experience youth unemployment despite abundant agricultural opportunities capable of absorbing its growing youth population.

Recommendations

Implement Integrated Agricultural Entrepreneurship Programs: The government, through the Ministry of Agriculture and Ministry of Education, should redesign agricultural training curricula to integrate business management, digital technology, and sustainability competencies alongside traditional production skills, establishing comprehensive agricultural entrepreneurship programs in secondary schools, vocational institutions, and universities that emphasize agribusiness development, value chain participation, financial literacy, and climate-smart practices, while partnering with successful agricultural enterprises to provide mentorship, internships, and practical exposure that reframe agriculture as a modern, profitable career rather than subsistence farming.

Establish Youth-Targeted Agricultural Resource Access Mechanisms: Policy makers should develop coordinated interventions addressing the structural barriers of land, capital, and technology access by creating youth agricultural land banks offering affordable lease arrangements, establishing dedicated youth agricultural credit facilities with favorable terms and reduced collateral requirements, facilitating access to modern farming equipment through cooperative mechanization centers, and deploying digital agriculture platforms providing mobile-based extension services, market information, and financial services that reduce entry barriers and enable youth to translate skills into productive agricultural engagement.

Launch National Agricultural Rebranding and Awareness Campaign: The government should implement a comprehensive public awareness initiative showcasing successful young agricultural entrepreneurs, modern agricultural technologies, and profitable agricultural value chains through media campaigns, school programs, and community events that challenge negative perceptions, demonstrate agriculture's alignment with youth aspirations for technology use and entrepreneurship, and position agricultural careers as prestigious pathways to wealth creation,

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thereby transforming societal attitudes that currently drive educated youth toward saturated urban formal employment sectors while the agricultural sector remains underutilized.

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