

University Incubation and Agribusiness Sustainability: The Mediating Role of Agribusiness Innovation in Uganda

¹Nalela Kizito, Ndejje University, Kampala, nalelakizito@gmail.com, OCHID: 0000-0002-9527-5490

²Naome Kakundwa, Ndejje University, Kampala, kakundwanaomi@gmail.com, ORCID: 0000-0002-1077-1760

³Dinah Kyarugahe Tumwebaze, Ndejje University, Kampala, dirugahe@gmail.com, ORCID: 0009-0001-9896-0872

Abstract

This study examined the effect of university incubation on agribusiness sustainability through agribusiness innovation in Uganda. The study was motivated by persistent challenges facing agribusiness sustainability, including low returns on investment, constrained sales revenue growth, declining soil fertility, inadequate value addition, limited employment opportunities, and weak commercialization despite the sector's significant contribution to Uganda's economy. The study was anchored on the Triple Helix Theory and the Resource-Based View Theory, which explain how university-industry-government collaboration and strategic resource capabilities promote innovation and sustainable enterprise development. A cross-sectional quantitative research design was adopted using a sample of 311 respondents drawn from agribusiness enterprises, university incubation initiatives, and agribusiness support networks in Uganda. Data were collected using structured questionnaires and analyzed using descriptive statistics, Pearson correlation analysis, Confirmatory Factor Analysis (CFA), Structural Equation Modelling (SEM), and bootstrapping mediation analysis. The SEM results revealed that university incubation significantly and positively influenced agribusiness sustainability ($\beta = 0.641$, $p < 0.001$) and agribusiness innovation ($\beta = 0.486$, $p < 0.001$), while agribusiness innovation significantly influenced agribusiness sustainability ($\beta = 0.417$, $p < 0.001$). The mediation analysis further established that agribusiness innovation partially mediated the relationship between university incubation and agribusiness sustainability through a significant indirect effect ($\beta = 0.267$, 95% CI = 0.174–0.382, $p < 0.001$), alongside a significant direct effect ($\beta = 0.486$, 95% CI = 0.372–0.601, $p < 0.001$) and total effect ($\beta = 0.753$, 95% CI = 0.641–0.841, $p < 0.001$). The study concludes that university incubation is a critical driver of agribusiness sustainability both directly and indirectly through strengthening agribusiness innovation. The findings imply that investments in mentorship, entrepreneurial training, networking support, research commercialization, and access to finance can significantly enhance sustainable agribusiness development. The study recommends strengthening university-industry partnerships, expanding incubation financing, promoting agribusiness innovation ecosystems, and supporting university incubation hubs to accelerate agribusiness sustainability in Uganda. 0751426963

Key words: *University Incubation, Agribusiness Innovation, Agribusiness Sustainability, Structural Equation Modelling, Triple Helix Theory, Resource-Based View Theory.*

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Introduction

Agriculture remains the backbone of Uganda's economy, contributing approximately 24% of Gross Domestic Product (GDP) and employing more than 70% of the country's labor force (African Development Bank [AfDB], 2021). The sector is a major source of food security, employment, foreign exchange earnings, and rural livelihoods. Despite its strategic importance, Uganda's agricultural sector continues to face challenges such as low productivity, weak commercialization, limited value addition, poor market access, and inadequate adoption of innovative technologies. These challenges have constrained the sustainability and competitiveness of agribusiness enterprises, particularly small and medium-sized enterprises (SMEs) that dominate the sector (Van Campenhout et al., 2021).

Globally, universities have increasingly emerged as critical actors in promoting innovation, entrepreneurship, and sustainable economic development through incubation programs. University incubation refers to the institutional support offered by universities to entrepreneurs and start-up enterprises through mentorship, training, networking opportunities, access to finance, and commercialization of research outputs (Hassan, 2024). The Entrepreneurial University Theory argues that modern universities should go beyond teaching and research to actively contribute to innovation and enterprise development (Clark, 1998). Through incubation initiatives, universities facilitate knowledge transfer, technology commercialization, and business growth, thereby enhancing entrepreneurial success and sustainability (Hassan, 2024).

The increasing significance of university incubation is further explained by the Triple Helix Model, which emphasizes collaboration among universities, industry, and government as a driver of innovation and economic transformation (Etzkowitz & Leydesdorff, 2000). Under this framework, universities generate knowledge, industries commercialize innovations, and governments provide enabling policies and resources. Such interactions create innovation ecosystems that foster entrepreneurship, technological advancement, and sustainable business development. Consequently, university incubation has become a strategic mechanism for supporting entrepreneurship in sectors such as agriculture, where innovation is necessary for addressing productivity, environmental, and market challenges (Etzkowitz & Leydesdorff, 2000; Hassan, 2024).

In Africa, university incubation has gained prominence as a tool for promoting youth entrepreneurship and agribusiness development. The ENABLE-TAAT initiative implemented by the African Development Bank demonstrated that incubation and entrepreneurship support significantly improved business income, technology adoption, and employment creation among young agripreneurs in countries such as Uganda, Kenya, and Nigeria (Adeyanju et al., 2023). Similarly, university-based entrepreneurship programs have been associated with improved managerial competencies, innovation capacity, and market participation among agribusiness entrepreneurs (Opolot et al., 2018). These findings suggest that incubation programs can strengthen enterprise resilience and competitiveness while supporting sustainable agricultural transformation.

In Uganda, universities such as Makerere University, Gulu University, and Uganda Martyrs University have established innovation and incubation hubs to support entrepreneurship and enterprise development. These initiatives provide training, mentorship, networking opportunities, and business advisory services to aspiring entrepreneurs. However, despite the increasing number of incubation initiatives, many agribusiness enterprises continue to face challenges related to access to finance, technology, markets, and innovation support services (Epeju, 2020). Furthermore, the commercialization of university-generated knowledge remains relatively low, limiting the contribution of universities to agribusiness transformation and sustainability (Opolot et al., 2018). The concept of agribusiness sustainability has become increasingly important due to growing concerns about environmental degradation, resource scarcity, and the need for inclusive economic growth. Agribusiness sustainability refers to the ability of agricultural enterprises to achieve long-term economic viability while maintaining environmental integrity and contributing positively to social development (AfDB, 2021). Sustainable agribusinesses are expected to generate consistent profits, adopt environmentally friendly practices, and create positive social impacts within their communities. Achieving these outcomes requires continuous innovation that enhances productivity, resource efficiency, competitiveness, and environmental performance (Adeyanju et al., 2023).

Agribusiness innovation is increasingly recognized as a key driver of sustainable enterprise development. Agribusiness innovation encompasses the introduction of new products, technologies, production methods, processes, and business models that improve organizational performance and competitiveness (Ademola et al., 2017). Through innovation, agribusiness enterprises can improve productivity, reduce operational costs, increase market responsiveness, and adopt environmentally sustainable practices. Existing literature indicates that university incubation enhances innovation by providing entrepreneurs with knowledge, technical expertise, entrepreneurial skills, and access to networks that facilitate product and process development (Hassan, 2024; Opolot et al., 2018). Consequently, innovation may serve as a critical mechanism through which incubation contributes to sustainability outcomes.

Empirical studies have established positive relationships between incubation and innovation, as well as between innovation and business performance (Adeyanju et al., 2023; Hassan, 2024). However, limited evidence exists regarding the mediating role of agribusiness innovation in explaining how university incubation influences agribusiness sustainability, particularly in developing countries such as Uganda. Most existing studies have examined these relationships independently, leaving a theoretical and empirical gap concerning the mechanisms through which incubation support translates into sustainable business outcomes (Epeju, 2020). Therefore, understanding whether agribusiness innovation mediates the relationship between university incubation and agribusiness sustainability is critical for designing effective university-based entrepreneurship interventions and innovation policies.

Accordingly, this study investigates the relationship between university incubation and agribusiness sustainability and examines the mediating role of agribusiness innovation among agribusiness enterprises in Uganda. The findings are expected to contribute to entrepreneurship and innovation literature while informing policymakers, universities, and development agencies on strategies for promoting sustainable agribusiness development through incubation and innovation.

Agribusiness sustainability has become a Ugandan major priority both globally and nationally and it contributes approximately 24–25% of the country's Gross Domestic Product (GDP). Sustainable agribusinesses are expected to generate adequate returns on investment (ROI), achieve continuous sales revenue growth, adopt sustainable soil fertility management practices, create productive and decent employment opportunities, ensure fair labor practices, and promote value addition to agricultural products (World Bank, 2018; Nabyonga, Basamba, Nyakoojo, & Ssenku, 2022). These outcomes are critical for improving the competitiveness, resilience, and long-term viability of the agricultural sector.

However, the reality in Uganda presents a different picture. Evidence indicates that numerous agribusinesses operate with low profitability and limited returns on investment, while sales revenue growth remains constrained, there is inadequate processing facilities, and low levels of commercialization (World Bank, 2018). Furthermore, there is a declining soil fertility and employment opportunities are often characterized by low productivity, seasonality, and limited income security (Nabyonga et al., 2022) and value addition remains low (World Bank, 2018).

All the above challenges contribute to unsustainable land-use practices, limit the sector's contribution to income generation and economic transformation, and result in widespread rural poverty, low household incomes, food insecurity, increased dependence on imports and external borrowing, and a generally low standard of living. Although many studies have examined the role of university incubation in addressing various developmental and entrepreneurial challenges, limited attention has been given to how university incubation influences agribusiness sustainability. Therefore, this study seeks to examine the effect of university incubation on agribusiness sustainability through agribusiness innovation in Uganda, with the aim of generating evidence on how university-based support systems can foster sustainable agribusiness development.

Objectives of the Study

- i. To examine the effect of university incubation on agribusiness sustainability in Uganda.
- ii. To assess the effect of university incubation on agribusiness innovation in Uganda.
- iii. To determine the effect of agribusiness innovation on agribusiness sustainability in Uganda.
- iv. To examine the mediating effect of agribusiness innovation in the relationship between university incubation and agribusiness sustainability in Uganda.

Literature review

The literature review examines existing theoretical, conceptual, and empirical studies related to university incubation, agribusiness innovation, and agribusiness sustainability. The purpose of the review is to establish the current state of knowledge, identify areas of agreement and disagreement among scholars, and highlight the gaps that justify the present study. Agribusiness sustainability has attracted increasing attention from researchers, policymakers, and development practitioners due to its contribution to economic growth, food security, employment creation, environmental conservation, and social well-being (World Bank, 2018). At the same time, university incubation has emerged as an important mechanism for promoting entrepreneurship, innovation, and enterprise development through mentorship, training, networking, technology transfer, and research commercialization (Etzkowitz & Leydesdorff, 2000).

Theoretical review

The study is based on two theories including the following; -

Triple Helix Theory

This study is anchored on the Triple Helix Theory, developed by Henry Etzkowitz and Loet Leydesdorff in 2000. The theory explains how innovation and entrepreneurship emerge through interactions among universities, industries, and governments. It argues that modern universities should move beyond their traditional roles of teaching and research to actively participate in knowledge commercialization, technology transfer, innovation development, and enterprise creation (Etzkowitz & Leydesdorff, 2000).

The theory assumes that sustainable economic development is achieved when universities, industries, and governments collaborate to create innovation ecosystems that facilitate knowledge creation, dissemination, and application. Universities generate knowledge and research outputs, industries commercialize innovations and provide market opportunities, while governments establish supportive policies and institutional frameworks. Through these interactions, entrepreneurial ventures are created and supported to grow sustainably.

The relevance of the Triple Helix Theory to this study lies in its ability to explain how university incubation promotes agribusiness innovation and sustainability. University incubation programs provide entrepreneurs with mentorship, training, research commercialization opportunities, networking support, and access to technology. These incubation services facilitate the transformation of innovative ideas into commercially viable agribusiness enterprises. In Uganda, initiatives such as Makerere University's Food Technology and Business Incubation Centre (FTBIC), CURAD, and Gulu University innovation programs demonstrate the practical application of Triple Helix interactions in supporting agribusiness innovation and enterprise development.

However, the theory has been criticized for assuming strong institutional

relationships and adequate resources among participating actors. In many developing countries, including Uganda, weak institutional capacity, limited funding, inadequate infrastructure, and fragmented innovation systems may constrain effective collaboration among universities, industries, and governments (Mutambi, 2013). Despite these limitations, the theory remains relevant because it provides a useful framework for understanding how university incubation can facilitate agribusiness innovation and sustainability through collaborative partnerships.

Resource-Based View Theory

The study is further guided by the Resource-Based View (RBV) Theory, originally developed by Jay Barney (1991). The theory posits that organizational success and sustainability depend on the possession and effective utilization of valuable, rare, inimitable, and non-substitutable resources. These resources may include knowledge, skills, technology, networks, organizational capabilities, and financial resources.

The Resource-Based View assumes that enterprises gain competitive advantage when they possess unique resources that competitors cannot easily acquire or imitate. Such resources enable organizations to improve efficiency, innovation, productivity, and long-term performance. According to Barney (1991), sustainable competitive advantage arises when firms develop capabilities that are difficult for competitors to replicate.

The theory is relevant to this study because university incubation provides agribusiness enterprises with critical resources necessary for innovation and sustainability. Through incubation programs, entrepreneurs gain access to entrepreneurial training, mentorship, technical knowledge, networking opportunities, research outputs, innovation support, and commercialization services. These resources enhance the innovation capabilities of agribusiness enterprises, enabling them to develop new products, improve production processes, increase value addition, and achieve sustainable growth.

Nevertheless, the Resource-Based View has been criticized for paying limited attention to external environmental factors such as market conditions, government policies, infrastructure, and industry competition. While resources are important, external factors may also influence the ability of agribusiness enterprises to achieve sustainability. Despite this limitation, the theory remains appropriate because it explains how university incubation provides strategic resources that strengthen agribusiness innovation and ultimately improve sustainability outcomes. The Triple Helix Theory and Resource-Based View Theory complement each other in explaining the relationships among university incubation, agribusiness innovation, and agribusiness sustainability. The Triple Helix Theory explains the external institutional relationships among universities, industries, and governments that facilitate entrepreneurial development and innovation. In contrast, the Resource-Based View explains how the resources and capabilities generated through these interactions enhance innovation and sustainability at the enterprise level.

Together, the theories suggest that university incubation creates an enabling ecosystem through institutional collaboration while simultaneously providing strategic resources that enhance agribusiness innovation and sustainability. Therefore, the two theories provide a comprehensive framework for understanding how university incubation influences agribusiness sustainability through agribusiness innovation in Uganda.

University Incubation and Agribusiness Sustainability

University incubation has emerged as a critical mechanism for promoting enterprise development, innovation, and sustainability across various sectors, including agribusiness. University incubation refers to structured support systems provided by higher education institutions through mentorship, entrepreneurial training, networking, technology transfer, research commercialization, and access to business development services (Etzkowitz & Leydesdorff, 2000). Through these services, incubators facilitate the transformation of innovative ideas into viable enterprises capable of contributing to economic, social, and environmental sustainability.

From a sustainability perspective, university incubation is expected to enhance agribusiness sustainability by improving profitability, increasing sales growth, promoting value addition, creating employment opportunities, and supporting environmentally responsible production practices. According to Hassan (2024), university incubation strengthens entrepreneurial competencies, enhances business survival rates, and improves enterprise performance through knowledge transfer and innovation support. Similarly, Leal, Leal, and Silva (2023) observed that collaboration among universities, incubators, municipalities, and business associations promotes entrepreneurial ecosystems and local economic development through coordinated institutional support.

In the agribusiness sector, incubation programs provide entrepreneurs with technical knowledge, market information, mentorship, and access to innovative technologies that improve production efficiency and competitiveness. The experience of Makerere University's Food Technology and Business Incubation Centre (FTBIC), CURAD, and Gulu University innovation initiatives demonstrates how university incubation can support agribusiness innovation, value addition, commercialization, and sustainable enterprise development in Uganda.

Empirical studies generally support a positive relationship between university incubation and sustainability outcomes. Jaber, Sobhani, and Jamshidi (2026) found that incubator-mediated university-industry collaboration significantly enhances entrepreneurship development and innovation commercialization within agricultural ecosystems. Similarly, Lone, Rashid, and Gulzar (2026) established that agribusiness incubation programs strengthen entrepreneurial intention, innovation diffusion, and enterprise growth in fragile agrarian economies.

However, not all studies report uniformly positive outcomes. Some scholars argue that incubation alone may not guarantee enterprise sustainability where entrepreneurs continue to face challenges such as inadequate financing, weak infrastructure, limited market access, and unfavorable policy environments (Adeyanju et al., 2023; Epeju, 2020). These findings suggest that while incubation contributes to sustainability, its effectiveness depends on broader institutional and market conditions.

The reviewed literature demonstrates considerable agreement regarding the importance of university incubation in enterprise development. Nevertheless, limited empirical evidence exists on how university incubation directly influences agribusiness sustainability, particularly in Uganda. Most previous studies have focused on entrepreneurship development, innovation, and business performance rather than broader agribusiness sustainability indicators such as return on investment, revenue growth, employment creation, value addition, and environmental stewardship. This study therefore seeks to bridge this empirical and contextual gap. Hence a study tested the following hypothesis

H₀₁: University incubation has no significant effect on agribusiness sustainability in Uganda.

University Incubation and Agribusiness Innovation

Agribusiness innovation is increasingly recognized as a critical driver of competitiveness, productivity, and sustainability. Innovation encompasses the development and adoption of new products, production processes, technologies, organizational practices, and marketing approaches that improve enterprise performance (OECD, 2018). University incubation has been identified as one of the most effective institutional mechanisms for promoting innovation because it provides entrepreneurs with access to research outputs, technical expertise, entrepreneurial training, and commercialization support.

The Triple Helix Theory posits that innovation emerges through interactions among universities, industries, and governments (Etzkowitz & Leydesdorff, 2000). Within this framework, universities serve as entrepreneurial institutions that generate and transfer knowledge to businesses through incubation programs. These interactions facilitate technology diffusion, entrepreneurial learning, and innovation adoption. Several studies have reported positive associations between university incubation and innovation. Maulidian et al. (2024) found that university business incubators significantly enhance sustainability-oriented innovation by providing entrepreneurs with access to technical support, innovation guidance, and entrepreneurial mentorship. Similarly, Bouzidi, Selatnia, and Redjem (2024) established that sustainable university incubators strengthen innovation capabilities through research commercialization, networking opportunities, and entrepreneurial support.

Furthermore, Prasetio et al. (2025) observed that university incubation ecosystems promote innovation by enhancing entrepreneurial competencies, technological adaptation, and sustainability awareness among emerging entrepreneurs. Santoso, Nugroho, and Tukiyo (2024) similarly reported that eco-green entrepreneurial learning within university incubation environments significantly improves innovation development and commercialization.

The Ugandan experience also provides evidence supporting the relationship between university incubation and innovation. University-led initiatives such as FTBIC, CURAD, and Gulu University innovation programs have played important roles in promoting agribusiness innovation, value addition, technology adoption, and commercialization of agricultural products.

Despite widespread agreement regarding the positive influence of university incubation on innovation, some scholars argue that innovation outcomes vary depending on institutional capacity, incubation quality, financing availability, and industry partnerships (Mutambi, 2013; Adeyanju et al., 2023). Weak commercialization systems, limited incubation infrastructure, and inadequate industry linkages may reduce the effectiveness of incubation programs in promoting innovation.

Therefore, while existing literature suggests that university incubation enhances agribusiness innovation, there remains limited evidence from Uganda regarding the extent to which incubation contributes to innovation within agribusiness enterprises.

H₀₂: University incubation has no significant effect on agribusiness innovation in Uganda.

Agribusiness Innovation and Agribusiness Sustainability

Innovation has become one of the most important determinants of agribusiness sustainability. Sustainable agribusinesses require continuous improvements in production systems, product quality, resource utilization, environmental management, and market competitiveness. Agribusiness innovation enables enterprises to improve productivity, reduce operational costs, increase profitability, enhance value addition, and strengthen resilience to environmental and market challenges (OECD, 2018).

According to Rajkamal et al. (2022), innovation facilitates sustainable entrepreneurship by enabling enterprises to develop environmentally friendly products, improve resource efficiency, and respond effectively to changing market demands. Similarly, Vasilescu et al. (2023) argue that innovation plays a central role in balancing economic growth, environmental protection, and social wellbeing.

Empirical studies generally support a positive relationship between innovation and sustainability outcomes. Anghel and Anghel (2022) found that innovation significantly improves environmental sustainability through the development of green technologies and sustainable production systems. Chandel (2022) similarly reported that innovation promotes economic sustainability by enhancing productivity, competitiveness, and enterprise growth.

In the agribusiness sector, innovation contributes to sustainability through value addition, improved production techniques, climate-smart agriculture, waste reduction, renewable energy adoption, and efficient resource utilization. Enterprises that adopt innovative technologies and production methods are more likely to achieve higher profitability, improved sales growth, enhanced market competitiveness, and stronger environmental performance.

However, some studies indicate that innovation alone may not guarantee sustainability. Ghosh et al. (2026) found that weak market systems, limited financing, fragmented value chains, and inadequate institutional support can constrain the sustainability benefits of innovation. Similarly, Mishra et al. (2024) argued that innovation outcomes are often influenced by the broader entrepreneurial ecosystem within which enterprises operate.

Although the existing literature provides substantial evidence linking innovation to sustainability, limited studies have specifically examined the influence of agribusiness innovation on agribusiness sustainability within Uganda. This creates an empirical gap that warrants further investigation.

H03: Agribusiness innovation has no significant effect on agribusiness sustainability in Uganda.

The Mediating Role of Agribusiness Innovation on the relationship between university incubation and agribusiness sustainability in Uganda.

Recent studies increasingly recognize that the relationship between incubation and sustainability may not be direct but may operate through innovation. University incubation provides entrepreneurs with training, mentorship, networking opportunities, technical expertise, and commercialization support. These resources enhance innovation capabilities, which subsequently contribute to sustainability outcomes. The Resource-Based View (Barney, 1991) suggests that valuable organizational resources such as knowledge, innovation capabilities, and entrepreneurial competencies create competitive advantage and improve long-term performance. In this context, university incubation provides strategic resources that enhance innovation, while innovation

serves as the mechanism through which sustainability outcomes are achieved.

Several studies support the mediating role of innovation. Jaberi et al. (2026) found that innovation commercialization mediates the relationship between university-industry collaboration and entrepreneurial development. Similarly, Bouzidi et al. (2024) reported that sustainable business incubation promotes enterprise sustainability through innovation development and commercialization processes.

The logic of mediation is further supported by evidence from Ugandan incubation initiatives such as FTBIC and CURAD, which facilitate innovation adoption, value addition, technology transfer, and commercialization before sustainability outcomes are realized.

Despite growing interest in incubation, innovation, and sustainability, limited empirical studies have investigated agribusiness innovation as a mediator between university incubation and agribusiness sustainability, particularly in Uganda. Most existing studies focus on direct effects and overlook the mechanisms through which incubation influences sustainability outcomes. Consequently, this study seeks to address this theoretical, empirical, and contextual gap by examining whether agribusiness innovation mediates the relationship between university incubation and agribusiness sustainability in Uganda.

H04: Agribusiness innovation does not significantly mediate the relationship between university incubation and agribusiness sustainability in Uganda.

Methodology

Research design

The study adopted a cross-sectional quantitative research design to examine the influence of value chain coordination on green entrepreneurship development in Uganda, with university incubation investigated as a mediating variable. The design enabled the collection of quantitative data from respondents at a single point in time while examining relationships among the study variables (Setia, 2016).

Table 1: Research Design Summary

Methodological Aspect	Description
Research approach	Quantitative
Research design	Cross-sectional
Study focus	Value chain coordination, university incubation, and green entrepreneurship development
Unit of analysis	Agribusiness enterprises and incubation beneficiaries
Data type	Primary quantitative data
Data collection period	Single point in time

Source: Primary Data

Study population and sampling

The study targeted agribusiness enterprises affiliated with university incubation initiatives and coordinated value chain networks in Uganda. Respondents included agribusiness entrepreneurs, incubation beneficiaries, agribusiness managers, university incubation coordinators, and value chain actors involved in production, processing, marketing, and agribusiness support services.

A sample size of 311 respondents was used in the study. Purposive sampling was employed to identify respondents directly involved in agribusiness incubation and value chain systems, while simple random sampling was used to minimize selection bias and improve representativeness.

Table 2: Population and Sampling Summary

Item	Description
Target population	Agribusiness enterprises and incubation beneficiaries
Respondents	Entrepreneurs, incubation coordinators, agribusiness managers, value chain actors
Sample size	311 respondents
Sampling techniques	urposive and simple random sampling
Sampling justification	Adequate for SEM analysis (Kline, 2016)
Data collection period	Single point in time

Source: Primary Data

Data collection instrument

Primary data were collected using a structured self-administered questionnaire adapted from previous empirical studies on value chain coordination, university incubation, and green entrepreneurship development. The questionnaire consisted of closed-ended items measured on a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree.

Table 3: Operationalization of Study Variables

Variable	Indicators
University Incubation (Independent Variable)	Business coaching, entrepreneurial skills development, technical training, capacity building, Industry partnerships, advisory services,
Agribusiness Innovation (Mediating Variable)	Development of new products, improved product quality, diversification of products, storage innovations, product differentiation
Agribusiness Sustainability (Dependent Variable)	Return on Investment (ROI), sales revenue growth, profitability, market expansion, employment creation, fair wages

Source: Primary Data

Validity and reliability

Confirmatory Factor Analysis (CFA) was conducted to assess construct validity and measurement model adequacy. Reliability was assessed using Cronbach Alpha coefficients and Composite Reliability (CR), while convergent validity was assessed using Average Variance Extracted (AVE).

Table 4: Reliability and Validity Thresholds

Measure	Recommended Threshold	Purpose
Cronbach Alpha	≥ 0.70	Internal consistency reliability
Composite Reliability (CR)	≥ 0.70	Construct reliability
Average Variance Extracted (AVE)	≥ 0.50	Convergent validity

Source: Primary Data

Data analysis

Data analysis was conducted using Statistical Package for Social Sciences (SPSS) and Analysis of Moment Structures (AMOS). Descriptive statistics including means, standard deviations, skewness, and kurtosis were used to summarize respondent perceptions and assess data normality. Pearson correlation analysis was used to examine relationships among the study variables.

Confirmatory Factor Analysis (CFA) was conducted to assess the adequacy of the measurement model, while Structural Equation Modelling (SEM) was employed to examine direct relationships among value chain coordination, university incubation, and green entrepreneurship development. The mediation effect of university

incubation was tested using bootstrapping procedures with 5,000 resamples.

Table 5: Data Analysis Techniques

Objective	Analysis Technique
Examine relationships among variables	Pearson correlation analysis
Assess measurement model adequacy	Confirmatory Factor Analysis (CFA)
Test direct relationships	Structural Equation Modelling (SEM)
Test mediation effects	Bootstrapping mediation analysis (5,000 resamples)

Source: Primary Data

Table 6: Model Fit Indices and Thresholds

Fit Index	Recommended Threshold
χ^2/df	< 3.0
CFI	≥ 0.90
TLI	≥ 0.90
RMSEA	≤ 0.08
SRMR	≤ 0.08
Data collection period	Single point in time

Source: Primary Data

The mediation effect of university incubation was tested using bootstrapping procedures with 5,000 resamples to estimate direct, indirect, and total effects. Mediation was confirmed where the bootstrapped confidence intervals excluded zero. Model fit was assessed using chi-square to degrees of freedom ratio (χ^2/df), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). The study adopted the recommended thresholds of $\chi^2/df < 3.0$, CFI and TLI ≥ 0.90, and RMSEA and SRMR ≤ 0.08 to determine acceptable model fit.

Descriptive Statistics Results

Table 7: Descriptive Statistics of Study Variables (N = 311)

Variable	Mean	Std. Deviation	Skewness	Kurtosis
University Incubation (UI)	3.94	0.71	-0.412	-0.318
Agribusiness sustainability (AS)	3.78	0.82	-0.287	-0.441
Agribusiness Innovation (AI)	4.02	0.69	-0.503	-0.276

Source: Primary Data

The descriptive statistics results indicate that respondents generally agreed with the statements measuring the study variables, as reflected by mean scores above 3.5. Specifically, mean = 3.94 for University Incubation (UI). Similarly, mean = 3.78 for Agribusiness sustainability (AS), while mean = 4.02 for Agribusiness Innovation (AI).

The standard deviation values ranging between 0.69 and 0.82 show relatively low variability in responses, implying consistency among respondents' views regarding the constructs under investigation. The skewness statistics for all variables were within the acceptable threshold of ±1, indicating that the data were approximately normally distributed. Specifically, UI (-0.412), AS (-0.287), and AI (-0.503) showed slight negative skewness, suggesting that most respondents tended to provide higher ratings on the study variables. Likewise, the kurtosis values for UI (-0.318), AS (-0.441), and AI (-0.276) were within the acceptable range of ±2, confirming the absence of extreme peakedness or flatness in the data distribution. Therefore, the data satisfied the assumption

of normality and were considered appropriate for further inferential analyses such as correlation, Confirmatory Factor Analysis (CFA), and Structural Equation Modelling (SEM).

Correlation Analysis Results

Table 8: Pearson Correlation Matrix

Variables	VCC	UI	GED
University Incubation (UI)	1		
Agribusiness sustainability (AS)	.641**	1	
Agribusiness Innovation (AI)	.703**	.688**	1

Correlation is significant at $p < 0.01$

The results indicate a significant positive relationship between University Incubation and Agribusiness Sustainability ($r = 0.641$, $p < 0.01$). This suggests that improvements in university incubation services are associated with higher levels of agribusiness sustainability. The relationship is strong, implying that university incubation plays an important role in enhancing sustainable agribusiness outcomes.

The findings further reveal a strong positive relationship between University Incubation and Agribusiness Innovation ($r = 0.703$, $p < 0.01$). This indicates that agribusiness enterprises supported through university incubation are more likely to adopt innovative products, processes, marketing approaches, and value-addition practices. The relatively high coefficient suggests that university incubation is a key driver of innovation among agribusiness enterprises.

Similarly, Agribusiness Innovation was found to have a strong positive relationship with Agribusiness Sustainability ($r = 0.688$, $p < 0.01$). This implies that agribusiness enterprises that engage in innovation tend to experience better sustainability outcomes, including improved profitability, sales growth, employment creation, value addition, and environmental management practices.

Since all correlation coefficients are below the threshold of 0.80, the results indicate the absence of multicollinearity concerns among the study variables (Hair et al., 2022). Overall, the findings suggest that university incubation, agribusiness innovation, and agribusiness sustainability are positively and significantly associated, providing preliminary support for the proposed conceptual framework and the mediating role of agribusiness innovation.

Table 9: Measurement Model Assessment

Fit Index	Recommended Threshold	Obtained Value	Interpretation
χ^2/df	< 3.0	2.114	Good Fit
CFI	≥ 0.90	0.948	Good Fit
TLI	≥ 0.90	0.936	Good Fit
RMSEA	≤ 0.08	0.052	Acceptable Fit
SRMR	≤ 0.08	0.047	Good Fit

Source: Primary Data

The Confirmatory Factor Analysis (CFA) results demonstrated that the measurement model achieved satisfactory goodness-of-fit indices, confirming the adequacy of the constructs used in the study. The model produced a chi-square to degrees of freedom ratio $\chi^2/df = 2.114$, which was below the recommended threshold of 3.0, indicating a good model fit. In addition, the Comparative Fit Index CFI=0.948 and Tucker-Lewis Index TLI=0.936 exceeded the recommended value of 0.90, suggesting that the measurement model adequately explained the covariance structure among the observed variables.

Furthermore, the Root Mean Square Error of Approximation RMSEA =0.052 and Standardized Root Mean Square Residual SRMR

=0.047 were both below the acceptable threshold of 0.08, indicating minimal residual errors and strong model consistency. Overall, the CFA findings confirmed convergent validity and construct reliability of the measurement scales for Value Chain Coordination, University Incubation, and Green Entrepreneurship Development. Therefore, the measurement model was considered statistically adequate and suitable for subsequent Structural Equation Modelling (SEM) analysis.

Table 10: Reliability and Validity Results

Construct	Cronbach Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
University Incubation (UI)	0.891	0.903	0.614
Agribusiness sustainability (AS)	0.904	0.917	0.638
Agribusiness Innovation (AI)	0.887	0.901	0.602

Source: Primary Data

The results indicate that all constructs achieved satisfactory reliability and validity. The Cronbach Alpha values ranged from 0.887 to 0.904, exceeding the recommended threshold of 0.70, indicating strong internal consistency. Similarly, the Composite Reliability (CR) values ranged from 0.901 to 0.917, surpassing the acceptable benchmark of 0.70 and confirming construct reliability. Furthermore, the Average Variance Extracted (AVE) values ranged from 0.602 to 0.638, which are above the recommended threshold of 0.50, demonstrating adequate convergent validity. Therefore, the measurement scales for University Incubation, Agribusiness Sustainability, and Agribusiness Innovation were considered reliable and valid for further analysis.

Table 11: Structural Model Results

Path	Standardized Beta (β)	S.E	C.R	p-value	Decision
UI $\rightarrow$ AS	0.641	0.052	9.884	0	Significant
AS $\rightarrow$ AI	0.417	0.061	6.832	0	Significant
UI $\rightarrow$ AI	0.486	0.058	8.207	0	Significant

Source: Primary Data

The results indicate that University Incubation significantly and positively influences Agribusiness Sustainability ($\beta = 0.641$, $p < 0.001$). This implies that improvements in incubation services such as mentorship, training, networking, research commercialization, and access to finance enhance the sustainability of agribusiness enterprises. The findings further reveal that Agribusiness Innovation significantly and positively influence Agribusiness Sustainability ($\beta = 0.417$, $p < 0.001$). This suggests that enterprises that adopt innovative products, processes, marketing approaches, and value-addition practices are more likely to achieve sustainable growth and improved performance.

Similarly, University Incubation significantly and positively influences Agribusiness Innovation ($\beta = 0.486$, $p < 0.001$). This indicates that university incubation programs play a critical role in fostering innovation by providing entrepreneurs with the knowledge, skills, technology, and support needed to develop and commercialize innovative agribusiness solutions.

Overall, all the hypothesized relationships were statistically significant, implying that university incubation directly enhances both agribusiness innovation and agribusiness sustainability, while agribusiness innovation also contributes significantly to agribusiness sustainability. These findings provide support for the proposed conceptual framework and suggest that agribusiness innovation may play an important mediating role in the relationship between university incubation and agribusiness sustainability.

Table 12: Structural Model Fit Indices

Fit Index	Obtained Value
χ^2/df	2.263
CFI	0.944
TLI	0.931
RMSEA	0.056
SRMR	0.049
Data collection period	Single point in time

Source: Primary Data

The Structural Equation Modelling (SEM) structural model demonstrated satisfactory goodness-of-fit indices, indicating that the proposed model adequately fitted the observed data. The chi-square to degrees of freedom ratio $\chi^2/df=2.263$ was below the recommended threshold of 3.0, suggesting a good overall model fit.

Furthermore, the Comparative Fit Index (CFI) =0.944 and Tucker-Lewis Index (TLI) =0.931 exceeded the acceptable benchmark of 0.90, indicating that the structural model sufficiently explained the relationships among the latent constructs. The Root Mean Square Error of Approximation (RMSEA) = 0.056 and Standardized Root Mean Square Residual (SRMR) =0.049 were both below the recommended maximum value of 0.08, confirming minimal residual errors and acceptable approximation of the model to the population covariance matrix.

Overall, the SEM structural model achieved acceptable and statistically sound fit indices, implying that the hypothesized relationships among Value Chain Coordination, University Incubation, and Green Entrepreneurship Development were empirically supported and the model was appropriate for explaining green entrepreneurship development in Uganda.

Bootstrapping Mediation Analysis Results

Table 13: Mediation Analysis using Bootstrapping (5,000 Resamples)

Effect	Beta	Lower CI	Upper CI	p-value	Interpretation
Direct Effect (UI → AS)	0.486	0.372	0.601	0	Significant
Indirect Effect (UI → AS → AI)	0.267	0.174	0.382	0	Significant
Total Effect	0.753	0.641	0.841	0	Significant

Source: Primary Data

The bootstrapping mediation analysis results confirmed that the results further show that the indirect effect of University Incubation on Agribusiness Sustainability through Agribusiness Innovation (AI) is positive and significant ($\beta = 0.267$, $p < 0.001$). Since the bootstrapped confidence interval (0.174–0.382) excludes zero, agribusiness innovation significantly mediates the relationship between university incubation and agribusiness sustainability.

Additionally, the total effect of University Incubation on Agribusiness Sustainability was strong and significant ($\beta = 0.753$, $p < 0.001$), indicating that the combined direct and indirect pathways substantially influence agribusiness sustainability.

Because both the direct effect and indirect effect remained significant, the findings confirm partial mediation. This implies that university incubation enhances agribusiness sustainability directly through incubation support services and indirectly through promoting agribusiness innovation. Therefore, agribusiness innovation serves as

an important mechanism through which university incubation contributes to sustainable agribusiness development.

Since University Incubation only partially mediates the relationship, explicitly state that university incubation is a vital catalyst, but it cannot fix a fundamentally broken market. This means that, if infrastructure or macroeconomic policies in Uganda don't support agribusinesses, incubators can only do so much.

Table 14: Hypotheses Decision

Hypothesis	Decision
H01: University incubation has no significant effect on agribusiness sustainability in Uganda.	Rejected
H02: University incubation has no significant effect on agribusiness innovation in Uganda.	Rejected
H03: Agribusiness innovation has no significant effect on agribusiness sustainability in Uganda.	Rejected
H04: Agribusiness innovation does not significantly mediate the relationship between university incubation and agribusiness sustainability in Uganda.	Rejected

The findings revealed that all the hypothesized relationships were statistically significant at $p < 0.001$. Consequently, all the null hypotheses were rejected. Specifically, university incubation significantly enhances agribusiness sustainability and agribusiness innovation, while agribusiness innovation significantly improves agribusiness sustainability. Furthermore, agribusiness innovation was found to significantly mediate the relationship between university incubation and agribusiness sustainability. These findings imply that university incubation contributes to sustainable agribusiness development both directly and indirectly through strengthening innovation capabilities among agribusiness enterprises. Therefore, effective incubation programs that provide mentorship, entrepreneurial training, networking opportunities, research commercialization, and innovation support are essential for promoting agribusiness sustainability in Uganda.

Descriptive Statistics Results

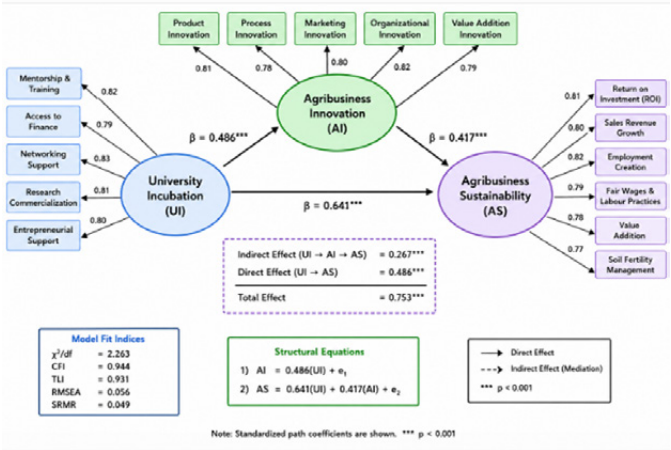


Figure 1: SEM results

Source: Primary Data

The structural model illustrates the relationships among University Incubation, Agribusiness Innovation, and Agribusiness Sustainability in Uganda. The findings indicate that University Incubation, measured through mentorship and training, access to finance, networking support, research commercialization, and entrepreneurial support, has a significant positive effect on Agribusiness Innovation ($\beta = 0.486$, $p < 0.001$). This suggests that incubation programs provide entrepreneurs with the knowledge, resources, and support necessary to develop innovative products, processes, marketing strategies, and value-addition initiatives. The results further reveal that Agribusiness Innovation significantly influences Agribusiness Sustainability ($\beta =$

0.417, $p < 0.001$), implying that innovative agribusiness enterprises are more likely to achieve higher returns on investment, increased sales revenue growth, improved employment creation, better labour practices, enhanced value addition, and sustainable soil fertility management. Additionally, University Incubation has a strong direct effect on Agribusiness Sustainability ($\beta = 0.641$, $p < 0.001$), demonstrating that incubation support contributes directly to sustainable agribusiness outcomes. The mediation analysis shows a significant indirect effect of University Incubation on Agribusiness Sustainability through Agribusiness Innovation ($\beta = 0.267$, $p < 0.001$), alongside a significant total effect ($\beta = 0.753$, $p < 0.001$). These findings confirm that Agribusiness Innovation partially mediates the relationship between University Incubation and Agribusiness Sustainability. Furthermore, the model exhibits good fit indices ($\chi^2/df = 2.263$, CFI = 0.944, TLI = 0.931, RMSEA = 0.056, and SRMR = 0.049), indicating that the proposed model adequately explains the relationships among the study variables. Overall, the results suggest that strengthening university incubation programs can promote agribusiness sustainability both directly and through enhanced innovation capabilities.

Discussion

The study established that university incubation has a significant positive effect on agribusiness sustainability. This finding suggests that agribusiness enterprises that receive incubation support through mentorship, entrepreneurial training, networking opportunities, business advisory services, and research commercialization are more likely to achieve sustainable outcomes such as profitability, revenue growth, value addition, employment creation, and market expansion. The findings are consistent with Hassan (2024), who reported that university incubation strengthens entrepreneurial competencies and improves enterprise survival and performance. Similarly, Leal et al. (2023) found that incubation ecosystems contribute to sustainable enterprise development through coordinated institutional support. The results also support Jaber et al. (2026), who observed that incubator-mediated collaboration enhances enterprise growth and sustainability within agricultural ecosystems.

The findings can be explained using the Resource-Based View Theory, which argues that organizations achieve sustainable competitive advantage through valuable resources and capabilities. University incubation provides strategic resources such as knowledge, technical skills, innovation support, networks, and market information that are difficult for competitors to imitate. These resources enhance the capacity of agribusiness enterprises to achieve long-term sustainability. In Uganda, the findings are reflected in initiatives such as Makerere University's Food Technology and Business Incubation Centre (FTBIC), CURAD, and Gulu University innovation hubs, which support agribusiness enterprises through technology transfer, mentorship, commercialization, and market linkages. These initiatives have contributed to value addition, improved product quality, and enterprise competitiveness, thereby enhancing agribusiness sustainability.

The study further revealed that university incubation significantly and positively influences agribusiness innovation. This indicates that incubation programmes play a critical role in facilitating the development of new products, improved production processes, product diversification, storage innovations, and market-oriented technologies among agribusiness enterprises. The findings agree with Maulidian et al. (2024), who found that university incubators enhance innovation through entrepreneurial mentorship, technical guidance, and commercialization support. Similarly, Bouzidi et al. (2024) reported that sustainable university incubators strengthen innovation capabilities through research commercialization and entrepreneurial networking. The results also support Prasetyo et al. (2025), who concluded that university incubation ecosystems foster innovation by improving entrepreneurial competencies and technology adoption.

The findings further validate the Triple Helix Theory, which emphasizes collaboration among universities, industry, and government in generating innovation. Universities act as knowledge producers, industries commercialize innovations, and governments create enabling policy environments. The significant relationship observed in this study confirms that incubation serves as an important mechanism through which knowledge generated by universities is translated into practical agribusiness innovations.

In Uganda, incubators such as FTBIC and CURAD have enabled agripreneurs to adopt modern production technologies, improve product quality, and commercialize agricultural innovations, thereby strengthening innovation capacity within the agribusiness sector.

The study established that agribusiness innovation significantly influences agribusiness sustainability. This implies that enterprises that continuously innovate are more likely to achieve improved profitability, market competitiveness, employment creation, value addition, and environmental sustainability. The findings support Rajkamal et al. (2022), who argued that innovation promotes sustainable entrepreneurship by enabling enterprises to develop environmentally friendly products and improve resource utilization. Similarly, Vasilescu et al. (2023) emphasized that innovation is central to achieving economic, environmental, and social sustainability. The findings are also consistent with Anghel and Anghel (2022), who reported that innovation enhances environmental sustainability through green technologies and sustainable production systems.

From the Resource-Based View perspective, innovation represents a strategic capability that allows firms to create value, differentiate themselves from competitors, and sustain long-term performance. Enterprises that innovate are able to respond effectively to changing market conditions and environmental challenges, thereby enhancing sustainability.

In Uganda, agribusiness innovation contributes to sustainability through improved agricultural processing, climate-smart technologies, renewable energy adoption, product diversification, and enhanced value addition, all of which improve enterprise performance and resilience.

The study confirmed that agribusiness innovation partially mediates the relationship between university incubation and agribusiness sustainability. The indirect effect was significant, while the direct effect remained significant, indicating partial mediation.

This finding suggests that university incubation improves agribusiness sustainability not only directly through training, mentorship, networking, and business support services but also indirectly by strengthening innovation capabilities. Incubation equips entrepreneurs with the knowledge, skills, technologies, and resources necessary to innovate, and these innovations subsequently enhance sustainability outcomes. The findings support Barney's (1991) Resource-Based View Theory, which argues that organizational resources contribute to performance through the development of valuable capabilities such as innovation. The results also support the Triple Helix Theory, which emphasizes that innovation emerges through interactions among universities, industries, and government institutions.

The findings agree with Jaber et al. (2026), who found that innovation commercialization mediates the relationship between university-industry collaboration and enterprise development. Similarly, Bouzidi et al. (2024) established that sustainable business incubation promotes sustainability through innovation development and commercialization processes.

However, the partial mediation effect suggests that innovation alone cannot fully explain the relationship between university incubation and agribusiness sustainability. Other factors such as access to finance, market conditions, infrastructure, government policies, and institutional

support may also influence sustainability outcomes. This implies that while university incubation is a critical catalyst for sustainable agribusiness development, its effectiveness is maximized when supported by favorable external business environments.

Overall, the findings demonstrate that university incubation and agribusiness innovation are complementary mechanisms that collectively contribute to sustainable agribusiness development in Uganda. The results therefore provide empirical support for the integration of the Triple Helix Theory and the Resource-Based View Theory in explaining how university-based entrepreneurial support enhances sustainability through innovation.

Conclusion

The study concludes that university incubation is a critical driver of agribusiness sustainability in Uganda. The findings demonstrate that incubation programmes provide entrepreneurs with mentorship, entrepreneurial training, networking opportunities, business advisory services, and commercialization support that significantly improve the sustainability of agribusiness enterprises. As a result, incubated enterprises are more likely to achieve higher profitability, increased sales growth, greater value addition, employment creation, and long-term competitiveness.

The study further concludes that university incubation significantly enhances agribusiness innovation by facilitating the development and adoption of new products, technologies, production methods, and business models. Agribusiness innovation was also found to significantly contribute to sustainability by improving productivity, resource utilization, market responsiveness, and environmental performance. These findings highlight innovation as a key mechanism through which agribusiness enterprises achieve sustainable growth and resilience.

In addition, the study confirms that agribusiness innovation partially mediates the relationship between university incubation and agribusiness sustainability. This implies that university incubation contributes to sustainability both directly through entrepreneurial support services and indirectly through strengthening innovation capabilities. However, the partial mediation effect indicates that innovation alone cannot fully explain sustainability outcomes, suggesting that other factors such as access to finance, infrastructure, market opportunities, and supportive policies also play an important role.

Overall, the study concludes that strengthening university incubation systems and promoting agribusiness innovation are essential strategies for enhancing agribusiness sustainability in Uganda. The findings support the Triple Helix Theory and Resource-Based View Theory by demonstrating that collaboration among universities, industry, and government, combined with the provision of strategic entrepreneurial resources, contributes significantly to sustainable agribusiness development. Universities, policymakers, development partners, and agribusiness stakeholders should therefore invest in incubation programmes and innovation ecosystems to accelerate sustainable agricultural transformation and economic development in Uganda.

Recommendations

Since the study found that university incubation significantly influences agribusiness sustainability and agribusiness innovation. Strengthening incubation programmes will therefore enhance entrepreneurs' ability to innovate, improve productivity, and achieve sustainable business growth. Universities should invest more in incubation centers by providing entrepreneurs with technical training, business mentorship, innovation support, and commercialization opportunities. The government should provide innovation grants, startup funds, and affordable credit facilities to

support agribusiness entrepreneurs emerging from university incubation programmes. Because adequate financing will enable entrepreneurs to adopt new technologies, expand operations, and improve sustainability outcomes.

Secondly, stakeholders should establish stronger partnerships to facilitate technology transfer, market access, research commercialization, and entrepreneurial networking. This is based on the fact that, the study confirmed that agribusiness innovation partially mediates the relationship between university incubation and agribusiness sustainability. This implies that sustainable agribusiness development is achieved when incubation is supported by strong institutional collaboration and innovation systems, as proposed by the Triple Helix Theory. All these will address the study's main findings on university incubation, agribusiness innovation, and agribusiness sustainability.

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