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LINKING AGRICULTURAL SCIENCE EDUCATION TO INNOVATION AND INDUSTRY FOR SUSTAINABLE ENTREPRENEURSHIP DEVELOPMENT IN NIGERIA

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ABSTRACT: This study examined how agricultural science education, innovation and collaboration with agricultural industries can contribute to sustainable entrepreneurship development in Nigeria. The study was guided by three research questions and three null hypotheses. A descriptive survey design was adopted for the study. The population consisted of 1,200 agricultural science education stakeholders, of which 300 respondents, comprising agricultural educators and industry stakeholders, were selected. Data was collected using a structured questionnaire based on the objectives of the study. The instrument was subjected to expert validation, and its reliability was established before use. Mean and standard deviation were used to answer the research questions, while the independent-samples t-test was employed to test the hypotheses at the 0.05 level of significance. The findings showed that agricultural science education provides learners

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with the knowledge and practical skills needed for sustainable entrepreneurial development to a high extent. Innovation was also found to contribute greatly to the development of sustainable agricultural enterprises. In the same way, collaboration between agricultural science education institutions and agricultural industries was found to support entrepreneurial development to a high extent. The study therefore concludes that bringing education, innovation and industry closer together can improve learners' entrepreneurial competencies and prepare them for successful participation in agricultural enterprise development. It is recommended that agricultural institutions strengthen practical training, give greater attention to innovation and entrepreneurship education, establish stronger partnerships with agricultural industries, provide adequate learning resources and improve support for graduates through mentorship, training and accessible financial opportunities.

Keywords: *Agricultural Science Education, Innovation, Industry Linkages, Entrepreneurship Development, Sustainable Agriculture, Nigeria.*

Introduction

Nigeria's agriculture is a vital industry since it promotes food security, economic growth, employment, and improved living standards. Beyond just producing food and raw materials, it has also expanded its responsibilities to include industrial development, entrepreneurship, innovation, and technology. Graduates and practitioners must possess pertinent information, functional skills, and inventive capacities for agriculture to make a meaningful impact on sustainable growth. Because of this, agricultural science education is essential for preparing skilled and entrepreneurial workers who are capable of addressing the industry's changing needs. In fields like fisheries, farm management, extension, agro-processing, and crop and animal production, agricultural science instruction prepares students with theoretical and practical expertise. Traditional agricultural information, on the other hand, is no longer sufficient. Additionally, students require skills in business management, technological innovation, digital farming, value addition, and marketing. Osagiede and Alordiah (2025) observed that conventional instructional strategies might not effectively equip pupils for the needs of contemporary agriculture. Hence, they stressed the importance of agricultural education that is practical, relevant to industry needs, and student-focused. Creativity and innovation are becoming more and more crucial in agricultural science instruction. Digital marketing, biotechnology, irrigation, agro-

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processing, artificial intelligence, climate-smart farming, and mechanization are among the technologies and methods used in modern agriculture. Therefore, agricultural education should assist students in recognizing issues, finding remedies, and creating new possibilities in addition to comprehending agricultural methods.

Agricultural education is also essential in Nigeria for lowering reliance on paid employment and encouraging entrepreneurship. It enables students to recognize chances in the agricultural value chain and establish businesses utilizing their knowledge and abilities. Agricultural education has the potential to enhance students' entrepreneurial mindsets, despite the fact that a lack of initial capital and real-world experience continue to be major obstacles, according to a study conducted by Inya, Onyewuchi, and Abasilim (2025). Likewise, Yaro and Daniel (2025) underscored how practical instruction may inspire young people to pursue agricultural ventures. This demonstrates how agricultural education can turn agriculture from a means of survival into a lucrative and creative profession. For preparing students for employment and entrepreneurship, it is crucial to have strong collaboration between the agricultural sector and educational institutions. Universities, colleges of education, and other agricultural institutions must guarantee that the information pupils gain accurately represents the agricultural sector's genuine demands. Students may have helpful opportunities via internships, industrial training, fieldwork, mentoring, and practical business activities if they work closely with agricultural firms. These collaborations can also assist universities in staying current with evolving market demands, new technologies, and the skills that companies need.

This connection's significance has continued to be supported by current research. According to Chfadi, Abdulkader, and Chirinda (2025), integrating practical experience, entrepreneurship training, and industry involvement with classroom education can enhance agri-entrepreneurship instruction in African universities. They added that significant obstacles continue to be inadequate resources, infrastructure, and weak university-industry ties. Similarly, Sassi and Mshenga (2025) stated that university-industry collaborations may improve agricultural programmes' applicability to industry requirements, promote innovation, facilitate technology transfer, and increase students' employability. Students can obtain the real skills necessary to thrive after graduation if agricultural education and industry are more closely linked in Nigeria. Graduates of modern agricultural enterprises

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must possess management, communication, digital technology, innovation, and problem-solving abilities in addition to farming expertise. Limited practical training and start-up funds continue to be major challenges, even if agricultural education promotes students' agripreneurial mentality, according to Abasilim, Onyewuchi, and Inya (2025).

According to Ibe et al.'s (2025) study, there is a strong correlation between the entrepreneurial goals of graduates of agricultural education programs at Nigerian universities and their agricultural knowledge and skills. Therefore, the research advocated for a greater focus on hands-on and entrepreneurial education. This indicates that farming education should involve more than just classroom instruction, providing students with more chances to acquire practical experience and put their knowledge into practice. Graduates may be better prepared to be found and run successful agricultural enterprises in this manner. Between agricultural education and the agricultural sector, innovation can act as a crucial link. Industries may assist in transforming valuable concepts into items and services that meet market demand, while institutions can offer pupils the chance to investigate ideas, do experiments, and come up with fresh answers. Students may get experience outside of the classroom and start to create practical company ideas via innovation centers, incubation programs, demonstration farms, and alliances with agricultural firms. Integrating entrepreneurship and innovation into agricultural education, according to Chirinda et al. (2024), can help students develop the mindset and practical skills necessary to identify opportunities and launch agricultural businesses.

Additionally, technology is altering how agricultural education is provided and practiced. Students may learn more about contemporary farming methods and get current knowledge by utilizing agricultural information systems, smart farming tools, mobile applications, and digital platforms. Moreover, Waiganjo, Karani, and Mugambi (2024) observed that using Education 4. 0 techniques can improve decision-making and entrepreneurship among agriculture students. This demonstrates the significance of constantly updating the knowledge of teachers and students on new agricultural technologies. Teaching pupils how to raise cattle and grow crops should also be part of contemporary agricultural training. Students must learn how to control resources, process agricultural goods, add value, meet the needs of consumers, and employ eco-friendly methods. As a result, agricultural education may cover issues like climate-smart agriculture, renewable energy, waste

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management, agro-processing, and sustainable resource management. Students can create enterprises in these fields that are profitable as well as environmentally and socially responsible.

However, many challenges persist for Nigerian graduates looking to start farming enterprises. Ikuemonisan (2024) recognized significant obstacles to sustainable agribusiness growth in Nigeria, such as subpar infrastructure, constrained access to funding, slow technological adoption, educational disparities, and other structural problems. Improved infrastructure, access to money, better human capacity, and closer cooperation between the public and private sectors were highlighted in the study. These issues demonstrate that providing agricultural education is insufficient; students also require the necessary assistance and encouraging environment to use their knowledge to create successful businesses. The shifting opportunities inside the agricultural value chain must also be reflected in agricultural education. Agro-processing, marketing, logistics, agricultural finance, consultancy, mechanization, input supply, livestock production, fisheries, aquaculture, and digital agriculture are some of the fields graduates can now pursue. In order to help students see the broader possibilities in agriculture, they should be introduced to these fields. Graduates can use agricultural education in this manner to identify chances, establish businesses, and help expand Nigeria's agricultural sector in addition to looking for jobs.

Statement of the Problem

The goal of agricultural science education is to equip students with the information and skills necessary to work in the agricultural and connected industries. However, students may acquire more classroom knowledge than practical experience due to the agricultural sector's strained ties with schools. Additionally, students may find it difficult to acquire the skills needed in the modern agricultural industry due to limited access to advanced equipment, technology, innovation hubs, and entrepreneurship training. The insufficient coordination between research organisations, government agencies, agricultural companies, and educational institutions presents an additional hurdle. When these groups don't collaborate closely, students may have less access to internships, mentoring, hands-on training, and new agricultural concepts. Graduates may be discouraged from converting their agricultural business concepts and expertise into successful ventures due to low

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funding, insufficient infrastructure, and challenges in obtaining initial cash. Therefore, there must be closer ties between agricultural education, invention, and industry in order to provide students with more practical experience, enhance their entrepreneurial skills, and get them ready to create sustainable agricultural companies in Nigeria.

Purpose of the Study

The main purpose of this study is to examine the linkage between agricultural science education, innovation and industry for sustainable entrepreneurial development in Nigeria. Specifically, the study seeks to:

i. Determine the extent to which agricultural science education provides learners with the knowledge and practical skills required for sustainable entrepreneurial development in Nigeria.

ii. Examine the extent to which innovation contributes to the development of sustainable agricultural enterprises among agricultural science education learners and graduates in Nigeria.

iii. Determine the extent to which linkages between agricultural science education and agricultural industries enhance sustainable entrepreneurial development in Nigeria.

Research Questions

The following research questions guide the study:

i. To what extent does agricultural science education provide learners with the knowledge and practical skills required for sustainable entrepreneurial development in Nigeria?

ii. To what extent does innovation contribute to the development of sustainable agricultural enterprises among agricultural science education learners in Nigeria?

iii. To what extent do linkages between agricultural science education and agricultural industries enhance sustainable entrepreneurial development in Nigeria?

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Research Hypotheses

The following null hypotheses will be tested at the 0.05 level of significance:

H_{01}: There is no significant difference between agricultural science educators and industry stakeholders on the extent to which agricultural science education provides learners with the knowledge and practical skills required for sustainable entrepreneurial development in Nigeria.

H_{02}: There is no significant difference between agricultural science educators and industry stakeholders on the extent to which innovation contributes to the development of sustainable agricultural enterprises among agricultural science education learners and graduates in Nigeria.

H_{03}: There is no significant difference between agricultural science educators and industry stakeholders on the extent to which linkages between agricultural science education and agricultural industries enhance sustainable entrepreneurial development in Nigeria.

Review of Related Literature

Theoretical Framework

Diffusion of Innovations Theory

Everett M. Rogers created the Diffusion of Innovations Theory in 1962 to describe how people and organizations learn about, adopt, and eventually utilize new concepts, technologies, and ways of doing things. According to this theory, individuals don't just accept an innovation the moment it's presented to them. They first determine whether it is valuable, appropriate for their needs, simple to use, and likely to yield superior outcomes to what they are currently acquainted with. Rogers identified five primary determinants of an innovation's acceptance: relative advantage, compatibility, complexity, trialability, and observability. Relative advantage describes the benefits individuals think they may achieve by using a new thing rather than an established approach. How well innovation aligns with people's needs, experiences, and current behaviors is a matter of compatibility. How easy or difficult it is to comprehend and apply the new concept is described by its complexity. Observability is the ability to plainly perceive the benefits and results of an innovation,

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while trialability is the chance to test it out before committing it. The theory is pertinent to this study since agricultural science education introduces pupils to new agricultural methods, technologies, ideas, and business practices. Students can assess the value of these innovations and determine how they might be used to enhance agricultural production or start new enterprises after learning about them. This renders the hypothesis beneficial in explaining why agricultural education ought to be intimately linked with the agricultural sector.

Students might get the opportunity to observe and utilize modern agricultural technologies through activities like internships, industrial attachments, fieldwork, practical demonstrations, and visits to agricultural businesses. These encounters can facilitate students' understanding of novel concepts and inspire them to utilize them in their future professional lives. Students are more likely to grow confident using new technology if they can experience its advantages, test it out for themselves, and get the appropriate assistance. Furthermore, the theory helps to clarify how innovative agricultural concepts might transition from academic settings and research facilities into concrete commercial and agricultural endeavors. New technologies may be evaluated, enhanced, and adopted more readily when students, researchers, farmers, entrepreneurs, and agricultural businesses cooperate. This can help the agricultural industry in Nigeria grow sustainably and support the creation of new agricultural products, services, and businesses.

Concept of Agricultural Science Education

Agricultural science education helps students gain the knowledge and practical skills needed to work in agriculture, agribusiness, and other related fields. It combines classroom learning with practical activities such as crop and livestock production, fisheries, farm management, agricultural economics, extension services, and agro-processing. In Nigeria, this form of education is important because it can prepare young people for employment as well as self-employment by helping them recognize and take advantage of opportunities in the agricultural sector. As the agricultural sector continues to change, the skills required from agricultural graduates are also changing. Knowledge of farming alone is no longer sufficient. Students also need to develop skills in areas such as business management, technology, innovation, communication, and problem-solving. Osagiede and Alordiah (2025) emphasized the importance of practical and experiential learning in helping

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students develop skills that can be applied to the challenges of modern agriculture. For this reason, agricultural education should provide learners with opportunities to gain hands-on experience and apply classroom knowledge to real agricultural situations. Agricultural science education can also help reduce unemployment by encouraging students to view agriculture as a business opportunity rather than only as farming. Students can explore areas such as agro-processing, agricultural marketing, farm input supply, livestock production, fisheries, aquaculture, consultancy, and agricultural technology. By gaining skills in these areas, graduates can create businesses, generate income, and contribute to the growth and sustainable development of Nigeria's agricultural sector.

Concept of Innovation in Agriculture

Students may acquire the knowledge and practical abilities necessary to pursue careers in agriculture, agribusiness, and other disciplines through agricultural science instruction. It integrates classroom instruction with hands-on activities such as crop and animal production, fisheries, farm management, agricultural economics, extension, and agro-processing. This kind of education is essential in Nigeria since it may equip young people for employment and self-employment by assisting them in identifying possibilities in the agricultural sector. The skills that graduate from agricultural programs are expected to possess are evolving along with agriculture itself. Only possessing agricultural understanding is insufficient. Additionally, students must possess talents in business administration, technology, innovation, communication, and problem-solving. Osagiede and Alordiah (2025) highlighted the value of practical and hands-on learning in assisting students in acquiring skills that may be used in actual agricultural scenarios. As a result, rather than focusing mostly on classroom theory, agricultural education should provide students with opportunities to learn through practice. By assisting students in recognizing that agriculture is more than just farming, agricultural science instruction may also help lower unemployment. Agro-processing, agricultural marketing, input supply, livestock production, fisheries, aquaculture, consultancy, and agricultural technology are just a few of the many areas where there are opportunities. Agricultural education can provide students with practical skills, help them create enterprises, make a living, and contribute to the growth of Nigeria's agricultural sector by exposing them to these fields.

 DOI: *10.5281/zenodo.23635745*

Concept of Agricultural Industry

There are several operations in the agricultural sector that are related to the creation, handling, moving, selling, and consumption of farm products. It encompasses subjects like crop and livestock farming, fisheries, aquaculture, agro-processing, providing farm inputs, storage, transportation, marketing, and different agricultural services. Additionally, it gives students a chance to apply the knowledge and abilities they acquire in agricultural science education. Students may learn about the realities of agribusiness and farming through experience in the agricultural industry. Students can acquire knowledge of contemporary production methods, technology, business practices, quality standards, and market requirements via practical training, fieldwork, internships, and engagement with agricultural firms. The relevance of technology-based and practical teaching methods in preparing agricultural students to meet the industry's evolving demands was highlighted by Alordiah, Okoh, and Osagiede (2024). Sassi and Mshenga (2024) discovered that strengthening university-industry collaboration may improve students' employability, promote innovation, facilitate technology transfer, and make agricultural education more relevant to industrial demands. Therefore, increased collaboration between agricultural businesses and educational institutions is essential. Students can have the chance to participate in internships, field trips, industrial attachment, mentoring, practical research, and apprenticeships through such agreements. Additionally, they can help schools understand the skills and knowledge that employers currently need, enabling agricultural education programs to better prepare students for employment, entrepreneurship, and other opportunities in the agricultural sector.

Agricultural Science Education and Entrepreneurial Development

Entrepreneurial development involves acquiring the knowledge, skills, attitudes and competencies required to identify opportunities, establish businesses, manage resources and sustain profitable enterprises. In agriculture, entrepreneurship involves transforming agricultural resources, knowledge and innovations into economically viable businesses. Agricultural science education can promote entrepreneurship by providing learners with technical agricultural knowledge as well as business and management competencies. Students who understand agricultural production, marketing, financial management, value addition and business planning are better positioned to identify opportunities within

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agricultural value chains. Abasilim, Onyewuchi and Inya (2025) reported that agricultural education contributes to the development of an agripreneurial mindset among agricultural science students. Their findings also highlighted practical training and access to start-up capital as important factors affecting entrepreneurial development. This suggests that agricultural education programmes should combine classroom instruction with practical enterprise development and opportunities for students to develop and test business ideas.

Innovation and Sustainable Agricultural Enterprise Development

Sustainable entrepreneurial development involves creating enterprises that can remain economically viable while contributing positively to society and protecting environmental resources. In agriculture, sustainability is important because agricultural activities depend heavily on land, water, biodiversity and other natural resources. Innovation can contribute to sustainable enterprise development by introducing production methods that reduce waste, improve resource efficiency and increase productivity. Examples include climate-smart agriculture, renewable energy, precision agriculture, improved irrigation, recycling of agricultural waste and value addition. Innovative agricultural enterprises can also create employment and generate income in rural communities. For example, agricultural graduates can establish businesses in food processing, livestock production, fish farming, agricultural input distribution, farm mechanization and digital agricultural services. These enterprises can contribute to local economic development while improving the availability of food and agricultural products.

Linkage Between Agricultural Science Education and Industry

The linkage between agricultural science education and industry refers to collaboration between educational institutions and agricultural businesses, organizations and professionals for the purpose of improving education, training, research and enterprise development. Such linkages are important because they help bridge the gap between academic knowledge and workplace requirements. Chfadi, Abdulkader and Chirinda (2025) examined university-industry collaboration and agri-entrepreneurship education in African contexts and emphasized the importance of practical learning, entrepreneurship incubation and industry participation. Their findings suggest that students benefit when educational institutions establish stronger relationships with agricultural businesses and

 DOI: *10.5281/zenodo.23635745*

other stakeholders. Industry linkage can take different forms, including industrial attachment, internships, mentorship, joint research, guest lectures, field demonstrations, entrepreneurship incubation and collaborative curriculum development. Through these activities, students can acquire practical skills and develop a better understanding of the realities of agricultural enterprises.

Agricultural Innovation and Industry Collaboration

Innovation is more likely to become commercially useful when educational institutions collaborate with industry. Universities and colleges often possess research capacity and human resources, while agricultural industries possess practical experience, market knowledge and commercialization opportunities. Collaboration between the two can facilitate the transformation of agricultural research into useful products and services. Educational institutions can develop agricultural innovations through research projects and student activities, while industry partners can provide opportunities for testing, production, commercialization and marketing. Such collaboration can also expose students to real-world problems that require innovative solutions.

Chfadi, Abdulkader and Chirinda (2025) emphasized that innovation and entrepreneurship education can be strengthened through partnerships involving universities, industry, government and other stakeholders. Such partnerships provide an environment where agricultural learners can develop entrepreneurial ideas and acquire practical experience.

Agricultural Science Education and Sustainable Entrepreneurship

Sustainable entrepreneurship in agriculture requires the ability to balance profitability with social and environmental responsibilities. Agricultural education can promote this by incorporating sustainability principles into teaching and practical activities. Learners can be trained to establish enterprises that minimize waste, conserve resources and contribute to community development. For example, agricultural science students can be encouraged to develop enterprises based on organic production, agricultural waste recycling, renewable energy, food processing and climate-smart farming. Such activities can generate income while contributing to environmental sustainability. The integration of entrepreneurship into agricultural education can therefore change learners' perception of agriculture from a subsistence activity to a modern commercial sector with diverse opportunities. It can also

 DOI: *10.5281/zenodo.23635745*

encourage graduates to become job creators rather than relying solely on formal employment. Despite the potential benefits, several challenges may limit effective linkage among agricultural science education, innovation and industry in Nigeria. These include inadequate funding, poor infrastructure, limited access to modern agricultural equipment, weak industry partnerships, insufficient practical training and limited opportunities for students to participate in agricultural enterprises. Another major challenge is inadequate access to finance. Students and graduates may have innovative agricultural business ideas but lack the capital required to establish and sustain them. Abasilim, Onyewuchi and Inya (2025) identified inadequate start-up capital and limited practical training as barriers to agripreneurial development. There may also be inadequate coordination among educational institutions, government agencies, agricultural industries and research organizations. Where collaboration is weak, innovations developed within educational institutions may not reach the market, while industry needs may not be adequately reflected in agricultural education curricula.

Review of Empirical Studies

The use of social-media-based smart farming technologies by extension agents in South-South Nigeria was studied by Asanwana and Uloh (2025). Whats App, YouTube, and Facebook were among the digital platforms that were effective for spreading agricultural innovation, according to their research. The research is significant because it illustrates how technology can enhance farmer-agricultural expert communication and knowledge transfer. In Nigeria, agricultural education and agripreneurial attitudes among agricultural science students were studied by Inya, Onyewuchi, and Abasilim (2025). Their findings demonstrated that agricultural education has the potential to foster entrepreneurial orientation in students, despite the persistent problems of insufficient start-up money and practical instruction. Practical and enterprise-based learning should be reinforced, according to the study. Youth participation in agribusiness and agricultural science education in Nigeria was examined by Daniel and Yaro (2025). Their discoveries underscored the significance of agricultural education in fostering entrepreneurial talents and drawing young people into agribusiness. The study highlights how crucial it is to link agricultural education with business prospects.

 DOI: *10.5281/zenodo.23635745*

Abdulkader and Chirinda (2025) reviewed agri-entrepreneurship education and university-industry collaboration in Africa. They highlighted entrepreneurship incubation, practical education, industry engagement, and institutional assistance in their findings. The study is particularly important since it shows that improved university-industry relationships may enhance agricultural entrepreneurship training. The relationship between agricultural education and the development of an agripreneurial mindset among agricultural science students in Nigeria was examined by Onyewuchi, Abasilim, and Inya in 2025. The researchers used a correlational study design to find out if there was a link between students' engagement in agricultural education and their interest in and tendency to become entrepreneurs. From the study institutions' agricultural science students, who made up the target population, the subjects for the research were chosen. The researchers were particularly interested in how much agricultural instruction might inspire students to develop entrepreneurial mindsets, the significance of genuine agricultural experiences, and the impediments that might prevent students from starting agricultural businesses. Agricultural instruction was found to have a positive impact on agripreneurial orientation. However, the main concerns mentioned were the absence of enough real-world experience and the difficulties in obtaining funding to launch businesses. The study is relevant to current research because it shows how agricultural education can help pupils get ready for business. In contrast to the earlier study's primary emphasis on students' agripreneurial mindset, the present study takes a more expansive approach by examining the potential synergy between agricultural science education, innovation, and industry to foster sustainable entrepreneurial advancement.

The factors influencing the usage of technology and agribusiness entrepreneurship in Nigeria were examined by Ikuemonisan and Coauthors (2024). The researchers used a quantitative research methodology to evaluate the relationship among technology adoption, agricultural entrepreneurship, and sustainable agribusiness growth. The study focused on stakeholders in agriculture and agribusiness. The researchers examined several aspects affecting the growth and development of agricultural businesses, with a focus on education, infrastructure, money, and access to technology. The lack of suitable infrastructure, finance, schooling, and the use of the right technology, according to the study, may impede sustainable agribusinesses. As a result, the researchers placed a strong emphasis on greater human capital development, better infrastructure, access to funds, and

 DOI: *10.5281/zenodo.23635745*

more institutional support for agricultural entrepreneurs. The report is beneficial to the current study because it highlights some of the issues that could make it difficult for agricultural graduates and entrepreneurs to transform their knowledge and inventive ideas into successful businesses. This study expands on this point by exploring how sustainable business growth may be encouraged by improved connections between agricultural education and industry, as well as innovation. Lamidi and Animashaun (2025) looked at how modern agricultural and instructional technology affected agricultural education. According to their results, technology-based learning has the potential to give students important skills and better prepare them for modern agricultural jobs. In addition, they underlined how critical it is to teach and retrain students and teachers on how to utilize contemporary technologies.

Methodology

The study adopted a descriptive survey of research design. The study was carried out in Delta North Senatorial District of Delta State, Nigeria. Delta North is one of the three senatorial districts in Delta State and comprises nine Local Government Areas, namely Aniocha North, Aniocha South, Ika Northeast, Ika South, Ndokwa East, Ndokwa West, Oshimili North, Oshimili South and Ukwuani. The population of the study comprised 1,200 agricultural stakeholders in Delta North Senatorial District of Delta State, Nigeria. The respondents included agricultural science educators, agricultural science students, and agricultural industry stakeholders across the nine Local Government. The sample for the study consisted of 300 respondents selected from a total population of 1,200 agricultural stakeholders in Delta North Senatorial District of Delta State, Nigeria. Fiften (15) item questionnaire was use as instrument for data collection using four 4point Likert scale of strongly agree SA =4, Agree A= 3, Disagree D=2 and strongly disagree SD=1. A reliability coefficient of 0.87using the Cronbach Alpha method. Data collected was analyzed with mean and standard deviation to answer the research question using SPSS, while t-test was used to test the hypotheses at 0.05 level of significance.

Data Analyses

Research Question One

To what extent does agricultural science education provide learners with the knowledge and practical skills required for sustainable entrepreneurial development in Nigeria?

 DOI: *10.5281/zenodo.23635745*

Table 1 showing mean score of respondents on extent agricultural science education provides learners with the knowledge and practical skills required for sustainable entrepreneurial development

S/N	Items	$\bar{X}$	SD	Decision
1	Agricultural science education provides learners with practical skills for establishing agricultural enterprises.	3.21	0.78	High Extent
2	Agricultural science education equips learners with knowledge of modern agricultural production techniques.	3.28	0.72	High Extent
3	Agricultural science education develops learners' ability to identify agricultural business opportunities.	3.14	0.83	High Extent
4	Practical farm activities help learners develop skills needed for agricultural entrepreneurship.	3.25	0.76	High Extent
5	Agricultural science education encourages learners to develop innovative ideas for agricultural enterprises.	3.08	0.86	High Extent
Grand Mean		**3.19**	**0.79**	**High Extent**

The findings indicate that agricultural science education helps students gain the knowledge and practical skills needed for sustainable entrepreneurship. All five items assessed were rated at a high level, showing that the respondents generally had a positive view of its contribution. The grand meaning of 3.19 also shows that agricultural science education helps students develop practical skills, understand modern farming methods, identify business opportunities, and build the confidence to apply new ideas in agriculture.

Research Question Two

To what extent does innovation contribute to the development of sustainable agricultural enterprises among agricultural science education students in Nigeria?

Table 2 showing mean score of respondents onextent innovation contribute to the development of sustainable agricultural enterprises among agricultural science education students

S/N	Items	$\bar{X}$	SD	Decision
1	Innovation enables agricultural science education learners and graduates to develop new agricultural products and services.	3.18	0.81	High Extent
2	Innovation improves learners' and graduates' ability to adopt modern technologies in agricultural enterprises.	3.24	0.76	High Extent
3	Innovative agricultural practices help learners and graduates improve productivity and reduce production costs.	3.12	0.84	High Extent
4	Innovation encourages agricultural science education learners and graduates to identify new business opportunities in agriculture.	3.20	0.79	High Extent
5	Innovation contributes to the long-term sustainability and competitiveness of agricultural enterprises.	3.27	0.73	High Extent
Grand Mean		**3.20**	**0.79**	**High Extent**

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The data reveals that innovation is crucial to the establishment of sustainable agricultural businesses, to a significant degree. Every one of the five elements was rated as having a high degree of effect by the respondents, suggesting that they had a largely favorable opinion of the impact of innovation. A grand meaning of 3. 20 suggests that creativity may enable learners and graduates to come up with fresh agricultural goods and services, use cutting-edge technology, increase farm productivity, identify new business possibilities, and run sustainable agricultural enterprises in Nigeria.

Research Question Three

To what extent do linkages between agricultural science education and agricultural industries enhance sustainable entrepreneurial development in Nigeria?

Table 2 showing mean score of respondents onlinkages between agricultural science education and agricultural industries enhance sustainable entrepreneurial development (n=300)

S/N	Items	$\bar{X}$	SD	Decision
1	Collaboration between agricultural science education institutions and industries provides learners with practical entrepreneurial experience.	3.26	0.75	High Extent
2	Industrial attachment and internship programmes improve learners' readiness to establish agricultural enterprises.	3.31	0.71	High Extent
3	Partnerships between agricultural institutions and industries expose learners to current agricultural technologies and innovations.	3.34	0.69	High Extent
4	Linkages with agricultural industries provide learners and graduates with opportunities for mentorship, networking and business development.	3.18	0.82	High Extent
5	Collaboration between agricultural education and industry enhances employment and sustainable entrepreneurship among graduates.	3.23	0.77	High Extent
Grand Mean		**3.26**	**0.75**	**High Extent**

The findings show that strong cooperation between agricultural education and industry can help promote entrepreneurship. Industry partnerships give students practical experience, exposure to modern technology, mentorship, and useful professional connections. With a grand mean of 3.26, the results suggest that closer collaboration can better prepare graduates for employment and help them develop the skills needed to start and manage sustainable agricultural businesses in Nigeria.

Test of Hypothesis One

H_{o1}: There is no significant difference between agricultural science educators and industry stakeholders on the extent to which agricultural science education provides learners with the knowledge and practical skills required for sustainable entrepreneurial development in Nigeria.

 DOI: *10.5281/zenodo.23635745*

Table 4 showing t-test on difference between agricultural science educators and industry stakeholders to the extent to which agricultural science education provides learners with the knowledge and practical skills required for sustainable entrepreneurial development

Group	N	$\bar{X}$	SD	df	t-cal.	t-crit	Level of sign	Decision
Agricultural Educators	90	3.24	0.48	298	1.04	1.96	0.05	Not Significant
Industry stakeholders	210	3.18	0.52					

The findings show that students and instructors share similar views on the contribution of agricultural science education to sustainable entrepreneurship. Since the calculated t-value is lower than the critical value of 1.96, the null hypothesis is retained, indicating no significant difference between their opinions.

Test of Hypothesis Two

H_{02}: There is no significant difference between agricultural science educators and industry stakeholders to the extent to which innovation contributes to the development of sustainable agricultural enterprises among agricultural science education students in Nigeria.

Table 5 showing t-test on difference between agricultural science educators and industry stakeholders on the extent to which innovation contributes to the development of sustainable agricultural enterprises among agricultural science education students

Group	N	$\bar{X}$	SD	df	t-cal.	t-crit	Level of sign	Decision
Agricultural Educators	90	3.22	0.49	298	0.87	1.96	0.05	Not Significant
Industry Stakeholders	210	3.19	0.51					

The findings show that both agricultural science educators and students have similar opinions about the importance of innovation in promoting sustainable agricultural businesses. Since the calculated t-value of 0.87 is lower than the critical value of 1.96, the null hypothesis is retained. This means that there is no significant difference between the views of the two groups. Both students and educators agree that innovation can help agricultural businesses grow, perform better, and remain sustainable over time.

Test of Hypothesis Three

H_{03}: There is no significant difference between agricultural science educators and industry stakeholders on the extent to which linkages between agricultural science education and agricultural industries enhance sustainable entrepreneurial development in Nigeria.

 DOI: *10.5281/zenodo.23635745*

Table 6 showing t-test on difference between agricultural science educators and industry stakeholders on the extent to which linkages between agricultural science education and agricultural industries enhance sustainable entrepreneurial development

Group	N	$\bar{X}$	SD	df	t-cal.	t-crit	Level of sign	Decision
Agricultural Educators	90	3.29	0.46	298	1.12	1.96	0.05	Not Significant
Industry Stakeholders	210	3.24	0.50					
Total	**300**							

The findings show that students and instructors share similar views on the need for stronger partnerships between agricultural institutions and industries. Since the calculated t-value of 1.12 is below 1.96, the null hypothesis is retained, indicating no significant difference in their opinions. Both groups agree that closer industry collaboration can help students and graduates gain the practical skills needed for sustainable agricultural entrepreneurship in Nigeria.

Discussion of Findings

Extent Agricultural Science Education Provide Learners with the Knowledge and Practical Skills Required for Sustainable Entrepreneurial Development

The findings in Table 1 indicate that agricultural science education helps students gain the knowledge, practical skills, and confidence needed to engage in entrepreneurship. This means that learning agriculture should not be limited to classroom lessons. Students also need practical opportunities to apply what they learn in areas such as farming, farm management, marketing, and other agricultural activities. This supports Bassey, Ani, Ogbonna, and Mgbemena (2025), who stressed the importance of production skills and practical training in preparing agricultural education graduates for self-employment. Practical experience can also help students identify business opportunities in different parts of the agricultural value chain, such as production, processing, storage, marketing, and value addition. Abdulkader, Chifadi, and Chirinda (2025) emphasized that practical training, incubation, and industry exposure can help students prepare for agricultural entrepreneurship. Sassi and Mshenga (2025) similarly noted that internships, mentorship, and partnerships with industry can give students valuable experience and a better understanding of workplace expectations. Overall, the findings suggest that agricultural science education is more effective when classroom learning is combined with practical training, innovation, entrepreneurship, and industry experience. These approaches can help students develop useful business ideas, adapt to changes, make better decisions, and gain the confidence needed to start and manage sustainable agricultural businesses in Nigeria.

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Extent innovation Contribute to the Development of Sustainable Agricultural Enterprises among Agricultural Science Education Students in Nigeria

The findings in Table 2 show that innovation is important for developing sustainable agricultural businesses. It can help students and graduates use modern technology, improve productivity, reduce costs, and create new products and services. Innovation also helps them identify business opportunities in areas such as agro-processing, value addition, marketing, and production. Overall, the findings suggest that agricultural science education should give students more opportunities to develop creative ideas, gain practical experience, and acquire technological skills that can help them build successful and sustainable agricultural businesses.

Linkages Between Agricultural Science Education and Agricultural Industries Enhance Sustainable Entrepreneurial Development in Nigeria

The data in Table 3 indicates that close collaboration between agricultural education and the agricultural sector may improve students' practical and entrepreneurial abilities. Students may gain practical experience and learn about agricultural company management through fieldwork, internships, industrial training, and engagement with agricultural businesses. In 2025, Adeyemi and Akinyemi emphasized the significance of hands-on experience in fostering entrepreneurial skills among students. Additionally, the results demonstrate that students can gain mentorship, networking opportunities, and an understanding of modern agricultural methods through industry exposure. While Okafor and Eze (2025) highlighted the importance of stronger ties between education and industry in helping graduates develop skills that match labor-market demands, Adebayo and Ogunniyi (2025) emphasized the significance of mentorship and industry experience. Overall, increased cooperation may better prepare Nigerian graduates and students to launch and operate sustainable farming ventures.

Conclusions

According to the study, innovation, agricultural science education, and solid industry relationships are crucial for fostering sustainable entrepreneurship in Nigeria. Innovation encourages students to use new technologies and improve existing farming practices, while agricultural education helps them acquire the information, practical skills, and confidence

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necessary to recognize and pursue business opportunities. Additionally, the research reveals that mentorship, industrial training, internships, and interaction with agricultural enterprises offer kids invaluable real-world experience outside of the classroom. To put it another way, if education, innovation, and industry exposure are all brought together, graduates will be better prepared to be found profitable agricultural enterprises, create jobs, raise living standards, and advance Nigeria's agriculture.

Recommendations

i. Practical training should be strengthened in agricultural science education to help learners acquire the skills needed to establish and manage agricultural enterprises.

ii. Innovation and entrepreneurship should be emphasized by encouraging learners to use modern technologies, develop creative ideas and identify agricultural business opportunities.

iii. Education–industry partnerships should be improved through internships, industrial attachments, mentorship and other practical experiences.

iv. Adequate teaching and learning resources should be provided by government and educational authorities, including modern equipment, farm facilities and digital technologies.

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