ENTREPRENEURSHIP INCLUSIVE SKILLS REQUIRED IN AGRICULTURAL SOFTWARE DEVELOPMENT FOR SUSTAINABLE AGRICULTURAL WORKFORCE IN CROSS RIVER STATE, NIGERIA

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Abstract

The purpose of the study was to determine entrepreneurship inclusive skills required in agricultural software development for sustainable workforce in Cross River State, Nigeria. Three research questions were posed and two hypotheses were formulated to guide the study. Survey research design was adopted for the study. The population of the study was 200 consisting computer software experts. Random sampling technique was used for the study. A total of 120 subjects were involved in the study. A researcher structured questionnaire was the instrument used for data collection. The validation of the instrument duly carried out by computer education lecturers from University of Uyo. Mean, standard deviation and population t-test were the statistical tools used for data analysis. The findings revealed that the following inclusive skills: communication, empathy, and cultural awareness were significantly required in agricultural software development. The findings also revealed that entrepreneurship in software development for soil analysis, irrigation management, livestock management, and crop management were significantly required by agricultural education graduates for sustainable Agricultural workforce in Cross River State, Nigeria. Based on the findings of the study, it was recommended among others that entrepreneurship training on software development and sales of Apps should be introduced into entrepreneurship programmes of Colleges of Education and Universities in Cross River State, Nigeria.

Key Words: Inclusive Skills, Entrepreneurship, Agricultural software, Sustainable agriculture

Introduction

A growing body of evidence captures successful approaches for upgrading youth skills across all contexts and sectors, with some covering rural areas and the agriculture sector. Investing in youth skills development pays off with positive impacts, particularly on employment and earnings outcomes. Effective youth skills development programs have several common features: They offer multiple pathways for learning and employment, focus on employer and market demand for skills, use applied learning methods, and offer follow-on services and supports that link youth with tangible employment or self-employment.

For agriculture specifically, entrepreneurial skills transfer effectively occurs in work-based learning venues such as schools, on-site employer-based training, internships, volunteer opportunities, and co-curricular youth organizations. Inclusive and soft skills such as social skills, positive self-concept, self-control, communication skills and higher-order thinking are as important to success in the workplace as technical or agricultural-specific skills, including in the agriculture sector where ever-changing global demands require flexibility and adaptation. Even though a skill might be developed in an agriculture or workforce setting, evidence shows that youth apply many of these skills e.g., problem solving, planning ahead, and negotiations in other aspects of their life, including conflict mitigation and health and nutrition (FAO, 2001)

Inclusive skills refer to the skills that are necessary to work effectively with people from diverse backgrounds. These skills include communication, empathy, and cultural awareness. They are important for creating an inclusive workplace where everyone feels valued and respected. Inclusive skills required in agricultural software development include among others, communication skills as developers need to be

able to communicate effectively with people from diverse backgrounds; empathy, as developers need to be able to understand the needs of farmers and other stakeholders; and cultural awareness since developers need to be aware of cultural differences that may impact the design and implementation of software.

Entrepreneurship is the ability and readiness to develop, organize and run a business enterprise, along with any of its uncertainties in order to make a profit. It is the act of creating a business or businesses while bearing all the risks with the hope of making a profit. At its most basic level, entrepreneurship refers to an individual or a small group of partners who strike out on an original path to create a new business. An aspiring entrepreneur actively seeks a particular business venture and it is the entrepreneur who assumes the greatest amount of risk associated with the project. A successful agricultural entrepreneur should be able to identify a need in the agricultural industry, develop a business plan, secure funding for the business, develop products or services, test the product or service with potential customers, launch the business and start marketing the products or services.

Agricultural education entrepreneurship is the process of creating and managing a business in the agricultural sector. It involves identifying opportunities in the agricultural industry and developing innovative solutions to meet the needs of farmers and consumers. Agricultural education entrepreneurship can help in creating employment and help farmers to increase their income by providing them with new skills and knowledge to improve their farming practices. Agricultural education entrepreneurship can be applied in various areas in agricultural sector such as farming and agriculture technology, agricultural marketing and sales, agricultural consulting and advisory services, and agricultural education and training. Agricultural education and training activities include providing training on new farming techniques and technologies, providing education on agricultural business management, providing education on agricultural marketing and sales, and providing education on agricultural policy and regulations. Agricultural education entrepreneurship could focus on providing training and education on sustainable farming practices, developing and selling agricultural products such as fertilizers, pesticides, and seeds, providing consulting services to farmers on business management and marketing, and developing and selling agricultural software and apps.

According to the Food and Agriculture Organization of the United Nations (FAO) (2000), digital agriculture is the integration of digital technologies into agriculture to improve production, efficiency, and sustainability. It involves using data, artificial intelligence, sensing, communications, and computing to help farmers and other stakeholders make better decisions and manage resources. It can also streamline data collection and analysis, enhance predictive capabilities, and increase labor productivity. Digital agriculture is a new and emerging field that has various applications, such as monitoring crop and animal health, mapping fields, and applying fertilizers. Agricultural software and apps are computer programs designed to help farmers manage their farms more efficiently. They can help farmers with tasks such as crop management, soil analysis irrigation management and livestock management. Agricultural software refers to software that is designed to help farmers manage their farms more efficiently. This can include software for soil analysis, irrigation management, livestock management, and more. some examples of agricultural software include among others FarmLogs, Agworld,Climate FieldView,Granular,Agrocares, SoilWeb,Soil Health Tool, CropX, Hortau, AquaSpy, CattleMax, AgriWeb, and HerdWatch.

Entrepreneurial skills are essential in the sales of agricultural software and apps. According to the Food and Agriculture Organization of the United Nations (FAO) (2000), agricultural entrepreneurship is the process of creating or seizing an opportunity to introduce new products or services in agriculture and turning it into a profitable business venture. Farmers who have entrepreneurial skills can identify market opportunities, develop innovative products, and create value for their customers. They can also leverage digital technologies to improve their business operations and reach new markets. Some of the entrepreneurial skills that are important for sales of agricultural software and apps include creativity, innovation, risk-taking, problem-solving, communication, marketing, and financial management.

Agricultural-based entrepreneurs are enriched with the competences of creativity, innovation and risk taking as well as the ability to plan, and manage resources in order to achieve target objectives. Agricultural entrepreneurship values are imperative for agricultural, economic, and social development as well as food security. However, there seems to be dearth of inclusive skills and agricultural entrepreneurship values in digital agriculture among graduates of agricultural education in Nigeria. This study was designed to determine inclusive skills and entrepreneurship required

in agricultural software development for sustainable agricultural workforce in Cross River State, Nigeria.

Purpose of the Study

The purpose of the study was to determine entrepreneurship inclusive skills required in agricultural software development for sustainable workforce in Cross River State, Nigeria. The objectives of the study were:

1. To determine the inclusive skills required by agricultural education graduates in agricultural software development in Cross River State, Nigeria.
2. To find out whether agricultural education graduates require entrepreneurial skills in the development of agricultural software for the management of soil, irrigation system, crop and livestock in Cross River State, Nigeria.
3. To find out whether agricultural education graduates require entrepreneurial skills for the sale of agricultural software and APPs in Cross River State, Nigeria.

Research Questions

The following questions guided study:

1) What are the inclusive skills required in agricultural software development for sustainable Agricultural workforce in Cross River State, Nigeria.
2) To what extent do agricultural education graduates require entrepreneurship in the development of agricultural software for the management of soil, irrigation system, crop and livestock in Cross River State, Nigeria.
3) To what extent do agricultural education graduates require entrepreneurial skills in the sales of agricultural software and APPs in Cross River State, Nigeria.

Research Hypotheses

The following null hypothesis guided study:

1. The extent to which agricultural education graduates require entrepreneurship in the development of agricultural software for the management of soil, irrigation system, crop and livestock in Cross River State, Nigeria is significantly low.
2. The extent to which agricultural education graduates require entrepreneurship in the sales of agricultural software and APPs in Cross River State, Nigeria is significantly low.

Methodology

Survey research design was adopted for the study. The population of the study was 200 consisting of all Agricultural education-based entrepreneurs selected from the three agro-ecological zones of Cross River State. Random sampling technique was used to select 120 respondents involved in for the study The researcher-designed instrument titled: Inclusive Skills and Entrepreneurship Required in Agricultural Software Development (ISERASD) was used to collect relevant data for the study. The validity of the instrument was duly carried out. The reliability estimate yielded a coefficient of 0.78, an indication that the instrument was reliable. Mean, standard deviation and population t-test were the statistical tools used for data analysis.

Results

The results of the analysis obtained were as presented below:

Research Question 1: What are the inclusive skills required in agricultural software development for sustainable Agricultural workforce in Cross River State, Nigeria

TABLE 1: Inclusive skills required in agricultural software development for sustainable Agricultural workforce in Cross River State, Nigeria N=120

S/NO.	Inclusive skills	$\overline{x}$	Remark
1	Communication skills	3.4	*
2	Empathy	3.0	*
3	Cultural awareness	3.2	*
4	Self- acquaintance	2.9	*
5	Listening,	3.8	*
6	Collaboration	3.6	*
7	Adaptability	3.4	*
8	Patience.	2.8	*
9	Exchange of best practices	3.1	*

* Required; * Not Required

Result in Table1 presents the mean score of respondents on the inclusive skills required in agricultural software development for sustainable Agricultural workforce in Cross River State. All the items recorded a mean score above 2.5, the cut-off point. This indicated that all the underscored inclusive skills are required in agricultural software development for sustainable Agricultural workforce in Cross River State, Nigeria

Research Question 2: To what extent do agricultural education graduates require entrepreneurship in the development of agricultural software for the management of soil, irrigation system, crop and livestock in Cross River State, Nigeria.

TABLE 2: Extent to which agricultural education graduates require entrepreneurship in the development of agricultural software for the management of soil, irrigation system, crop and livestock in Cross River State, Nigeria N=120

S/NO.	Agricultural software and Apps	$\overline{x}$	Remark
1	Agworld: A software that helps farmers manage their crops and soil	3.1	*
2	Climate FieldView: A software that helps farmers manage their crops	3.3	*
3	Granular: A software that helps farmers manage their crops and soil	3.5	*
4	FarmLogs,: A software that helps farmers manage their crops and soil	2.8	*
5	AgroCares: A software that helps farmers analyze their soil.	3.2	*
6	SoilWeb: A software that helps farmers analyze their soil	3.2	*
7	Soil Health Tool: A software that helps farmers analyze their soil	3.7	*
8	CropX: A software that helps farmers manage their irrigation.	2.6	*
9	Hortau: A software that helps farmers manage their irrigation.	3.1	*
10	CattleMax: A software that helps farmers manage their livestock.	2.9	*
11	AgriWebb: A software that helps farmers manage their livestock.	3.4	*
12	Herdwatch: A software that helps farmers manage their livestock.	3.0	*

* Required; * Not Required

Result in Table 2 presents the mean score of respondents on the extent to which agricultural education graduates require entrepreneurship in the development of agricultural software for the management of soil, irrigation system, crop and livestock in Cross River State, Nigeria. All the items recorded a mean score above 2.5, the cut-point. This indicated that agricultural education graduates require entrepreneurship in all the underscored items.

Research Question 3: To what extent do agricultural education graduates require entrepreneurial skills in the sales of agricultural software and APPs in Cross River State, Nigeria.

TABLE 3: Mean score on the extent to which agricultural education graduates require entrepreneurship in the sales of agricultural software and APPs in Cross River State, Nigeria N=120

S/NO.	Entrepreneurial skill in sales of agricultural software and Apps	$\overline{x}$	Remark
1	Creativity	3.4	*
2	Innovation	3.0	*
3	Risk taking	3.2	*
4	Problem solving	2.9	*
5	Marketing	3.8	*
6	Financial management	3.6	*

* Required; * Not Required

Result in Table3 presents the mean score of respondents on the extent to which agricultural education graduates require entrepreneurship in the sales of agricultural software and APPs in Cross River State, Nigeria. All the items recorded a mean score above 2.5, the cut off point. This indicated that all the underscored items are required in agricultural software

development for sustainable Agricultural workforce in Cross River State, Nigeria.

Hypothesis 1: The extent to which agricultural education graduates require entrepreneurship in the development of agricultural software for the management of soil, irrigation system, crop and livestock in Cross River State, Nigeria is significantly low.

TABLE 4: Population t-test analysis of the extent to which agricultural education graduates require entrepreneurship in the development of agricultural software for the management of soil, irrigation system, crop and livestock in Cross River State, Nigeria (N=120)

Variables	N	$\overline{x}$	μ	SD	t-cal
Entrepreneurship in the development of agricultural software for the management of soil, irrigation system, crop and livestock	120	2.11	17.5	3.91	4.46

P = 0.05; N = 120; df = 119; t-tab. = 1.96

The result of the analysis presented in Table 4 indicated that the calculated t value of 4.46 was greater than the critical value of 1.96 when tested at 0.05 level of significance with 119 degree of freedom. The result was significant therefore, the null hypothesis was rejected. This implied that agricultural education graduates require entrepreneurial to a significant extent in the development of software for the management of soil and irrigation system in Cross River State, Nigeria

Hypothesis 2: The extent to which agricultural education graduates require entrepreneurship in the sales of agricultural software and APPs in Cross River State, Nigeria is significantly low.

TABLE 5: Population t-test analysis of extent to which agricultural education graduates require entrepreneurship in the sales of agricultural software and APPs in Cross River State, Nigeria

Variables	N	$\overline{x}$	μ	SD	t-cal
Entrepreneurship in the sales of agricultural software and APPs in Cross River State, Nigeria	120	2.31	16.5	2.91	3.45

P = 0.05; N = 120; df = 119; t-tab. = 1.9

The result of the analysis presented in Table 5 showed that the calculated t value of 3.45 was greater than the critical value of 1.96 when tested at 0.05 level of significance with 119 degree of freedom. The result was significant. Therefore, the null hypothesis was rejected. This implied that the extent to which agricultural education graduates require entrepreneurship in the sales of agricultural software and APPs in Cross River State, Nigeria was significantly high.

Discussion of Findings

One of the findings of the study revealed that inclusive skills are required in agricultural software development for sustainable Agricultural workforce in Cross River State. This finding is in consonant with Food and Agriculture Organization (2021) who identified inclusive communication as an essential inclusive skill required in any corporate programme delivery. The author enumerated that inclusive communication means sharing information in a way that everybody can understand. For service providers, it means ensuring that people understand and express themselves in different ways. For people who use services, it means getting information and expressing themselves in ways that meet their needs. Inclusive communication, the author maintained relates to all modes of communication: written information, online information, telephone, face to face etc. Inclusive communication makes services more accessible for everyone and helps to achieve successful outcomes for individuals and the

wider community. Besides, it enables people to live more independently and to participate in public life.

The study also revealed that agricultural education graduates require entrepreneurship in the development of agricultural software for the management of soil, irrigation system, crop and livestock in Cross River State, Nigeria. This finding is in agreement with European Commission, 2013 who maintained that digital entrepreneurship involves the transformation of existing businesses through novel digital technologies and the creation of new innovative enterprises characterized by: the use of digital technologies to improve business operations, the invention of new digital business models and engaging with customers and stakeholders through digital channels. Globally, the author pointed out thee there are an increasing number of initiatives to foster digital entrepreneurial activity related to the creation, and development in the agriculture and food sector. The Food and Agriculture Organization of the United Nations (FAO) (2022) also supported the findings of this study. Digital agriculture according to FAO is the integration of digital technologies into agriculture to improve production, efficiency, and sustainability. It involves using data, artificial intelligence, sensing, communications, and computing to help farmers and other stakeholders make better decisions and manage resources. It can also streamline data collection and analysis, enhance predictive capabilities, and increase labor productivity. Digital agriculture has various applications, such as monitoring crop and animal health, mapping fields, and applying fertilizers.

The findings of the study also confirmed that agricultural education graduates require entrepreneurship in the sales of agricultural software and APPs in Cross River State, Nigeria). This finding is supported by (Cheriet) (2020 who pointed out that entrepreneurship in the sales of agricultural software and apps is a growing field. The author maintained that with the increasing demand for digital agriculture, there is a need for entrepreneurs to develop software and apps that can help farmers manage their farms more efficiently. These software and apps can help farmers monitor factors such as moisture, nutrient trends, and wind patterns of arable land. They can also help farmers access new markets and technologies, improve irrigation systems, and boost crop yields. Some of the key technologies in digital agriculture, the author enumerated, are artificial intelligence/machine learning (AI/ML) algorithms to improve crop yields, control pests, help in soil testing, provide actionable data for farmers and reduce their workload. Blockchain technology offers tamper-proof and accurate data on farms, inventories, instant and secure transactions, and food tracking. Distributed ledger technology (DLT), also known as the blockchain, is a new and innovative way of managing transactions. It is a distributed database that allows secure, transparent, and tamper-proof transactions. Blockchain is increasingly used in digital agriculture to improve transparency, trust, and efficiency.

Conclusion

Agricultural entrepreneurship is an emerging field. It involves analyzing and understanding the strategies of agricultural entrepreneurs, particularly in response to the institutional changes and economic and technological disruptions to which the agricultural industry is subject. Preparation of agricultural education graduates in entrepreneurial skills development programmes have several common imperatives. They offer multiple pathways for learning and employment, focus on employer and market demand for skills, use applied learning methods, and offer follow-on services and supports that link the graduates with tangible employment or self-employment. Entrepreneurial skills development can be given to agricultural education graduates occurs in work-based learning venues such as farmer field schools, on-site employer-based training, internships, volunteer opportunities, and co-curricular youth organizations. Inclusive and soft skills such as social skills, positive self-concept, self-control, communication skills and higher-order thinking are also important to agricultural education graduates in the development and sales of agricultural software and Apps in Cross River State.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. To foster and enhance improved inclusive skill development among agricultural education graduates, inclusive education should be promoted by the Government of Cross River State in tertiary institutions where agricultural education is offered.
2. Entrepreneurial training should be provided by the Government of Cross River State to agricultural education graduates on agricultural software development for the management of soil, irrigation system, crop and livestock
3. Entrepreneurial training should be provided by the Government of Cross River State to agricultural education graduates on the sales of agricultural software and APPs.

References

Alsos, G. A.; Carter, S.; Ljunggren, E, & Welter F, (2011). *The handbook of research on entrepreneurship in agriculture and rural development.* Edward Elgar: Cheltenham

Cheriet, F. (2020). *Agricultural entrepreneurship: Challenges and perspectives*. Downloaded on June 5, 2020 from https://www.cairn.info/revue-de-l-entrepreneuria

European Commission (2013). *Digital Agricultural Skills among Youth Populations*. Brussel: European Commission

Food and Agriculture Organization (2000). Entrepreneurship in agriculture and healthcare: Different entry strategies of care farmers. Rome: FAO

Food and Agriculture Organization (2021). Digital agripreneurial and innovation culture. Rome: FAO