



PRECISION LIVESTOCK FARMING TECHOLOGIES AND ITS

COST ANALYSIS ON POULTRY PRODUCTION IN OYO METROPOLIS, OYO STATE

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Abstract

This study aimed at investigating the impact of precision livestock farming technologies (PLF) on workforce skills and employability in poultry husbandry sector in Oyo metropolis. A sample of twelve (12) farms was selected through simple random sampling techniques from Atiba, Oyo west, Oyo East and Afijio Local Government Areas was used for the study. A questionnaire instrument developed by the researcher was used for data collection on demographic

information, familiarity, training and education, impact on workforce skills and employability, efficiency and

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Precision Livestock Farming, cost analysis, poultry production, Oyo metropolis

productivity and challenges and barriers in adoption of PLF. The findings revealed that mostly male, adults, educated with 5 years of experiences were participated in the study. The farmers were familiars, trained and educated on the uses of PLF periodically and impact PLF was felt of workforce skill with increase in employability

of personal that enhanced efficiency and productivity of the poultry sector. However, challenges and barriers were also documented. Meanwhile, the cost of monthly electricity bills, the cost of importing those equipment used in PLF Technologies, cost of repairing equipment, cost of operating equipment and couple with cost of installation of all the equipment were said to be on the higher side and at long run affect the cost of production. Based on the results, the following recommendations were made: the adoption of PLF should be more for increment in

workforce skill, employability, efficiency and productivity of poultry products. Government can assist in subsidies of the equipment importation, stable stability of electricity to assist the adoption of PLF technologies in this study area.

Introduction

Technology advancements at the supplier and consumer levels are having an impact on agriculture, which is becoming more knowledge-intensive and digitalized (Ehlers et al., 2022). The vast majority of these new technologies come from sources other than agriculture. The creation, diffusion, and implementation of new farm-level technologies, techniques, and regulations, as well as quantitative business models, all have an impact on the adoption of new technologies and have an effect on farm capital and other inputs. For farmers, extension services, agribusiness, and policymakers, adopting technologies for sustainable agricultural systems is a difficult and ever-changing issue because of all these factors. Considering the wide range of objectives related to new technology adaption in the context of livestock farming, it is necessary for farmers, scientists and companies to work together collaboratively.

A vital part of the world's economy and food production is livestock farming. However, inefficiency, resource waste, and a lack of control over animal health and productivity are some of the problems that traditional farming methods frequently confront. Due to these difficulties, PLF was created with the intention of resolving them by utilizing state-of-the-art technologies (Liu et al., 2023).

A new field called Precision Livestock Farming (PLF) is revolutionizing livestock management techniques by fusing scientific discoveries with business considerations. By combining cutting-edge technologies, data analytics, and automated systems with conventional agricultural practices, it empowers farmers to maximize productivity and make well-informed decisions. An outline of PLF's scientific and business elements is given in this introduction, together with information on its importance, its advantages, and the necessity of its implementation in the livestock sector (Berckmans, 2017).

Precision Livestock Farming (PLF), a sustainable farming system concept, refers to agriculture's ongoing ability to improve the general welfare of people and animals by making better use of the information that is accessible on farms. Farmers may therefore produce enough commodities and services in ways that are both economically efficient and socially and environmentally responsible by using information more effectively (Banhazi et al., 2022).

This study is to give farmers, stakeholders, and other pertinent parties useful insights to improve the efficiency of animal husbandry by examining the degree of technology adoption, the driving factors, and its effects on environmental and economic sustainability. It is envisaged that millennial farmers may positively impact the future of environmentally friendly and sustainable agriculture by raising awareness and implementing the right technology. Farmers' socioeconomic characteristics, institutional factors, technology features, use of production facilities, costs, technical implementation of production technology, risk, communication networks, extension agents, and technical efficiency are some of the factors influencing the adoption of new technologies. Each component has varying degrees of effect, which dictates how a technology adoption choice is made (Alahmad et al., 2023).

According to a survey on how consumers view PLF technologies, they anticipate that these technologies would improve farm animals' health and welfare while also improving the environment and bringing more transparency to livestock production (Krampe et al., 2021). However, they also voiced concern that PLF technology may increase livestock farming's

industrialization, that data is susceptible to abuse and cybercrime, and that PLF information might not be properly conveyed to customers. Farmers are de-intensifying their operations in response to public opposition to the industrialization of livestock production, either to comply with government regulations or to profit from increased product prices. Less intensive animal farming, however, uses more land, which a scarce resource is given the world's expanding population and competition from carbon farming to counteract rising emissions.

One of the main factors influencing farmers' adoption of new technologies is cost/benefit considerations (Fernández-Alonso et al., 2023). Calculating this ratio is challenging, though, because work changes are rarely taken into account in addition to technical and financial considerations. The economic worth of the well-being that new technologies provide to farmers is very hard to measure (Finger et al., 2024). The satisfaction that comes from having healthy animals, working in a safe workplace, or enhancing the environmental effects of the farm is difficult to quantify (Vecchio et al., 2022). It is therefore the balance between economic performance and improvement of life quantity which has evaluated to decide whether or not an investment is appropriate other factors need considering since the choice of technology to be adopted can depend on the farm work forces expectation or the financial capacity and life cycle of the operation (Jacob et al., 2018).

Nigeria plays a significant role in food production in West Africa, particularly in the cultivation of cereals, despite challenging natural conditions like a harsh continental climate and limited water resources. This makes the country's agricultural sector intriguing from the perspective of enhancing the agricultural sector through the introduction of smart technologies. Businesses that engage in agricultural production activities with the intention of making a suitable profit while taking into consideration contemporary farming methods are known as smart agricultural enterprises. The Internet of Things, artificial intelligence, satellite data recognition, contemporary technical methods of data collection to improve agricultural production's efficiency, productivity, and sustainability, and technology transfer are some examples of these (Saiz-Rubio & Rovira-Más, 2020).

The majority of agricultural businesses, however, do not have a methodical strategy for handling operational procedures and inventive development in agricultural output. Furthermore, there is a big disconnect between what agribusiness wants and what science and technology in agriculture require. A large portion of the issues that agro-enterprise management resolves in its operations may be resolved by implementing technology transfer, particularly precision farming technologies, into agro-enterprise operations. This enables the production of more agricultural crops, which in turn enables the improvement of agricultural output's profitability.

The broad objective of the study is to determine the impact of Precision Livestock Farming Technologies and its cost analysis on Poultry production in Oyo metropolis of Oyo State and specifically to evaluate the demographic characteristics of those using the PLF technologies, determine the familiarity, training and education on PLF technologies, investigate the impact of PLF technologies on workforce skill and employability, assess the changes in job roles, responsibilities, efficiency and productivity in the uses of PLF technologies and determine the perceptions, attitude, challenges and barriers in using PLF technologies and evaluate the cost involves in operating PLF technologies in the study area.

MATERIALS AND METHODS

The study was conducted on-farm in Oyo metropolis which comprises of Atiba, Oyo west, Oyo East and Afijio local government areas of Oyo State, Nigeria. Oyo lies on the longitudes 3° 57' east of the Greenwich meridian and latitude 7° 5' North of the equator, it is about 55 kilometers north eastwards from Ibadan, the capital of Oyo state. The altitude is between 300 and 600 meters above sea level. The mean annual temperature is about 27°C while that of rainfall is 1165mm. The vegetation of the area is Guinea savanna zone (Amao & Ogunjinmi, 2023).

A total of twelve (12) farms from the local government areas, comprises of three farms from each local government due to very limited number of farms that involved in precision livestock farming technologies were visited in this study area. On-farm visit was paid to these farms, and each farm was visited

thrice. One hundred and twenty structural questionnaires were randomly distributed and used in collecting data on impact of precision livestock farming technologies on workforce skills and employability. The questionnaire has six sections. Section A was designed to shows the demographic structure of the respondent, Section B displays some items such as familiarity, training and education. Section C was evaluated impact of PLF on workforce skills and employability, changes in job roles, responsibilities, efficiency and productivity while Section D was on the perceptions, attitudes, challenges and barriers. The section E described the cost implication of using the PLF technologies. The data generated from this study were subjected to a descriptive statistical analysis that involved the use of statistical tool like frequency distribution, percentage, means and standard deviation with the benchmark for accepting any of the items was 2.50 and items whose mean was below 2.50 were rejected.

Results

Table 1 indicated the demographic information of the users of Precision livestock Farming technologies (PLF). The results revealed that the majorities of those engaged in PLF technologies are male (70.83%) while 29.17% of the respondents are female. The activeness age in the users of PLF technologies are between 26-30 years (55.00%) while those ages of 15-20 years, 21-25 years, 31-35 year and above 35 years were of 16.67%, 16.67%, 45.83% and 8.33% respectively. Most of the PLF users are learner with tertiary education (71.66%) follows by those who had secondary education (28.33%) while primary education level were not found in all the visited farms that operated PLF technologies. The years of experiences in the usage of the PLF technologies indicated that most respondents have been using the PLF technologies above five years (55.83%) follows by those whose has used 2 years (10.33%) in the operation of PLF technologies.

Table 1: The demographic information of the users of PLF

Variables	Frequency	Percentage
Sex		
Male	85	70.83
Female	35	29.17
Age (year)		
15 – 20	20	16.67
21-25	20	16.67
26-30	55	45.83
31-35	15	12.50
>35	10	08.33
Educational Status		
Primary	00	0.00
Secondary	34	28.33
Tertiary	86	71.66
Years of Experience (year)		
< 1	20	16.67
2	13	10.83
3	20	16.67
>5	67	55.83

Source: Fieldwork, 2024

Table 2 revealed the familiarity, training and education of the users of PLF. The results indicated that all the participants agreed that familiarity with PLF technologies was through training, Many of PLF technologies can the operate, First learnt about PLF technologies through training, Formal training on PLF technologies were received before any operation, Quality of training received on PLF technologies were better, Participation on training sessions or workshops related to PLF technologies were often, Training methods find most effectives are hands-on and online courses with the mean values of 3.45, 4.78, 3.51, 3.08, 3.87, 2.99 and 3.56 respectively while the standard deviation ranges between 0.08 to 0.59.

Table 2: The Familiarity, Training and Education of the users of PLF

S/N	Items	Mean	Std. D	Decision
1	Familiarity with PLF technologies was through training	3.45	0.08	Accepted
2	Many of PLF technologies can the operate	4.78	0.11	Accepted
3	First learnt about PLF technologies through training	3.51	0.34	Accepted
4	Formal training on PLF technologies were received before any operation	3.08	0.12	Accepted
5	Quality of training received on PLF technologies were better	3.87	0.23	Accepted
6	Participation on training sessions or workshops related to PLF technologies were often	2.99	0.45	Accepted
7	Training methods find most effectives are hands-on and online courses	3.56	0.59	Accepted

Std. D = Standard Deviation

The impact of PLF on workforce skills and employability is presented in Table 3. The results shows that most of the respondents agreed that the PLF technologies affect the technical skill required in the operations, many skills were learn and improve due to PLF technologies, confidences in using PLF technologies were great on daily bases, changed the way of approaching problem-solving in the farm operation, affected ability to make data-driven decisions, improved IT skills as compared to before the PLF technologies were introduced, had a great impact on the understanding of animal health and welfare, enhanced the ability to monitor and manage poultry production, have increased employability in the poultry industries, increased job opportunities within organization, enhanced demand for employees skilled in the job market, influenced job security positively and will influence future career opportunities.

Table 3: The Impact of PLF on Workforce skills and employability

S/N	Items	Mean	Std. D	Decision
1	Does the PLF technologies affect the technical skill required in the operations	3.89	0.18	Accepted
2	Many skills were learn and improve due to PLF technologies	4.23	0.38	Accepted
3	Confidences in using PLF technologies were great on daily bases	3.89	0.75	Accepted
4	PLF technologies have changed the way of approaching problem-solving in the farm operation	3.11	0.56	Accepted
5	PLF technologies have affected ability to make data-driven decisions	3.87	0.29	Accepted
6	PLF technologies improved IT skills as compared to before the PLF technologies were introduced	3.44	0.90	Accepted
7	PLF technologies had a great impact on the understanding of animal health and welfare	3.77	0.78	Accepted
8	PLF technologies have enhanced the ability to monitor and manage poultry production	3.22	0.71	Accepted
9	PLF technologies have increased employability in the poultry industries	3.50	0.89	Accepted
10	PLF technologies have increased job opportunities within organization	3.78	0.31	Accepted
11	PLF technologies have enhanced demand for employees skilled in the job market	4.09	0.43	Accepted
12	PLF technologies have influenced job security positively	2.67	0.41	Accepted
13	PLF technologies will influence future career opportunities	3.63	0.23	Accepted

Std. D = Standard Deviation

Table 4 shows the job responsibilities, efficiency and productivities of PLF. The results depicted that all the participants accepted the PLF technologies

have changed the daily job responsibilities, led to many skill role shifts within the team, greatly changed the interaction with colleagues, increased the workload with easy operations, enhanced the efficiency at work, increased the overall productivity of the farm, changed the quality of poultry production and the accuracy of the work on the farm.

Table 4: The Job responsibilities, efficiency and productivities of PLF

S/N	Items	Mean	Std. D	Decision
1	PLF technologies have changed the daily job responsibilities	3.88	0.56	Accepted
2	PLF technologies have led to many skill role shifts within the team	4.22	0.52	Accepted
3	PLF technologies have greatly changed the interaction with colleagues	3.08	0.10	Accepted
4	PLF technologies have increased the workload with easy operations	3.56	0.78	Accepted
5	PLF technologies have enhanced the efficiency at work	3.99	0.31	Accepted
6	PLF technologies have increased the overall productivity of the farm	4.86	0.45	Accepted
7	PLF technologies have changed the quality of poultry production	4.36	0.90	Accepted
8	PLF technologies have influenced the accuracy of the work on the farm	4.78	0.55	Accepted

Std. D = Standard Deviation

The perception, attitudes, challenges and barrier of PLF is presented in Table 5. The results revealed that all the participants accepted that good perception of PLF technologies on poultry industry, the PLF technologies have shaped the future of poultry production, greatly potential benefits on career, challenges of PLF technologies such as power and faults were common while using these PLF, shortcomings were overcomes by proper monitoring and

skill maintenance, increased the overall productivity of the farm, uses were superb compared with before introduction of PLF and resources availabilities enhances the using of PLF technologies.

Table 5: The perception, attitudes, challenges and barrier of PLF

S/N	Items	Mean	Std. D	Decision
1	Good perception of PLF technologies on poultry industry	3.71	0.34	Accepted
2	PLF technologies have shaped the future of poultry production	3.78	0.99	Accepted
3	PLF technologies have greatly potential benefits on career	3.48	0.17	Accepted
4	Challenges of PLF technologies such as power and faults were common while using these PLF	3.33	0.56	Accepted
5	PLF technologies shortcomings were overcomes by proper monitoring and skill maintenance	3.45	0.66	Accepted
6	PLF technologies have increased the overall productivity of the farm	4.22	0.33	Accepted
7	PLF technologies uses were superb compared with before introduction of PLF	4.90	0.11	Accepted
8	Resources availabilities enhances the using of PLF technologies	4.78	0.55	Accepted

Std. D = Standard Deviation

Table 6 depicted the cost involves in usage of PLF Technologies in the study area. The results indicated that cost inquired for PLF Technologies in poultry sector will surely affect the cost of production. The respondents claimed that the cost of monthly electricity bills are at higher level, the cost of importing those equipment use in PLF Technologies also at higher sides, cost of repairing equipment, cost of operating equipment and couple with cost of

installation of all the equipment were said to be on the higher side and at long run affect the cost of production.

Table 6: Cost Involves in Usage of PLF Technologies

S/N	Item	Mean	STD	Remark
1	High cost of electricity per month	4.56	0.88	Accepted
2	High cost of purchasing equipment	3.89	0.23	Accepted
3	High cost of repairing equipment	3.78	0.32	Accepted
4	High cost of operating the equipment	3.66	0.13	Accepted
5	High cost of installation and set up	4.44	0.12	Accepted

Std. D = Standard Deviation

Discussion

The demographic information of the users of Precision livestock Farming technologies (PLF) indicated male, adult, married, most are educated and spent about 5 years in the industry and this observation affirmed the results of Bahlo et al. (2022); Banhazi et al. (2022) and Krampe et al. (2021) these authors reported that the industries that partakes in precision farming technologies involved mostly male, adults and educated people because the operation needed someone that matured and educated due to training involves and maturity. The familiarity, training and education of the users of PLF that revealed that all the participant agreed that familiarity with PLF technologies was through training, re-training, seminar, youtube and online learning in the current finding was aligned with earlier reports of Makinde, (2020); Mapiye et al., (2021) and Neftissov et al., (2024) that PLF involves familiarity, training, seminar, workshop, retraining and update knowledge on the PLF enhanced and improved the knowledge of PLF users. The impact of PLF on workforce skills and employability on poultry sector indicated numerous advantages in the industries and this observation corroborated the

findings of Walter et al., (2017); Pivoto et al., (2018); Rowe et al., (2019); that workforce skills and employability improved when PLF technologies are involved. The job responsibilities, efficiency and productivities of PLF currently shows that using the PLF technologies in poultry sector will definitely improve efficiency and productivities of the poultry sector and this findings was in line with the studies of Werkheiser (2018); Werkheiser, (2020) who reported how PLF enhanced efficiency and productivities of the animal industries. The perception, attitudes, challenges and barrier of PLF usage that revealed many challenges agreed with the Werkheiser, (2020) on technology and responsibility: a discussion of under examined risks and concerns in PLF. Meanwhile the cost inquired in the usage of PLF Technologies were at higher side that will eventually affected the cost of production since the cost of monthly electricity bills the cost of importing those equipment use in PLF Technologies, cost of repairing equipment, cost of operating equipment and couple with cost of installation of all the equipment were said to be on the higher side and at long run affect the cost of production. This observation was supported by Fernández-Alonso et al. (2023) who claimed that cost-effective for precision agriculture largely depends on those factors such as cost of installation of all the equipment and its maintenance, source of power to those equipment etc and also this current findings corroborated the research works of Finger et al. (2024) that the cost of acquiring PLF Technologies affected the output produced in the farms and this towards influenced the sustainable crop protection in agriculture. Chin-Ling et al. (2024) recent reports on factors predicting innovation-decisions: The effects of performance expectancy, social influence, and facilitating conditions on U.S. Extension's promotion of precision agriculture technologies also agreed with the current findings on the factors on cost that hinder the development and adoption of PLF especially in developing countries around the world.

CONCLUSION

The findings of this study indicated that the majority of respondents agreed with and were familiar with the definition of PLF provided. The tools

introduced in this study were recognized and considered by the majority of respondents as PLF tools or tools that can improve PLF. The results suggested that the intention to adopt innovation may occur when the components of performance expectancy, social influence, and facilitating conditions are involved. By emphasizing these factors, stakeholders such as practitioners, researchers, and educators can develop targeted strategies to address the barriers to adoption especially the issue of cost.

RECOMMENDATION

Most PLF applications currently operating on farms require users to have internet service to gather signals and record field data to improve production performance coupled with the energy supplier to power those gadgets. Farmers need access to resources to use PLF, and access to professionals or trainers who can provide PLF expertise is equally important. Based on our findings, efforts to invest in PLF-related trainer or professionals and infrastructure are important to encourage and to promote PLF to farmers. Furthermore the study suggest the importance of developing strategies to enhance change agents' competencies to enhance their abilities to influence farmers'. PLF assist as a data-driven decision making and production efficiency and government can assist in subsidy of the equipment importation, stable stability of electricity to assist the adoption of PLF technologies in this study area.

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