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The Effect of Technology Use on Participants in the Women in Agriculture Programme in Delta North Agricultural Zone, Delta State, Nigeria

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Abstract
The study examined the impact of use of technology on participants of the women in agriculture programme. The study surveyed three Local Government Areas of Delta North Agricultural Zone in Delta state. Multistage purposive sampling method was use to select 120 respondents from three (3) Local Government Areas (LGAs) of the state. Primary data were sourced using questionnaire. The data collected were analyzed using descriptive statistics such as mean, frequency and percentage and inferential tools such as multiple and logistic linear regression technique. However, age, marital status, household size, educational level had a significant effect ($p<0.05$) in the use of agricultural technologies. The result highlighted varying adoption rates among participants in the Women in Agriculture Programme in Delta North Agricultural Zone, with land preparation and cultivation technologies (58.3%), efficient production methods (86.7%). Additionally, the result showed positive impacts on profitability, with technology improving income, crop quality, efficiency, and overall living standards. It further indicated that access to credit negatively influenced market reach, while technology adoption and higher annual income had positive effects. Lack of credit and low level of education were major constraints affecting the women in the use of technology. It is recommended that training and creation of awareness programme on the use of technology and access to credit should be made easily available as well as market infrastructure development to enhance market accessibility, supply chain, income and livelihoods in the study area.

Keywords: Technology Adoption, Women in Agriculture, Agricultural Productivity, Delta North, Farm Input

Introduction
There is growing contention amongst population concerning agricultural development practices that over time, have been seen to be overexploiting natural resources faster than they can be replaced or renewed. The carrying capacity of land is being overstressed by the ever increasing human population which has brought about high demand for food and shelter (Popp, Jahn, Matlock, and Kemper, 2012).Application of technology to agriculture is being fingered as a major step to addressing the food gap that is being created by population explosion in Africa (Palumbo, 2016). Nigeria, in particular. This is because, the introduction of new technologies has had a distinctive effect on rural populace both by class and gender. Hence, advancement of technology and its application has made substantial impact on the agricultural sector in Nigeria, especially in the area of food production through improvement in farm yield, efficiency and profitability which promotes better and more efficient farming methods.

In the perspective of Page, (2019), many millions of naira worth of new technologies are developed and passed on to rural farmers through different channels. However, the process of adopting the innovation has been slow and now only a little technology remains as a real challenge (Dissanayake *et al*, 2022).

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Technology refers to the systematic application of knowledge to the practical problems of life and the control of the environment through processes and structural resources (Williams, 2002). To extend this argument, it can be regarded as the practices or techniques, tools or equipment , know how and skills or mixture of the mentioned elements which are utilized to increase productivity , reduce levels of production and processing and conserve the available scarce resources or inputs like labour or energy (Ragasa 2012). New technologies will usually assist agrarians in these global, trends towards better modern farming (Drottberger and Langendahl, 2023). For example, in Nigeria, it has increased agricultural productivity by improving crop output, lowering production costs, and increasing overall agricultural efficiency.

Women in Nigeria are one of the most active and occupied group living within the suburbs. They carry out farming activities and are expected to play key roles in agriculture. Female's section of agricultural advancement has been estimated at 43% of the total agriculture in worldwide (FAO, 2011). The United Nation Development Programme (UNDP) in Nigeria estimates that between 60 to 80% of the agricultural labor forced in the different regions is composed of women and they account for two-thirds of the food crop production activities (Yemisi and Aisha, 2009). The involvement of women in agriculture is estimated to account for more than 50% of agricultural labour in Uganda, Tanzania and Malawi and less than 30% in Niger, Nigeria and Ethiopia (Palacios-lopez *et al*., 2017). But formal and cultural norms make it more difficult for women to thrive in agriculture. (Stearns, 2014). In fact, the degree of involvement of women in the farming industry differs among ethnic groups. in West Africa. Men control the logistical side of farm goods, and at the formal processing level, established processing enterprises are owned by men. A significant proportion of food purchases require a substantial amount of capital, and women are excluded from this process owing to a lack of finance (Dietzt al., 2018). More African women are able to take advantage of technology-based circumstances as a result of digitalization in agriculture; nonetheless, infrastructure and technology accessibility continue to be the major obstacles, exacerbating the disparity already mentioned and prompting the introduction of the women in agricultural programme (Kitole, Mkuna, and Sesabo, 2024). Women in Agriculture (WIA) programme is a components of the extension service sub-programme in Agricultural Development Project (ADP). Simply said, according to Chebet, 2023, "women in agriculture" refers to women who work in the farming industry, which involves keeping animals and nurturing, sowing, harvesting, processing, and marketing agricultural products. The Women-In-Agriculture initiative was founded primarily to support their well-being and provide them with a prominent position in the agricultural development sector. The Women-In-Agriculture programme, according to Ovwigho and Ifie (2014), was created to overcome the gender gap in the provision of agricultural extension services.

The National Council on Agriculture initiated the Women-In-Agriculture programme in the ADPs in 1989 (Adebisi *et al*., (2019); Adisa and Okunade (2005). The following objectives were outlined: (i) design research-based gender-targeted programs and technologies for women farmers with relevant institutions; (ii) promote the development of reasonable technologies which satisfy the needs of women farmers; (iii) aid in the search for credit opportunities for woman farmers; (iv) promote group and individual efforts aimed at developing the animal protein resources of the country; (v) enhance the agricultural output and income of woman farmers; (vi) enhance knowledge and skills of women on food processing, value addition as well as marketing; (vii) organize women in cooperative societies for the purpose of pooling resources together to access credit and information; (vii) encourage woman farmers to rear animals for the purposes of improving family diets. Achandi *et al,* 2018; and Croppenstedt *et al*, 2013, posits that Technologies that can increased production of food and women's productivityin agriculture can also expand the areas used for production. An analysis of the consequence of agricultural technology adoption on poverty evidenced that adoption of NERICA varieties had a favourable and noteworthyeffect on household expenditure and the influrnce was proven to be higher among women than men. However, gender-related restrictions and disparities in accessibility to prospects and assets that are productive impede growth in the agricultural and rural sectors. (IFAD, 2011). Therefore, guaranteeing equal access so technologies that reduces their workload and boost their output becomes essential. This become more petinent after Johnston *et al*, (2018)

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recognised that minimising detrimental effects on women's and children's health and nutrition requires lowering the workload for women working in agriculture. In light of this backdrop, the goal of this study is to identify the current technology that the study area's women in agriculture programme participants use as well as the factor and consequences of using of these technology with the aim of ascertaining the extent of actualization of objectives 1 and 2 within the initiative Women in Agriculture in the Delta North Agricultural zone with the intention of advising Non-governmental organizations and policy makers on what is obtainable in the field as well as positioning the farmers on how best to maximize the program taking into account the research's conclusions. The remaining component of the research shall be in the order of literature review, methodology and model specification, discussion of result, conclusion and recommendation.

Literature Review

Tufa *et al*., (2019) examined the differences between genders in technology adoption and agricultural productivity in Malawi. Their study analyzed data from 1,600 households and 5,238 plots. They employed a multivariate probit model to investigate how gender influences technology adoption. The findings revealed that plots managed by females were 14.6% to 23.1% less productive compared to those managed by males. Eventhough female plots managers faced a 23.1% anatomical disadvantage, they benefited from an 8.2% advantage in endowment.

Aurangozeb (2019), researched the use of integrated homestead farming technologies by rural women in Rangpur Dinazpur Rural Service (RDRS). The study's population was made of 250 rural women that were beneficiaries of the RDRS. Out of these 250 rural women, the study was able to use a sample of 100 or 40% of the total population. The findings of the study indicate that, 71 % of rural women had high integrated household agricultural technology, 21% had moderate substrate and 8% had poor substrate. Further, the findings also indicated a substantial pero positive relationship between the age of the rural women and their acceptance and use of integrated homestead farming technologies. In contrast, a number of significant positive relationships including socio-economic ones were established between the adoption of these innovations and education level, family size, annual income from field crops, extension media, cosmopolitan attitude, innovativeness and farming aspirations.

The research conducted by Nmadu, Sallawu, and Omojeso (2015) explored the socio-economic factors that influence cocoa farmers adoption of innovation in Ondo State. Their findings revealed that 60.0% of cocoa farms were managed by men, with an average of 51.11 years and a typical farm size of 6.32 hectares. The study suggests that enhancing extension services could boost adoption rates, productivity, and income for cocoa farmers.

Obisesan's 2014 study identified gender differences in technology adoption and its effect on welfare within Nigerian farming households. Male adoptors exhibited 20% higher level of adoption and a greater impact on the headcount index. The study indicates that enhanced production technology can alleviate poverty, but emphasizes the need for gender sensitivity and a supportive environment to encourage women's participation in technology adoption.

The study by Akpabio, Etim, and Okon (2012) found that 61.9% of introduced technologies were aware of, but only 33.3% were fully adopted. The introduction of technologies that are compatible with both socioeconomic and cultural contexts, an emphasis on follow-up activities, and the integration of a credit system with the WIA programme are suggested as solutions to the seven elements that led to non-adoption.

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Research Methods

The study Area

The study was conducted in the Delta North Agricultural zone of Delta State. The Delta State Agricultural Development Programme (DTADP) has categorized Delta State into three agricultural zones: Delta North, Delta Central, and Delta South. Located in the Niger delta region of Southern Nigeria, Delta State lies between latitude 5º00' and 6º30' North and longitude 5º00' and 6º45' East. The Delta North zone comprises nine Local Government Areas (LGAs): Oshimili South, Oshimili North, Aniocha South, Aniocha North, Ndokwa East, Ndokwa West, Ika South, Ika North East, and Ukwani. According to the National Population Commission in 2006, it was estimated that Delta North agricultural zone has a total population of 1,236,840 (30.07% of Delta State's total population), which is made up of 614,534 males and 622,306 females out of Delta State's total population of 4,112,445.

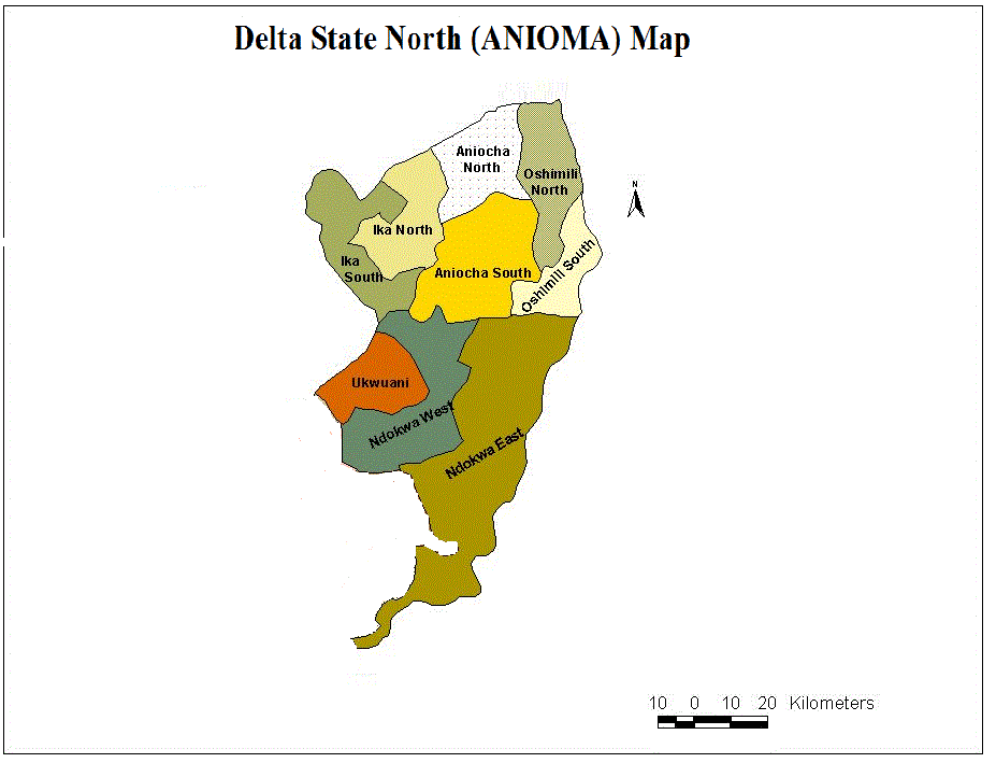

Figure 1: Map of the study area, Delta North, Nigeria (source: Google Map).

Sampling Techniques and Sample Size

The population for the study comprises of participants of WIA programme in Delta North Agricultural Zone. A purposive sampling technique was adopted to select respondents for this study. The first stage involved the selection of two communities each from three local government areas in the study area. The second stage involved the selection 20 respondents from each of the two communities selected. This gave us a total of 120 respondents, all of whom were participants of Women in Agriculture Programme from the selected communities.

Method of Data Collection

A structured questionnaire was used to gather primary information for the study. The questionnaire asks for information in line with the study's particular aims. Information contained in the questionnaire consist of the effect of technology on the social economic status of the participants, their adopted technologies and

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its purposes, the impacts of technology on their performance, assess to market as well as their profitability and constraints in the use of technology.

Method of Data Analysis

Data collected will be analyzed utilising descriptive metrics like mean, frequency distribution and percentage in order to accomplish targets I, II, and III, goals IV, and v will be analyzed using mean score. Hypothesis was tested using multiple linear regression and logit regression.

The socio-economic factor that determines the impact of use of technology on participants of WIA was specified implicitly as:

$Y = f(X_1, X_2, X_3, X_4, X_5 \ldots\ldots X_{14} + u)$

The explicit form of the model is expressed as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \cdots \beta_{14} X_{14} + u$$

Where:

Y = Impact of use of technology on participants of WIA
X_1 = Age (years)
X_2 = Marital status (married=2, divorced/widow=1, single=0)
X_3 = Educational level (years)
X_4 = Household size (number of persons)
X_5= Farming experience (years)
X_6= Income (naira)
X_7= Farm size (hectares)
X_8 = Access to extension service (number of visits)
X_9= Access to land
X_{10} = Access to credit
X_{11} = Co-operative membership
X_{12} = Access to market
X_{13} = Use of technology
X_{14} = Availability of technology
u = error term

The impacts of the adopted technologies on the market reach of the respondents will be analyzed using logit regression model. The model was specified as:

Li = In – Pi = ZiPi

Where,

Li = Log of the odd ration which is not linear in excellent X1 but also linear in the parameters
Pi = Is the probability of being and ranges from 0 to 1
Zi = The function of the explanatory variable X which is expressed explicitly as:

$$Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_n X_n + u$$

Where,

Zi = The dependent variable
$\beta_0 = Intercept$
$\beta_1 - \beta_9 = Coefficient\ of\ the\ independent$
X_1 = Age (years)
X_2 = Marital status (married=2, divorced/widow=1, single=0)
X_3 = Household size (number)
X_4 = Education level (number of years)
X_5 = Farm size (hectares)
X_6 = Farming experience (years)
X_7 = income (naira)

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X_8 = Access to extension service (number of visits)
X_9 = Access to land
X_{10} = Access to credit
X_{11} = Co-operative membership
X_{12} = Access to market
X_{13} = Use of technology
X_{14} = Accessibility of technology
u = error term

Results and Discussion

Socio Economic Characteristics

Table 1 revealed the socio-economic characteristics of respondents. The mean age of the respondents was 42 years. This implies that the farmers were in their economic active age. Therefore, adopting technological innovations in their farming activities is certainly not going to be an issue since majority of them are within the jet age bracket with proper enlightenment on the use of technology in farming operations.

The result further revealed that 55.8% were married, 25.0% were singles, 10.8% divorced while 8.3% of the respondents were widowed. This shows that most of the respondents were married. Being married may have accounted for 55.8% of the respondents since they have more responsibilities of caring for their families than single people. The large number of married individuals in farming could be attributed to the need for modern tools or extra hands in commercial agriculture. In the absence of such tools, spouses and children often contribute additional labour. This aligns with the statement by Soyebo *et al*., (2005) that married individuals frequently strive to make ends meet to support their families effectively. Additionally, this findings is consistent with Amao *et al*., (2011), who reported that a significant majority (71.43%) of respondents in their study in Pakistan were married. Regarding education level, Table 4.1 indicate that majority (34.2%) of farmers completed only primary school, while 20.8% had no formal education. The low educational attainment among these farmers may be linked to their residence in remote areas, where many believe that investing in a girl's education is futile since her primary role is seen as that of a wife. The data also reveals that 16.7% of farmers had completed secondary education, and 28.3% had attained tertiary education. Asiabaka (2002); Rogers (2003) and Edoja *et al*., (2021) emphasized that formal education helps farmers utilize written information sources and enhances their understanding of new agricultural practices. These findings are consistent with Adisa *et al*., (2012), who noted that the highest percentage of farmers had only primary education. Similarly, Amao *et al* (2011) found that a majority (82.84%) of their respondents had completed primary school. As shown in Table 4.1, the family sizes of farmers varied from one person (single) to 15 people (married). Notably, the most common household size was between 6 and 10 members, which made up 48.3% of the total. In contrast, households with 1-5 members accounted for 15.8%, while those with with 11-15 members represented 35.8%. The relatively high percentage of larger households (35.8%) among farmers can largely be attributed to the extended family system prevalent in the country. According to Edoja *et al*., (2021) and Manu *et al*., (2014), large household sizes among farmers are indicative of rural areas where a significant portion of the population is illiterate. The presence of larger households may imply more mouths to feed, but it could also mean more hands available to work on the farm, reducing the need for external labour. Additionally, the results indicated that 7.5% of respondents had less than 5 years of farming experience, while those with 6-10 years of experience made up 19.2%. Farmers with 11-15 years of experience constituted 25.0%, and the majority had between 15-19 years of experience. This suggests that most farmers in the study area are not new comers to farming and are well-positioned to notice changes in their farming practices. The mean farm size was 2.0 hectares. This implies that majority of the farmers were into small scale farming. This is in line with Adisa (2012) that the farmers were into small scale farming due to poverty rate and the percentage was (65%).

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The result showed that 41.7% of respondents identified their primary occupation aside from farming as civil service, petty trading and trading were 21.6% respectively, while 15% pursued artisan activities. The result showed that 59.2% reported having access to agricultural technology, indicating a moderate level of technological penetration among the surveyed population.

The sources of information on agricultural technology showed that 15.8% relied on family, 30.8% on friends, and 20.8% on fellow farmers. Social media platforms were utilized by 29.2% of respondents, indicating the diverse channels through which agricultural knowledge is disseminated, 16.7% relied on the internet and 17.5% on extension agents. However, a significant portion of the respondents (73.3%) reported never having contact with an extension agent, indicating a potential gap in the availability of agricultural support services. On a positive note, 55.8% of respondents were members of farmer's co-operative societies, suggesting a substantial level of community engagement and collaboration among farmers. In terms of financial resources, 42.5% of respondents had access to credit, while a slightly higher percentage (57.5%) did not. This finding indicates the need for improved financial inclusion strategies to support farmers in their agricultural pursuits.

Table 1: Socio-Economic Characteristics of Respondents

Parameter	Frequency	Percentage	Mean
How old are you			
20-30	16	13.3	
30-40	36	30.0	
40-50	48	40.0	**42 years**
50-60	20	16.7	
What is your marital status			
Single	30	25.0	
Married	67	55.8	
Divorced	13	10.8	
Widowed	10	8.3	
Level of Education			
Non-Formal Education	25	20.8	
Primary Education	41	34.2	
Secondary Education	20	16.4	
Tertiary Education	34	28.3	
What is your House hold size			
1-5	19	15.8	
6-10	58	48.3	
11-15	43	35.8	
For how long have you been farming			
1-5	9	7.5	
6-10	23	19.2	
11-15	30	25	
16-20	58	48.3	
What is the total size of your farmland			
<0.5	24	20.0	
0.6-1.0	38	31.7	
1.1-1.5	33	27.5	
1.6-2.0	15	12.5	
>2.0	10	8.3	
What was your annual income from last cropping season			

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<250,000	14	11.7
250001-500,000	31	25.8
500001-700,000	19	15.8
700,001-900,000	24	20.0
>900,000	32	26.7
Do you do any other job apart from farming		
Yes	66	55.0
No	54	45.0
What was your annual income from non-farm jobs in 2022		
<250,000	18	15.0
250001-500,000	32	26.6
500001-700,000	18	15.0
700,001-900,000	22	18.3
>900,000	30	25.0
What is your primary occupation aside from farming		
Petty Trading	26	21.6
Civil Service	50	41.7
Trading	26	21.6
Artisan	18	15
Do you have access to agricultural technology		
Yes	71	59.2
No	49	40.8
What are your major sources of information on agricultural technology		
Social media	35	29.2
Internet	20	16.7
Extension agents	21	17.5
Family	19	15.8
Fellow farmers	25	20.8
How often do you have contact with an extension agent		
Regularly	4	3.3
Occasionally	6	5.0
Rarely	22	18.3
Never	88	73.3
Are you a member of any farmer's co-operative society		
Yes	67	55.8
No	53	44.2
Do you have access to credit		
Yes	51	42.5
No	69	57.5

Source: Field Survey, 2023

Access to adopted technologies in the study area

Table 2 reveals access to adopted technologies in the study area. The result showed that 58.3% of the respondent adopted technologies for land preparation and cultivation, encompassing high-yield seed

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varieties, pesticides, fertilizers, and farm machinery like tractors. Food crops harvesting and storage technologies, represented by items such as harvesters, showed that 48.3% adopted the technology. Food crop processing and utilization technology showed 55.0% adoption, while Livestock products processing and utilization technology showed 49.2%. Fresh tomatoes processing and storage technology showed 40.0% adoption, fresh fish processing and storage technology showed 56.7% and Livestock processing and storage technology showed 55.8% of the respondent adopted the technologies. Finally, dry season vegetable production technology recorded the least adoption at 32.5% among the studied technologies, pointing to an area that requires significant attention and intervention to enhance technology uptake among the participants.

Table 2: Access the adopted technologies in the study area

Adopted Technologies	Response	Frequency	Percentage
Technologies used for land preparation and cultivation (e.g. high yielding varieties of seed, pesticides, fertilizer, farm machineries – tractor etc)	Yes	70	58.3
	No	50	41.7
Food crops Harvesting and storage technologies (e.g. harvester)	Yes	58	48.3
	No	62	51.7
Post-harvest operations and processing technologies (e.g. winnowing machines, thresher, solar drying equipment's):			
Food crop processing and utilization	Yes	66	55.0
	No	54	45.0
Livestock products processing and utilization technology	Yes	59	49.2
	No	61	50.8
Storage technology (e.g. silo, crib, barn):			
Fresh tomatoes Processing and storage technology	Yes	48	40.0
	No	72	60.0
Fresh fish Processing and storage technology	Yes	68	56.7
	No	52	43.3
Livestock Processing and storage technology	Yes	67	55.8
	No	53	44.2
Dry season vegetable production technology	Yes	39	32.5
	No	81	67.5

Source: Field Survey, 2023

Impact of the adopted technologies on market reach

Table 3 indicates the impact of adopted technologies on market reach among participants in Women in Agriculture in Delta North Agricultural Zone. The presence of a local market in their ward emerged as the most influential factor (90.8%), indicating its pivotal role in their agricultural activities. Free entry and exit in the market showed 77.5%, were highlighted by participants, emphasizing the essential aspect of seamless market access for their agricultural transactions. The result showed a positive impact on production and distribution efficiency due to technology adoption at 86.7%, indicating the role of technology in enhancing these processes. Participants acknowledged technology's contribution to expanding their market reach at 74.2%. The increase in customer base due to technology adoption showed 67.5% indicated a positive impact on expanding their customer network. While 60.0% of the participants reported increased sales due to technology adoption, suggesting a slightly lower direct impact on sales figures compared to other factors. These findings emphasize the critical role of technology in enhancing market access, efficiency, and customer base expansion for Women in Agriculture in Delta North Agricultural Zone, highlighting the need for a holistic approach integrating technological advancements with market infrastructure.

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Table 3: Impact of the adopted technologies on market reach

Market technology	Response	Frequency	Percentage
Do you have a market in your ward	Yes	109	90.8
	No	11	9.2
Do you have free entry and exit in the market	Yes	93	77.5
	No	27	22.5
Has the use of technology improved the production and distribution of your produce to your customers	Yes	104	86.7
	No	16	13.3
Has the use of technology increased your access to new markets	Yes	89	74.2
	No	31	25.8
Has the use of technology brought about an increase in your customer base	Yes	81	67.5
	No	39	32.5
Has the use of technology helped increase your sales	Yes	72	60.0
	No	48	40.0

Source: Field Survey, 2023

Impact of technology adoption on profitability of the respondent's farming enterprise

Table 4 presents the respondents' perceptions on the impact of technology adoption on the profitability of farming enterprises. The mean score of 2.7 suggests that respondents agree that the use of technology has led to an increased level of income. Additionally, with a mean score of 3.0, respondents agree that technology adoption has improved the quality of their crops. Furthermore, the mean score of 3.1 indicates general agreement among respondents that technology adoption has enhanced the overall efficiency of their enterprises, leading to high production and low costs. Moreover, respondents strongly agree, with a mean score of 3.2, that technology adoption has made farming practices easier and faster. Additionally, the mean score of 3.0 signifies agreement that technology adoption has contributed positively to their overall standard of living.

Table 4: Impact of technology adoption on profitability of the respondent's farming enterprise

Do you agree?	A	SA	D	SD	Mean
The use of technology has lead to increased level of income	27(22.5)	21(17.5)	35(29.2)	37(30.8)	2.7
The use of technology has improve the quality of crops	10(8.3)	22(18.3)	41(34.2)	47(39.2)	3.0
The use of technology has improve the overall efficiency of enterprise – high production and low cost	7(5.8)	23(19.2)	40(33.3)	50(41.7)	3.1
The use of technology has made farming practices easier and faster	6(5.0)	21(17.5)	40(33.3)	53(42.5)	3.2
The use of technology has improve the overall standard of living of the farmer	11(9.2)	22(18.3)	41(34.2)	46(38.33)	3.0

Mean above 2.5 = Agree

Constraints faced by respondents in relation to the use of technology

Table 4.5 indicates the constraints faced by respondents in adopting agricultural technology. Respondents agree (mean = 3.1) that limited access to productive resources hampers technology use, indicating challenges in accessing necessary tools and equipment. Similarly, they perceive the lack of credit as a significant barrier (mean = 3.2), highlighting financial constraints hindering technology adoption.

Limited access (2.3) to information was not a major challenge and low level of education was barrier (mean = 3.2), emphasizing the importance of education in overcoming technological challenges. Additionally,

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limited access to new techniques/practices was seen as a constraint (mean = 3.0), emphasizing the need for updated agricultural knowledge. Discrimination against women farmers was strongly acknowledged as a significant barrier (mean = 2.9), pointing to the social challenges faced by women in agricultural technology integration.

Table 5: Constraints faced by respondents in relation to the use of technology

Do you agree?	SD	D	A	SA	Mean
The use of technology is constrained by limited access to productive resources	13(10.8)	15(12.5)	43(35.8)	49(40.8)	3.1
Lack of credit is a barrier to the use of technology	14(11.7)	18(15.0)	43(35.8)	49(40.8)	3.2
Lack or limited access to Information is a barrier to the use of technology	38(31.7)	34(28.3)	27(22.5)	21(17.5)	2.3
Low level of education is seen as a barrier to the use of technology	14(11.7)	18(15.0)	43(35.8)	49(40.8)	3.2
Low access to new techniques/practices is a barrier to the use of technology	10(8.3)	22(18.3)	41(34.2)	47(39.2)	3.0
Discrimination against women farmers is a [i]barrier to the use of technology	17(14.2)	12(10.0)	42(35.0)	49(40.0)	2.9

Mean above 2.5 = Constraint

Relationship between socio-economic characteristic of respondents and participation in use of technologies

To assess the effect of socio-economic characteristics on l on the use of technology by participants of the women in agriculture programme in Delta North agricultural zone, multiple regression was performed. The overall model fit was 96.3% ($R^2 = 0.963$, $p < 0.05$) (see Table 6 and 7). This means that the variables can correctly predict level of usage by 96.3%.

R	R Square	Adjusted R Square	Std. Error of the Estimate
.983a	.967	.963	.24541

Predictors: (Constant), frequency, large, access to credit, year, household, age, marital, education

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	129.760	8	16.220	269.308	.000[b]
	Residual	4.457	112	.060		
	Total	134.217	120			

a. Dependent Variable: Women technology adoption

b. Predictors: (Constant), access to extension agent, marital status, farm size, household size, educational level, year of experience, age, access to credit

The main objective of this study was to examine women's adoption of technologies in the study area. This was achieved by testing the hypotheses drawn for this study, through the use of multiple regression model to analyze the socio-economic factors influencing adoption of the recommended technologies. The results in table 4.6 shows the socio-economic factors influencing the use of technology.

Access to credit (B= -1.337, P<0.05) was significant but negative factor in the use of technology. The negative value of the beta coefficient implies that as access to credit decreases, the use of technology decreases.

Age (B= -0.044, P<0.05) was significant but negative factor in the use of technology. The negative value of the beta coefficient implies that as age decreases, the use of technology increases.

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Marital status (B= -0.060, P<0.05) was significant but negative factor in the use of technology. The negative value of the beta coefficient implies that as marital status decreases, the use of technology increases.

Household size (B= -0.004, P<0.05) was significant but negative factor in the use of technology. The negative value of the beta coefficient implies that as household size decreases, the use of technology increases.

Educational level (B= -0.7980, P<0.05) was significant but negative factor in the use of technology. The negative value of the beta coefficient implies that as level of education decreases, the use of technology decreases.

Farming experience (B=0.117, P>0.05) is one of the positive and significant factor that determines the use of technology. The positive beta coefficient showed that farming experience is a positive predictor and it implies that increase in farming experience will also lead to increase in the use of technology. The implication of these findings is that farmers experience increases, through their awareness of modern technologies and acquisition and utilization of modern production technologies.

Farm size (B=0.075, P>0.05) is another positive and significant factor that determines the use of technology. The positive beta coefficient showed that farm size is a positive predictor and it implies that increase in farm size will also lead to increase in the use of technology. Again, farmers who own large farms are more likely to belong to cooperative/social organizations so as to grasp any opportunity to acquire knowledge, skills and modern technologies that would enable them increase their productivity, income and good livelihood.

Extension agents (B= -0.098, P<0.05) was significant but negative factor in the use of technology. The negative value of the beta coefficient implies that as extension agents decreases, the use of technology decreases.

The result also shows that three (access to credit, educational level and access to extension agent) were negative and statistically significant determinants in level of use of technologies in the area. This implies that change or increase in access to credit, educational level and access to extension agent will lead to increase in adoption of technology. The result contradict Adanna (2017) who showed that the coefficients of farming experience, interest on borrowed capital, and farm size were not statistically significant even at 10 percent probability level.

However, since almost all the socio-economic characteristics of the respondents had significant influence on the level of adoption of technologies, then the null hypothesis is rejected.

Table 6: Socio-economic factors influencing level of technology adoption

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	T	Sig.
(Constant)	11.077	.347		31.962	.000
Access to credit	-4.309	.247	-1.337	-17.475	.000
Age	-.042	.057	-.044	-.739	.463
Marital status	-.073	.075	-.060	-.976	.332
Household size	-.008	.059	-.004	-.127	.899
Education level	-1.031	.075	-.798	-13.663	.000
Year experience	.150	.049	.117	3.090	.003
Farm size	.086	.042	.075	2.058	.043

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Access to extension agent	-.073	.030	-.098	-2.453	.017

Source: Field Survey, 2023

Table 7 indicates the impacts of the adopted technologies on the market reach of respondents. The regression result showed that there was a negative (coef = -0.481) and significant ($p<0.05$) relationship between the access to credit and market reach. Use of technology indicated a positive (coef = 2.711) and significant ($p<0.05$) relationship with market reach. This implies that an increase in Use of technology will lead to an increase in market reach. Table 4.8 showed that there was a positive (coef = 3.158) and significant ($p<0.05$) relationship between accessibility of technology and market reach. This showed that a higher level of accessibility of technology will lead to an increase in market reach. The result also showed that there was a positive (coef = 5.152) and significant ($p<0.01$) relationship between annual income and market. This showed that a higher level of annual income will lead to an increase in market reach.

The result also showed that Access to extension service (coef = 0.832) and Storage technology (coef = 2.764) had a positive but insignificant ($p>0.05$) relationship with market reach. Since the majority of the variables tested have significant relationships, the null hypothesis stated earlier is therefore rejected.

Table 7: Impacts of the adopted technologies on the market reach of respondents

Variables	Coefficient	Std. Err.	t-stat	Sig
Access to credit	-0.481	0.119	-4.042*	0.051
Use of technology	2.711	0.813	3.335*	0.050
Accessibility of technology	3.158	0.927	3.407*	0.050
Annual income (in naira)	5.152	0.715	7.206**	0.000
Access to extension service	0.832	0.512	1.625	0.109
Storage technology	2.764	1.885	1.466	0.217

Source: Field survey, 2023.
R-squared = 0.627; Adjusted R-squared = 0.511
**Significant at 0.01 level of significance
*Significant at 0.05 level of significance

Conclusion and Recommendations

The study's findings illuminate a nuanced landscape in the Women in Agriculture program in Delta North Agricultural Zone. Technology adoption, while prevalent in areas like land preparation, faces hurdles in sectors such as dry season vegetable production. Market dynamics reveal the central role of local markets, with technology enhancing efficiency and market reach. However, persistent challenges like limited resource access and discrimination against women farmers hinder progress. Positive relationship between farming experience, farm size, and technology adoption emphasize the need for tailored support. Addressing these challenges through targeted interventions can amplify technology adoption, improve market access, and uplift the socio-economic status of women farmers, fostering a more sustainable and equitable agricultural landscape in the region. The study's conclusions lead to the following recommendations:

i. Implement educational initiatives focusing on under-adopted technologies, emphasizing their benefits and proper utilization, to bridge knowledge gaps among participants.
ii. Facilitate easier access to credit facilities, providing financial resources for women farmers to invest in modern technologies, thereby promoting their adoption and improving overall productivity.

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iii. Invest in local market infrastructure to enhance market accessibility and ensure a seamless supply chain, encouraging women farmers to engage in agricultural activities with the assurance of reliable market outlets.
iv. Conduct awareness campaigns to combat discrimination against women farmers, promoting gender equality in accessing resources, technology, and market opportunities within the agricultural sector.
v. Strengthen agricultural extension services, providing continuous guidance, technical expertise, and updates on modern agricultural practices to women farmers, ensuring their skills remain current and relevant.
vi. Foster collaborations between government agencies, non-governmental organizations, and private sectors to create comprehensive support systems, including training, funding, and market access, tailored to the unique challenges faced by women farmers.

References

Chebet, N. (2023). The Role of Women on Agricultural Sector Growth. International Journal of Agriculture, 8(1), 41–50. https://doi.org/10.47604/ija.1980

Drottberger, A., & Langendahl, P. A. (2023). Farming-as-a-service initiative in the making: Insights from emerging proto-practices in Sweden. *Smart Agricultural Technology*, *6*, 100368.

Edoja, P. E., Aye, G. C., Abu, O. and Ater, P. I. (2021a) Effects of Land Use and Degradation On Agricultural Productivity in South-South, Nigeria. GSJ: Volume 9, Issue 5, Online: ISSN 2320-9186

Kitole, F. A., Mkuna, E., & Sesabo, J. K. (2024). Digitalization and agricultural transformation in developing countries: Empirical evidence from Tanzania agriculture sector. Smart Agricultural Technology, 7, 100379. https://doi.org/10.1016/j.atech.2023.100379

Ovwigho, B. O. and Ifie, P. A. (2014). Effects of the Women in Agriculture (WIA) Programme on Welfare of Rural Women in Uvwie Block of the Agricultural Development Programme (ADP), Delta State, Nigeria. IOSR Journal of Agriculture and Veterinary Science, 7(1), 50–54. https://doi.org/10.9790/2380-07115054

Page, M. L. (2019). Farmers furious after losing licence to kill millions of birds. *New Scientist*, *242*(3228), 13. https://doi.org/10.1016/s0262-4079(19)30763-8

Palumbo, R. (2016). Sustainability of Well-being through Literacy. The Effects of Food Literacy on Sustainability of Well-being. *Agriculture and Agricultural Science Procedia*, *8*, 99–106.

Popp, J. S., Jahn, M. M., Matlock, M. D., & Kemper, N. P. (2012). *The role of biotechnology in a sustainable food supply*. Cambridge University Press.

Stearns, M. (2014). How Women as Succeeding as Entrepreneurial Leaders in Agriculture: Ten Case Studies from Sub-Saharan Africa and Latin America. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2446034

Williams, M. J. (2002). Technology, Knowledge Systems, Population Dynamics, and Coastal Ecosystems. *AMBIO: A Journal of the Human Environment*, *31*(4), 337–339.