



FACTORS INFLUENCING THE ADOPTION OF SASSAKAWA GLOBAL (SG 2000) TECHNOLOGIES ON MAIZE PRODUCTION IN CENTRAL AGRICULTURAL ZONE OF BAUCHI STATE, NIGERIA

¹Abdurrahman, A., ²Idi, S., and ³Abdullahi, S.

¹Bauchi State Agricultural Development Program, Gidan gona Bauchi State

²Department of Agricultural Economics, Faculty of Agriculture and Agricultural Technology, Abubakar Tafawa Balewa University, Bauchi.

³Department of Agricultural Extension and Rural Development, Faculty of Agriculture and Agricultural Technology, Abubakar Tafawa Balewa University, Bauchi.

Corresponding Author's E-mail: abdufatahabdurrahman64@gmail.com, **GSM:** 08030784069

ABSTRACT

The study examined the factors influencing the impact of adoption of Sasakawa Global (SG 2000) technologies on maize production in Central Agricultural Zone of Bauchi state. Multi-stage sampling technique was employed in selecting 174 respondents. Data were collected using structured questionnaire and analysed using descriptive and inferential statistics. The study revealed that, farmers demonstrated high adoption rates for core SG 2000 agronomic practices, including planting time (90.8%), weed control (88.5%), spacing (83.9%), pest/disease control (83.9%), single seed per plant (81.6%), and appropriate fertilizer application (79.3%). Adoption of harvest and storage technologies was lower (59.8%). The adoption of these technologies showed a profound positive impact ($P < 0.01$) significantly correlating with increased maize farm size, quantity harvested, sales earnings, and ownership of various assets (e.g., cars, motorcycles, household items), indicating improved livelihoods and wealth. Income ($P < 0.01$), farm size ($P < 0.01$), cooperative membership ($P < 0.01$), household size ($P < 0.05$) and marital status ($P < 0.05$), were the factors significantly influencing adoption of the SG 2000. The major constraints to the adoption of the SG 2000 were inadequate credit facilities (0.691), high cost of farm inputs (0.675), and high incidence of pests/diseases (0.737). The study concluded that adoption of SG 2000 had a significant impact on productivity, income and overall welfare of the respondents. Also, adoption of SG 2000 production technologies was influenced by income, farm size, marital status, household size, occupation, farm size and membership of cooperative societies. It was recommended that efforts should be intensified to strengthen existing cooperatives, government and development partners should prioritize investment in improving rural road networks and transportation facilities to reduce post-harvest losses and enhance market access for maize farmers.

Keywords: Technology, Adoption, SG 2000, Maize, Farmers.

INTRODUCTION

Food insecurity and persistently low agricultural productivity remain one of the major development challenges confronting Least Developing Countries (LDCs), particularly in sub-Saharan Africa. Agricultural systems across the region continue to face structural constraints including climate variability, limited access to improved technologies, inadequate credit facilities, weak agricultural extension systems, and inefficient output markets. These challenges have contributed to stagnating agricultural growth, declining rural livelihoods, and heightened vulnerability of farming households to poverty and food shortages (FAO, 2018; World Bank, 2017; IFPRI, 2020). In Nigeria, despite vast agricultural land resources and favorable agro-ecological conditions, domestic food production has not kept pace with rapid population growth, thereby worsening food insecurity and rural poverty (FAO, IFAD & WFP, 2019). Smallholder farmers dominate Nigeria's agricultural sector and play a central role in national food supply; however, their productivity remains constrained by low adoption of improved agricultural technologies and limited institutional support.

In response to these challenges, public-private partnerships (PPPs) have increasingly been promoted as strategic mechanisms for improving agricultural productivity in developing economies. PPP arrangements combine the institutional reach of public extension services with private sector



innovation, technical expertise, and financial resources to strengthen agricultural transformation processes. Empirical evidence indicates that PPP-based agricultural programmes enhance technology dissemination, improve farmers' access to production inputs, and strengthen farmer–market linkages, particularly among resource-poor farming households (Spielman *et al.*, 2010; Poulton & Macartney, 2012). Consequently, PPP initiatives have become central to agricultural development policy in Nigeria, especially in efforts aimed at modernizing smallholder farming systems and increasing crop productivity (Hall *et al.*, 2014).

One of the most prominent PPP agricultural interventions in sub-Saharan Africa is the Sasakawa Africa Association (SAA) operating through the Sasakawa Global 2000 (SG 2000) programme. Over the past decades, SG 2000 has collaborated with national governments, extension institutions, and development partners to promote high-yielding agricultural technologies for staple crops such as maize, wheat, rice, legumes, roots, and tubers. Through farmer training programmes and field demonstrations, the initiative has supported thousands of extension agents and millions of farmers across fourteen African countries (Sasakawa Africa Association, 2015; Sasakawa Global 2000, 2016). The programme's demonstration-based extension approach has been widely acknowledged for accelerating technology diffusion and improving agricultural productivity among participating farmers (Eicher & Rukuni, 2003).

In Nigeria, SG 2000 activities commenced in 1991 with the objective of enhancing food crop productivity through improved agronomic practices, efficient input utilization, and strengthened extension delivery systems (FMARD, 2015; Sasakawa Africa Association, 2015). The collaboration between the Federal Government of Nigeria and SG 2000 was formalized in March 1992 following the signing of a Memorandum of Understanding aimed at increasing agricultural productivity and strengthening marketing systems for staple crops, particularly wheat and maize (Eicher & Rukuni, 2003). Initial implementation began in Kano State for wheat production and Kaduna State for maize before expanding to other states including Adamawa, Gombe, Bauchi, and Jigawa as the extension model gained acceptance (Nnadi & Akwiwu, 2008; Oyewole & Kehinde, 2016). Over time, programme activities broadened beyond production to incorporate post-harvest management, value addition, and market access support for smallholder farmers.

A key intervention framework under SG 2000 is the Agricultural Technology Adoption Initiative (ATAI), which focuses on facilitating technology transfer to smallholder farmers based on the assumption that many profitable agricultural innovations already exist but remain under-adopted due to institutional barriers, information gaps, and market failures (Wainaina *et al.*, 2020; Abebe & Bekele, 2023). The initiative emphasizes cost-sharing arrangements among SG 2000, national extension services, and farmers, alongside intensive training and technical backstopping designed to promote sustainability and farmer commitment (Ogotu & Qaim, 2019; Midingoyi *et al.*, 2021). Previous studies suggest that participatory extension models and collaborative learning approaches significantly enhance adoption rates and enable farmers to independently sustain improved production practices over time (Kassie *et al.*, 2015; Tambo & Wünscher, 2017; Mwangi & Kariuki, 2020; Duflo *et al.*, 2011).

Despite the extensive implementation of SG 2000 interventions, the knowledge systems and participation experiences of maize farmers are rarely documented systematically, limiting their accessibility to researchers, extension practitioners, and development planners (Musa & Mwangi, 2008). Contemporary agricultural extension systems increasingly recognize that understanding farmers' perceived barriers to participation is essential for designing responsive and inclusive extension programmes (Kassem *et al.*, 2021). Farmer participation represents a critical element of sustainable agricultural development because it facilitates access to training, inputs, and information necessary for livelihood improvement (Sulaiman, 2013; Aref, 2011). Without active farmer participation, agricultural development initiatives risk limited adoption, weak sustainability, and reduced programme effectiveness.

The SG 2000 programme promotes a comprehensive technological package for maize production, including appropriate planting dates, improved seed varieties, optimal plant spacing, recommended fertilizer application rates, and improved crop management practices aimed at enhancing productivity and farmer welfare (Jamilu *et al.*, 2014). Although several studies have examined adoption



of improved maize technologies associated with SG 2000 interventions (Adebayo *et al.*, 2020; Jamilu *et al.*, 2014), empirical evidence assessing the extent to which these technologies influence adoption behaviour and productivity outcomes within specific local contexts remains limited. In particular, little attention has been paid to the Central Agricultural Zone of Bauchi State, where smallholder maize farmers continue to face socio-economic, institutional, and structural constraints affecting technology uptake.

The persistence of low adoption levels despite sustained extension interventions raises critical questions regarding the effectiveness of technology dissemination strategies and the factors influencing farmers' adoption decisions. Understanding these factors is essential for improving agricultural programme design, strengthening extension delivery systems, and ensuring that investments in agricultural innovation translate into measurable productivity gains and improved household welfare. Consequently, this study examines the factors influencing the adoption of Sasakawa Global 2000 technologies on maize production in the Central Agricultural Zone of Bauchi State, Nigeria. Specifically, the study attempted to;

- i. describe the type of technologies adopted by the respondents
- ii. examine the level of adoption of sg 2000 among the respondents
- iii. determine the impact of technology adoption on respondents
- iv. examine the factors influencing adoption of the technology among respondents
- v. describe the constraints affecting adoption of technologies in the study area.

MATERIALS AND METHODS

The Study Area

The study was conducted at central Agricultural zone of Bauchi state which covers, Ganjuwa, Warji, Ningi and Darazo local government areas. Bauchi central zone is part of Bauchi State, Nigeria, which is known for its diverse ethnic groups and rich cultural heritage. The population in the zone is estimated to be around 2,464,000, which is a significant portion of the state's total population (2006 census). That area is diverse with various ethnic groups such as Hausa, Fulani, Butawa, Faawa, Warjawa etc. residing in different areas contributing to the cultural richness of the region.

Bauchi State occupies a total land area of 49,119 km² representing about 5.3% of Nigeria's total land mass, and is located between latitudes 9° 3' and 12° 3' north and longitudes 8° 50' and 11° east. The state is bordered by seven states, Kano and Jigawa to the north, Taraba and Plateau to the south, Gombe and Yobe to the east and Kaduna to the west. Bauchi state is one of the states in the northern part of Nigeria that span two distinctive vegetation zones, namely, the Sudan savannah and the Sahel savannah. The Sudan savannah type of vegetation covers the southern part of the state. Here, the vegetation gets richer and richer towards the south, especially along water sources or rivers, but generally the vegetation is less uniform and grasses are shorter than what grows even farther south, that is, in the forest zone of the middle belt. The Sahel type of savannah, also known as semi-desert vegetation, becomes manifest from the middle of the state as one moves from the state's south to its north. This type of vegetation comprises isolated stands of thorny shrubs.

On the other hand, the southwestern part of the state is mountainous as a result of the continuation of the Jos Plateau, while the northern part is generally sandy. The vegetation types as described above are conditioned by the climatic factors, which in turn determine the amount of rainfall received in the area. For instance, the rainfall in Bauchi state ranges between 1,300 millimetres per annum in the south and only 700 millimetres per annum in the extreme north. This pattern is because in the West Africa sub-region, rains generally come from the south as they are carried by the south western lines. There is therefore a progressive dryness towards the north, culminating in the desert condition in the far north. So also, is the case in Bauchi state. Consequently, rains start earlier in the southern part of the state, where rain is heaviest and lasts longer. Here the rains start in April with the highest record amount of 1,300 millimeters per annum. In contrast, the northern part of the state receives the rains late, usually around June or July, and records the highest amount of 700 millimeters per annum (Odiana and Ibrahim 2015). Some of the activities of SG 2000 in Bauchi State involves on-job training of ADP staff who in turn provide training for farmers, strengthening of advisory services provided to



farmers covering all the areas embraced by SG 2000 thematic areas, engaging farmers to produce more of what the market needs while still promoting productivity, better post-harvest handling and improved storage and engaging farmers in the gaining of various agronomic practices, post production skills, agribusiness management and group dynamics.

Sampling Techniques and Sample Size

A multi stage sampling procedure was employed for the study. The first stage involved purposeful selection of central agricultural zone of Bauchi, this is because the zone is known for its high maize production capacity. In the second stage three Local Government Areas (Ganjuwa, Ningi and Darazo) were purposefully selected from the Central Agricultural Zone due to their high maize production. The third stage involved selection of two districts (Kafin madaki and Miya from Ganjuwa, Ningi and Bura from Ningi and Gabarin and Papa from Darazo) from each of the Local Government Area based on important factors. The fourth stage involved a purposeful selection of three villages from each of the districts where the activities of SG 2000 took place. A list of participants from each village was obtained from Bauchi State Agricultural Development programme (BASDP). While the list of non-participants was collected from the farmer’s cooperative association of the selected villages through the help of extension workers. The list formed the sampling frame of participants and non-participants respectively. The final stage involved the use of random sampling in selecting 55% (n=310) and 55% (n=310) of participants and non-participants respectively. This was chosen using the sample size determination formula as described by Taherdoost (2017), which provides a practical approach for calculating sample sizes in survey-based agricultural research.

The sample size formula is given as:

$$n = \frac{N}{1 + N(e)^2} \dots(1)$$

n= sample size.

N= population size.

e= margin of error.

The sampling procedure is presented in Table 1.

Table 2: Sample Size Selection Plan of the Study

LGA	Districts	Villages	RESPONDENTS		
			Sample Frame	Sample Size (55%)	
Ganjuwa	Kafin Madaki	Ringim	18	10	
		Marmasa	20	11	
		Nassarawa	12	7	
	Miya	Gungura	20	11	
		Siri Babba	12	7	
		RafinKado	19	10	
	Ningi	Ningi	Balma	12	7
			Jigawa Kura	18	10
			Ningi West	21	12
Burra		Kyata	18	10	
		Magama	12	7	
		Yiwba	14	8	
Darazo	Gabarin	Gangalawi	12	7	
		Dafautawo	18	10	
		Indabo	12	7	
	Papa	Zobo	20	11	
		Aliya	25	14	
		War	27	15	
Total			310	174	

Source: Authors Computation, 2024



Method of Data Collection and Analysis

The study used primary data which were collected using structured questionnaires. Data collected were analysed using descriptive and inferential statistics. Descriptive statistics such as frequency distribution, percentages and mean were used to achieve objective i, and v. while Inferential statistics such as Adoption index using sigma scoring method, Z-test and double difference and logit regression were used to achieve objective iv and factor analysis were used to achieve objective ii, iii and iv, respectively.

Logit regression was used to establish the association between several factors influencing the likelihood of adopting recommended maize production technologies of SG 2000. Its use to clarify connections between a dependent variable and a group of independent variables. The likelihood of adoption typically binary and dichotomous, giving farmers the choice of using recommended maize production technologies or not.

$$Y = \begin{cases} 1 & \text{if adopt} \\ 0 & \text{otherwise} \end{cases}$$

Model specification for regression is given as:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_{10}X_{10} + e \quad \dots (4)$$

Y = Adoption of recommended maize production technology (adoption= 1, non- adoption= 0).

Where;

β_0 =Intercept,

$\beta_1 - \beta_{10}$ =Regression coffeiceints,

X_1 =Age of maize farmers, (years),

X_2 =Sex of respondents (male=1, female=2),

X_3 =Marital status (single=1, married=2, divorced=3, widowed=4 and others=5),

X_4 =Educational level (years),

X_5 =Household size (Actual number),

X_6 =Farm size (hectares),

X_7 = Years of experience (years),

X_8 = Occupation (civil servant=1, livestock production=2, fish farming=3, trading=4, others=5),

X_9 = Labour (family labour=1, hired labour=2, others=3),

X_{10} =Farmer's income (₦).

The foundation of the sigma scoring method's adoption index is the idea that regular frequency counts and percentages can be mathematically standardized to provide normalized standard scores. In parametric statistical analysis, a standard score of this kind can be applied. A value known as the sigma distance is read from the statistical tables of normal deviates, and the percentages of farmers who adopted a specific agricultural innovation are determined. This method has been widely utilized in adoption studies to standardize adoption scores across multiple technologies (Adnan *et al.*, 2021; Ogundele & Okoruwa, 2022)

The fundamental presumption of factor analysis is that there are several independent variables, sometimes known as 'latent variables,' which explain why the correlations between the dependent variables all go to zero. Stated differently, the values of the dependent variables are determined by the latent variable. Factor analysis, as noted by Hair *et al.* (2019), is fundamentally a technique for meaningful data reduction that identifies underlying structures in complex datasets. Specification of the model for factor analysis consist of the following equation used for achieving objective v.

$$Y = \beta_{10} + \beta_{11}F_1 + \beta_{12}F_2 + e_1 \dots 1$$

Where;

Y= Farmers constraints

e= error terms

F=Factors

β = Factor loadings



RESULTS AND DISCUSSION

Type of Technologies Adopted by the Respondents

The finding from Table 2 revealed that, majority (90.8%) of the respondents adopted planting time, weed control (88.5%), spacing between plants (83.9%) and pest/disease control (83.9%) which were ranked 1st, 2nd and 3rd, respectively by the respondents in the study area. The high adoption of planting time reflects farmers’ awareness of the importance of aligning maize planting with rainfall patterns to ensure proper germination and early crop establishment. Timely planting reduces moisture stress and improves nutrient uptake, which ultimately enhances yield. Adamu and Yakubu (2021) found that maize farmers who adhered to recommended planting schedules recorded significantly higher yields than late planters, particularly in areas with erratic rainfall. Similarly, Bello *et al.* (2022) reported that proper planting time was one of the most readily adopted maize technologies due to its low cost and immediate visible benefits.

These were followed by single seed per plant (81.6%), appropriate fertilizer application (79.3%), spacing between rows (69.0%) and harvest/storage (59.8%) which were ranked 5th, 6th, 7th and 8th, respectively. This finding implies that respondents were aware and have adopted a number of technologies in SG 2000 on maize production practices in the study area. Adamu and Yakubu (2021) found high adoption of improved maize varieties and associated practices in areas with strong extension support. However, SG 2000 technologies help to promote post-harvest and storage in Nigeria, as noted by Osuafor *et al.* (2020). Effective weed management is essential for maize growth, especially during the early stages of crop development. Garba and Bello (2020) found that farmers who practiced timely weed control experienced reduced yield losses and higher profitability.

Table 2: Distribution of Respondents According to their Adopted Technologies

Variables	Percentage	Rank
Planting time	90.8	1 st
Weed control	88.5	2 nd
Spacing between plants	83.9	3 rd
Pest and disease control	83.9	3 rd
Single seed per plant	81.6	5 th
Appropriate fertilizer application	79.3	6 th
Spacing between rows	69.0	7 th
Harvest and storage	59.8	8 th

Source: Field Survey, 2024

Level of Adoption of SG 2000 among the Respondents

The adoption index scores as presented in Table 3 further confirmed a generally high level of adoption of SG 2000 technologies among respondents in the study area. Adoption scores ranged from 6.95 for harvest and storage practices to 7.77 for planting time, indicating that most technologies were adopted at a relatively high intensity.

High adoption scores were also recorded for spacing between plants (7.59), pest and disease control (7.59), weed control (7.51), single seed per plant (7.53), and appropriate fertilizer application (7.47). These practices are central to yield enhancement and are often emphasized during extension training under the SG 2000 program. Bello *et al.* (2022) found that farmers who adopted multiple agronomic practices simultaneously achieved significantly higher yields than those who adopted only one or two practices. Similarly, Garba and Bello (2020) reported that high adoption intensity was positively associated with productivity gains among maize farmers.



Table 3: Distribution of Respondents According to their Adoption Index Score

Technology	Percentage	Adoption score
Spacing between plants	83.9	7.59
Spacing between rows	69.0	7.19
Single Seed per plant	81.6	7.53
Appropriate Fertilizer Application	79.3	7.47
Planting time	90.8	7.77
Weed control	88.5	7.51
Pest and disease control	83.9	7.59
Harvest and storage	59.8	6.95

Source: Field Survey, 2024

Spacing between rows recorded a moderate adoption score of 7.19, while harvest and storage practices had the lowest adoption score (6.95). The relatively lower score for harvest and storage indicates persistent post-harvest challenges, including inadequate storage infrastructure and limited technical knowledge. Osuafor *et al.* (2020) found that post-harvest losses remained high among maize farmers in Nigeria due to low adoption of improved storage technologies, despite high adoption of field-level practices. This suggests the need for greater emphasis on post-harvest training within SG 2000 interventions. In general, the high adoption scores observed for most agronomic practices align with the core objectives of the SG 2000 program, which seeks to improve maize productivity through the dissemination of improved production technologies. Adamu and Yakubu (2021) concluded that sustained extension contacts significantly increased both the breadth and intensity of technology adoption among maize farmers.

Impact of Technology Adoption on Respondents

The correlation analysis shows that adoption of SG 2000 technologies has a highly significant ($P < 0.01$) positive correlation with various indicators of impact on the respondents, maize farm size (0.788) and quantity of maize harvested (0.776) shows a strong positive correlation between increased farm size and yield in the study area. Income (0.381) also shows a positive correlation with earnings from maize sales. This suggests that technology adoption enhanced farmers' confidence and capacity to expand production. Bello *et al.* (2022) similarly found that adoption of improved maize technologies significantly increased both farm size and output among smallholder farmers. Garba and Bello (2020) reported that maize farmers who adopted improved technologies recorded higher gross margins and improved household income levels.

Furthermore, the results revealed a strong and significant positive correlation between technology adoption and ownership of various household and productive assets, including cars (0.673), motorcycles (0.742), cooking stoves (0.839), wheelbarrows (0.630), ceiling/table fans (0.614), wristwatches (0.840), bicycles (0.787), refrigerators (0.478), radio sets (0.805), televisions (0.703), wall clocks (0.735), and mobile phones (0.406). These assets are widely used as indicators of improved living standards in rural Nigeria. Sadiq *et al.* (2021) found that asset accumulation increased significantly among maize farmers who adopted improved production technologies, reflecting enhanced welfare and economic stability.



Table 4: Level of SG 2000 Technologies Impact on Respondents

Variables	N	Correlation	Sig.
Maize farm size	174	.788	.000***
Quantity of maize harvested	174	.776	.000***
Income	174	.381	.000***
Number of cars owned	174	.673	.000***
Number of motor cycle owned	174	.742	.000***
Number of cooking stove owned	174	.839	.000***
Number of wheel barrow owned	174	.630	.000***
Ceiling /Table fan (After participation)	174	.614	.000***
Number of wrist watch owned	174	.840	.000***
Number of bicycles owned	174	.787	.000***
Refrigerators	174	.478	.000***
Radio sets	174	.805	.000***
Television	174	.703	.000***
Wall clock	174	.735	.000***
Telephone /mobile sets	174	.406	.000***
Membership of association/clubs	174	.624	.000***
Furniture	174	.796	.000***
Number of wives	174	.808	.000***
Number of livestock possessed	174	.915	.000***

Source: Field Survey, 2024 ***Significant at 1%

Additionally, membership of associations/clubs (0.624), ownership of furniture (0.796), number of wives (0.808), and number of livestock possessed (0.915) also showed a strong and significant positive correlations with technology adoption. Livestock ownership, in particular, recorded the strongest correlation, indicating that increased income from maize production enabled farmers to invest in livestock as a form of savings and wealth accumulation. Mohammed and Abubakar (2021) observed that technology adoption significantly improved farmers' ability to acquire livestock and expand household assets. The strong correlation with number of wives reflects traditional indicators of wealth and social status in many rural Nigerian communities, where increased income allows farmers to expand household size. Overall, the positive and significant correlations across all indicators demonstrate that adoption of SG 2000 technologies had a profound and wide-ranging impact on farmers' productivity, income, asset ownership, and overall living standards. These findings confirm that SG 2000 technologies are not only effective in increasing maize output but also play a critical role in improving rural livelihoods and wealth accumulation among smallholder farmers.

Factors Influencing Adoption of the Technology among Respondents

The regression analysis as presented in Table 5 revealed that, several socio-economic characteristics significantly influenced the adoption of recommended SG 2000 maize production technologies among respondents in the study area. The constant term was positive and statistically significant, indicating that, even in the absence of explanatory variables, there is a baseline tendency for farmers to adopt SG 2000 technologies. This suggests that the program itself has an inherent appeal or perceived benefit among farmers in the study area.

Occupation (3.585) had a positive and statistically significant effect on adoption, indicating that respondents whose primary occupation was farming or agriculture-related activities were more likely to adopt SG 2000 technologies. This suggests that farmers who depend primarily on agriculture for their livelihood have stronger incentives to adopt productivity-enhancing technologies. Oladele and Kolawole (2013) similarly found that full-time farmers were more responsive to agricultural innovations than part-time farmers, as their income and food security depend largely on farm performance. Farm size (3.913) was positively and significantly related to adoption, implying that farmers with larger land holdings were more likely to adopt SG 2000 technologies. Larger farm sizes may allow farmers to experiment with new technologies on part of their land without risking total crop failure. In addition, larger farms are often associated with better access to capital and inputs. Onyeneke



(2017) and Uchemba *et al.* (2020) both reported that farm size is a strong determinant of technology adoption in Nigeria, as larger farms can better absorb the risks and costs associated with new technologies.

Table 5: Factors Influencing the Adoption of Recommended Maize Production Technologies of SG 2000

Variables	B	Std. Error	Beta	T	Sig.
Constant	3.499	.959		3.648	.000
Age	.020	.028	.101	.694	.489
Sex	.151	.538	.020	.280	.780
Marital Status	-.704	.326	-.162	-2.163	.032**
Education levels	.132	.188	.045	.705	.482
Household size	-.075	.028	-.253	-2.709	.007**
Occupation	.506	.141	.238	3.585	.000***
Farming Exp	-.025	.024	-.142	-1.049	.296
Farm size	.449	.115	.311	3.913	.000***
Income	-3.322E-6	.000	-.102	-1.436	.153
Member of cop	2.433	.367	.410	6.630	.000***

Source: Field Survey, 2024 ***, **Significant at 1% and 5%

Membership of cooperative societies (6.630) had the strongest positive and highly significant influence on adoption. This finding underscores the critical role of farmer organizations in facilitating technology adoption. Cooperative members often enjoy better access to information, extension services, credit facilities, and subsidized inputs, all of which enhance adoption. Umeh and Chukwu (2015) found that cooperative membership significantly increased farmers' likelihood of adopting improved technologies due to collective learning and shared resources. Similarly, Mohammed and Abubakar (2021) emphasized that cooperatives serve as effective platforms for disseminating agricultural innovations in rural Nigeria.

Marital status (-2.163) had a negative and statistically significant coefficient, indicating that married farmers were less likely to adopt SG 2000 technologies compared to unmarried farmers. This finding contradicts a priori expectations, as marriage is often associated with greater household responsibility, which could motivate adoption to increase income. However, the result may reflect the higher risk aversion and financial obligations faced by married farmers, who may be more cautious about adopting new technologies that require additional inputs or investment. Uchemba *et al.* (2020) similarly observed that household responsibilities could reduce farmers' willingness to experiment with new technologies due to fear of failure and income loss.

Household size (-2.709) was also found to have a negative and significant influence on adoption. This implies that an increase in household size reduces the likelihood of adopting SG 2000 technologies. Although larger households are often expected to provide more family labor, this result suggests that increased consumption pressure in large households may divert resources away from investment in improved technologies. Onyeneke (2017) noted that while household labor can facilitate adoption, very large households often face financial strain, which discourages investment in improved production practices. This finding therefore highlights the trade-off between labor availability and household consumption needs.

Constraints Affecting Adoption of the Technology in the Study Areas

The factor analysis results as presented in Tables 6 and 7 categorizes the constraints affecting adoption of SG 2000 technologies into three major factors, namely high, moderate, and low constraints. The Kaiser-Meyer-Olkin (KMO) value of 0.772 indicates sampling adequacy, while Bartlett's Test of Sphericity was significant ($\chi^2 = 711.871$, $p < 0.01$), confirming the suitability of the data for factor analysis. Factor 1, which represents the most severe constraints, included poor road access and transport facilities (0.757), pilfering and theft (0.741), high incidence of pests and diseases (0.737), inadequate credit facilities (0.691), high cost of farm inputs (0.675), insufficient rainfall (0.648), inadequate storage facilities (0.565), and inadequate extension and farm advisory services (0.579). These constraints cut



across infrastructural, financial, environmental, and institutional dimensions, indicating that adoption challenges are multidimensional in nature. Anumudu *et al.* (2020) reported that poor rural infrastructure and limited access to credit significantly reduced farmers’ ability to adopt improved technologies across several crops in Nigeria.

Poor road access and transport facilities limit farmers’ access to input markets and output markets, increasing transaction costs and reducing profitability. Osuafor *et al.* (2020) noted that inadequate rural infrastructure discourages farmers from adopting technologies that require timely access to inputs and markets. Similarly, inadequate credit facilities and high input costs restrict farmers’ purchasing power, making it difficult to invest in SG 2000 technologies. Uchemba *et al.* (2020) emphasized that lack of affordable credit remains one of the most critical barriers to technology adoption among smallholder farmers.

Table 6: Constraints Faced by Maize Farmers in SG 2000 Technology Adoption

KMO and Bartlett's Test			
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.			.772
Bartlett's Test of Sphericity	Approx. Chi-Square		711.871
	Df		45
	Sig.		.000

Source: Field Survey, 2024

Table 7: Distribution of Respondents According to their Constraints

Variables	Factor 1	Factor 2	Factor 3
Poor road access and transport facilities	.757		
Pilfering /theft	.741		
High incidence of pests and diseases	.737		
Limited farm land			-.501
Inadequate credit facilities	.691		
High cost of farm inputs	.675		
Insufficient rainfall	.648		
Inadequate storage facilities	.565		
Inadequate extension and farm advisory services	.579		
Inadequate market information		.726	

Source: Field Survey, 2024

Environmental constraints such as insufficient rainfall and high incidence of pests and diseases also featured prominently under Factor 1. These constraints increase production risk and uncertainty, discouraging farmers from adopting technologies that may not perform well under adverse climatic conditions. Adamu and Yakubu (2021) identified pests, diseases, and climate variability as major threats to maize production and technology adoption in Nigeria.

Factor 2 consisted mainly of inadequate market information (0.726), indicating that limited access to price and market information moderately constrained adoption. Lack of market information reduces farmers’ ability to make informed decisions regarding production and sales, thereby weakening the incentive to adopt improved technologies. Anumudu *et al.* (2020) found that farmers with poor access to market information were less likely to adopt improved technologies due to uncertainty about profitability. Factor 3 included limited farm land (−0.501), which was categorized as a low-level constraint. Although land scarcity was not as severe as other constraints, it still affects farmers’ capacity to expand production and adopt technologies that require scale. Osuafor *et al.* (2020) similarly noted that land fragmentation limits technology adoption, particularly among smallholder farmers.

CONCLUSION AND RECOMMENDATIONS

The study concluded that adoption of Sasakawa Global (SG 2000) had a significant impact on productivity, income and overall welfare of the respondents in the study area. Also, adoption of SG2000



production technologies were influenced by marital status, household size, occupation, farm size and membership of cooperative societies. In addition, the adoption of SG2000

Based on the findings of this study, the following recommendations were made;

- i. Farmers in the study area should intensify the strengthen of existing cooperatives and encourage more farmers to join.
- ii. Government and development partners should prioritize investment in improving rural road networks and transportation facilities to reduce post-harvest losses and enhance market access for maize farmers.
- iii. Cooperatives should provide adequate access to credit and inputs

REFERENCES

- Abebe, A., & Bekele, A. (2023). Modeling the adoption of agricultural technologies: A review of theoretical and empirical approaches. *Technology in Society*, **72**: 102–115.
- Adamu, S., and Yakubu, B. (2021). Adoption of improved maize varieties and practices in Northeast Nigeria. *Journal of Agricultural Science*, **13**(2): 1–10.
- Adebayo, S. A., Olaniyi, O. A., and Saliu, J. O. (2020). Impact of Sasakawa Global 2000 (SG 2000) technologies on maize production in Oyo State, Nigeria. *Journal of Agricultural Extension and Rural Development*, **12**(4): 162–171.
- Adesina, A. A., and Baidu-Forson, J. (1995). Farmers' perceptions and adoption of new agricultural technology: Evidence from Burkina Faso and Guinea, West Africa. *Agricultural Economics*, **13**(1): 1–9.
- Adnan, N., Nordin, S. M., & Anwar, A. (2021). Adoption of sustainable agricultural practices among smallholder farmers: A systematic review. *Journal of Cleaner Production*, **285**, 125–138.
- Anumudu, C., Madu, R., and Okeke, P. (2020). Analysis of market information as a barrier to productivity among maize farmers in Anambra State, Nigeria. *International Journal of Agricultural and Rural Development*, **23**(1): 1–12.
- Aref, F. (2011). Farmers' participation in agricultural development: The case of Marvdasht County, Iran. *Journal of Agricultural Science and Technology*, **13**(2): 273–286.
- Bello, M., Sani, U., and Muhammad, L. (2022). Farmers' perception of climate change and its effect on crop production in Northern Nigeria. *Journal of Sustainable Agriculture and Environment*, **25**(2): 1–10.
- Duflo, E., Kremer, M., and Robinson, J. (2011). Nudging farmers to use fertilizer: Theory and experimental evidence from Kenya. *American Economic Review*, **101**(6): 2350–2390.
- Eicher, C. K., and Rukuni, M. (2003). The case of Sasakawa Global 2000. In *Agricultural extension in Africa*. World Bank/IFPRI.
- FAO, IFAD, UNICEF, WFP, and WHO. (2019). The state of food security and nutrition in the world. Food and Agriculture Organization.
- Feder, G., Just, R. E., and Zilberman, D. (1985). Adoption of agricultural innovations in developing countries: A survey. *Economic Development and Cultural Change*, **33**(2): 255–298.
- Federal Ministry of Agriculture and Rural Development (FMARD). (2015). Annual report on agricultural development programmes. FMARD.
- Food and Agriculture Organization (FAO). (2018). Maize: World production and trade statistics. FAO.
- Foster, A. D., and Rosenzweig, M. R. (2010). Microeconomics of technology adoption. *Annual Review of Economics*, **2**(1): 395–424.
- Garba, M. M., and Bello, A. A. (2020). Effects of farming experience on the adoption of improved rice varieties in Kano State, Nigeria. *Journal of Agricultural Economics and Development*, **9**(3): 88–100.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis* (8th ed.). Cengage Learning.
- Hall, A., Mytelka, L., and Oyeyinka, B. (2014). Innovation systems: Concepts and implications for agricultural research policy and practice. *ILAC Brief*, **2**, 4.



- International Food Policy Research Institute (IFPRI). (2020). Global food policy report: Resilient food systems. IFPRI.
- Jamilu, M. M., Muhammad, A. B., and Yahaya, S. M. (2014). The role of Sasakawa Global 2000 (SG 2000) on maize production in Bauchi State, Nigeria. *International Journal of Research in Agriculture and Food Sciences*, **2**(1): 1–10.
- Kassem, H. S., Mahdi, Y. J., and El-Hassan, A. K. (2021). Perceived barriers to educational participation among small-scale farmers in Northern Nigeria. *Journal of Agricultural Education and Extension*, **27**(2): 195–209.
- Kassie, M., Jaleta, M., Shiferaw, B., Mmbando, F., and Mekuria, M. (2013). Adoption of interrelated sustainable agricultural practices in smallholder systems: Evidence from rural Tanzania. *Technological Forecasting and Social Change*, **80**(3): 525–540.
- Lawal, A. R., Adebayo, S. A., and Ogunleye, K. Y. (2023). Adoption of pest and disease control measures among maize farmers in Southwest Nigeria. *Journal of Agricultural Extension*, **27**(3): 45–56.
- Midingoyi, S. G., Kassie, M., & Muriithi, B. (2021). Do farmers' socioeconomic characteristics determine the adoption of agricultural technologies? A meta-analysis. *Agricultural Economics*, **52**(4), 603–620.
- Mohammed, M., and Abubakar, A. (2021). Socio-economic factors influencing rice production among smallholder farmers in Kebbi State, Nigeria. *International Journal of Agricultural Sciences*, **11**(3): 1–10.
- Mohammed, S., Abubakar, M., and Ibrahim, A. (2022). Effect of plant spacing on maize yield in the Sudan savanna zone of Nigeria. *Journal of Agronomy and Crop Science*, **28**(4): 210–220.
- Musa, A. G., and Mwangi, M. (2008). Indigenous knowledge and agricultural innovation: The case of maize farmers in Plateau State, Nigeria. *Journal of Agricultural Extension*, **12**(1): 1–10.
- Nnadi, F. N., and Akwiwu, C. D. (2008). Agricultural extension and technology transfer in Nigeria: A review of Sasakawa Global 2000 programme. *Journal of Agricultural Extension*, **12**(2): 45–54.
- Odiana, S., and Ibrahim, M. A. (2015). An assessment of the evidence of climate change in Bauchi, Nigeria. *Journal of Applied Sciences and Environmental Management*, **19**(3): 375–381.
- Ogundele, A. A., & Okoruwa, V. O. (2022). Adoption intensity and welfare impacts of improved cassava technologies in Nigeria. *Journal of Agricultural Extension*, **26**(2): 45–58.
- Ogutu, S. O., & Qaim, M. (2019). Commercialization of the small farm sector and multidimensional poverty. *World Development*, **114**: 281–293.
- Oladele, O. I., and Kolawole, T. G. (2013). Socio-economic factors influencing rice technology adoption in Ogun State, Nigeria. *Journal of Agricultural Science*, **5**(1): 1–9.
- Onyeneke, R. U. (2017). Analysis of determinants of maize yield in Imo State, Nigeria. *Journal of Agricultural Science*, **9**(3): 15–26.
- Osuafor, A. M., Okoye, E. C., and Obinwa, E. A. (2020). Assessment of post-harvest handling practices of maize farmers in Anambra State, Nigeria. *Journal of Agricultural Science and Food Technology*, **6**(4): 105–115.
- Oyewole, S. O., and Kehinde, A. L. (2016). Assessment of Sasakawa Global 2000 agricultural extension programme in Jigawa State, Nigeria. *Journal of Agricultural Extension*, **20**(1): 1–10.
- Poulton, C., and Macartney, J. (2012). Can public–private partnerships leverage private investment in agricultural value chains in Africa? *World Development*, **40**(1): 96–103.
- Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.
- Sadiq, M. S., Usman, A., and Bello, M. (2021). Impact of improved maize varieties adoption on household income in Kaduna State, Nigeria. *Journal of Agricultural Economics and Rural Development*, **7**(2): 112–125.
- Sasakawa Africa Association (SAA). (2015). Annual report: Promoting sustainable agricultural development in Africa. SAA.
- Sasakawa Global 2000. (2016). Technical bulletin on smallholder farmer field demonstrations. SAA/SG 2000 Nigeria.



Nigerian Journal of Agriculture and Agricultural Technology (NJAAT)
Volume 6, Number 1B, March 2026
ISSN (Print): 2811-1885; ISSN (Online): 2811-1893



- Spielman, D. J., Hartwich, F., and von Grebmer, K. (2010). Public–private partnerships in agricultural research: An analysis of challenges facing industry. Environment and Production Technology Division Discussion Paper No. 113. International Food Policy Research Institute.
- Sulaiman, V. R. (2013). Enhancing small-scale farmers' participation in agricultural development programmes. *Journal of Agricultural Extension*, **17**(2): 1–13.
- Taherdoost, H. (2017). Determining sample size; how to calculate survey sample size. *International Journal of Economics and Management Systems*, **2**, 237–239.
- Uchemba, O. N., Amu, E. M., and Ogochukwu, D. N. (2020). Determinants of technology adoption among smallholder farmers in Nigeria. *International Journal of Agricultural Extension and Rural Development Studies*, **8**(1): 12–25.
- Umeh, G. N., and Chukwu, O. C. (2015). Determinants of rice technology adoption among farmers in Abia State, Nigeria. *International Journal of Agricultural Economics and Extension*, **3**(2): 5–14.
- World Bank. (2017). World development report: Agriculture for development. International Bank for Reconstruction and Development / The World Bank.