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Predictors of Agricultural Technology Adoption Among the Cassava Farmers in the North- Central Nigeria

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ABSTRACT: *This research paper delves into the underexplored realm of agricultural technology adoption behaviour among cassava farmers in North Central Nigeria, with a focus on elucidating the predictors of technology adoption within the region. Leveraging a quantitative survey research design, data was collected from 377 cassava farmers through structured questionnaires. Findings reveal significant relationships between various factors such as performance expectancy, effort expectancy, social influence, facilitating conditions, price value, hedonic motivation, prior experience, and the adoption of agricultural technology. Through multiple linear regression analyses, it was established that these factors exert substantial influences on technology adoption behaviour among cassava farmers. Based on empirical evidence, policy recommendations were formulated to enhance the adoption of agricultural technologies among cassava farmers, aiming to foster a transition from subsistence to commercial farming, thereby bolstering agricultural productivity and socio-economic development in the region. These recommendations encompass governmental support for improved cassava seedlings, duty-free importation of agricultural implements, procurement and distribution of tractors, expansion of extension services, fertilizer production facilities, subsidized procurement of agricultural machinery, and enhanced importation policies for agro-chemicals. This research contributes to a deeper understanding of the complex dynamics underlying technology adoption in agricultural contexts, offering insights for policymakers, practitioners, and researchers alike.*

KEYWORDS: agricultural technology adoption, performance expectancy, effort expectancy, social influence, facilitating conditions, price value, hedonic motivation, prior experience, cassava farmers, Nigeria.

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INTRODUCTION

The rapid expansion of the internet has transformed various business sectors, leading to the emergence of terms such as e-learning, e-government, e-banking, and e-commerce. More recently, this digital transformation has extended to agriculture, termed as e-agriculture (Oni, Idemudia & Odusote, 2017). Adeyemo (2013) defines agricultural technology as the design, development, conceptualization, application, and evaluation of innovative ways to utilize emerging Information and Communication Technologies (ICTs) in remote agricultural environments. In Nigeria, agriculture is a pivotal sector, engaging nearly 70% of the labor force and contributing over 40% to the gross domestic product (Koyenikan, 2008; FMARD, 2015). Furthermore, it serves as the primary source of income for approximately 2.5 billion people in the developing world (Koyenikan, 2008).

Over the years, the agricultural sector in Nigeria has witnessed various transformations under different governmental regimes, encompassing initiatives such as Operation Feed the Nation and the Green Revolution. The most recent initiative, the Agricultural Transformation Agenda (ATA) launched in 2015 by the Federal Ministry of Agriculture and Rural Development (FMARD), distributed mobile phones to grassroots farmers to foster e-agriculture. This initiative represented a significant shift in technological access for farmers. Despite an initial lack of familiarity with the concept of e-agriculture among farmers, its convenience, particularly in the delivery of fertilizers and agricultural implements, has facilitated its gradual acceptance. Nevertheless, awareness and utilization of platforms such as the National Information Technology Development Agency (NITDA) e-portal for e-agriculture remain relatively limited among farmers (NITDA, 2015).

In the context of sub-Saharan Africa, where over half of the population lives on less than one US dollar ($1) per day, the adoption of agricultural technology holds considerable promise for addressing socio-economic challenges, particularly in countries like Nigeria (Adeyemo, 2013). Potential benefits of technology adoption include enhanced income, poverty alleviation, improved national nutrition and health, reduced food prices, and employment generation. The adoption of technology in agriculture is influenced by factors such as farmers' educational levels, access to relevant information, and social networks (Lavison, 2013; Mwangi and Kariuki, 2015).

Efforts to promote technology adoption in agriculture include initiatives such as the proposed Agricultural Information Dissemination System (AgrIDS) in Australia, which aims to provide expert information to grassroots farmers. However, challenges such as limited access to resources and expertise persist, especially in regions like the Middle Belt of Nigeria, where essential technologies are often inaccessible to ordinary farmers (Ward, 2017). The prevalent use of mobile phones in Nigeria offers an opportunity for the acceptance and adoption of e-agriculture initiatives, such as the distribution of fertilizers and seedlings via SMS by the Ministry of Agriculture. This not only enhances transparency and accountability but also contributes to increased agricultural output and economic growth (Newswatch, 2015). Despite the current dominance of corporate

farmers in e-agriculture initiatives, there is potential for broader participation, including small-scale farmers, through improved access to information and resources (NITDA, 2015). Farmers' attitudes towards adopting agricultural technology vary, with some expressing reservations due to personal factors.

While there exists a plethora of literature on technology adoption behavior, studies focusing on farmers' adoption of agricultural technology in a typical developing economy like Nigeria are scant, particularly in the North Central region, which is considered the food basket of the nation. This study seeks to fill this gap by exploring the predictors of agricultural technology adoption behavior among cassava farmers, given that cassava is one of the most consumed agricultural products in Nigeria. The study's significance lies in its exploration of the predictors influencing cassava farmers' adoption of agricultural technology in the North-Central region of Nigeria. Cassava is a staple food in Nigeria, and understanding the factors that influence its production through technological adoption is crucial for enhancing agricultural productivity, improving food security, and fostering economic development. Furthermore, this research seeks to apply the Unified Theory of Technology Adoption in the context of agricultural marketing, which is an under-researched area. By doing so, the study contributes to bridging the existing literature gap and provides valuable insights for agricultural marketers, policymakers, agricultural extension agents, and other stakeholders to formulate effective strategies to promote the adoption of agricultural technology among cassava farmers.

Objective of the Study

The broad objective of this study is to empirically examine the predictors of agricultural technology adoption behaviour among Cassava farmers in North-central region of Nigeria. Specifically, the study seeks to investigate the nexus between effort expectancy, performance expectancy, hedonic motivation, social influence, facilitating conditions, price value, prior experience and agricultural technology adoption behaviour.

REVIEW OF RELATED LITERATURE

Adoption of Technology

Various authors have offered differing definitions of adoption. Loevinsohn et al. (2012) characterized adoption as "the integration of a new technology into existing practice, usually preceded by a period of 'trying' and adaptation." Conversely, Bonabana-Wabbi (2002) referenced Feder, Just, and Zilberman (1985), who defined adoption as "a mental process an individual passes from first hearing about an innovation to final utilization of it." Feder et al. (1985) further elaborated on adoption, describing it as "the integration of an innovation into farmers' normal farming activities over an extended period." These definitions emphasize the practical implementation of technology over time. Discontinuation of adoption may occur due to personal, institutional, or social factors, or the availability of superior alternatives (Dasgupta, 1989).

Feder et al. (1985) categorized adoption into "individual adoption" and "aggregate adoption." Individual adoption refers to the long-term utilization of a new technology by farmers when they possess full information about its potentials. Aggregate adoption, on the other hand, considers diffusion and time factors, defining diffusion as "the spread of a new technology within a region." Rogers (1983) further elaborated on diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system." These definitions underscore the temporal aspect and communication channels involved in the adoption process.

Melesse (2018) summarized paradigms introduced by various authors, including the innovation diffusion model, adopters' perception, and economic constraints models. The innovation diffusion model assumes technology appropriateness but highlights asymmetric information and high search costs as adoption barriers. Adopters' perception emphasizes how individual evaluations of technology attributes influence adoption decisions. The economic constraint model posits that resource availability, such as credit, land, and labor, affects adoption. Melesse (2018) argues for a collective approach integrating these paradigms to better understand the adoption process.

Acceleration of innovation diffusion from research programs requires knowledge of underlying adoption factors (Udensi et al., 2012). Facilitating technology adoption remains crucial for agricultural development (Dissanayake et al., 2022). Adoption of improved agricultural technologies by smallholders is essential for poverty alleviation, as it increases productivity and income, thus fostering economic growth and market opportunities (Tesfamichael et al., 2017). Despite the availability of time-saving technologies like cassava harvesters and stem cutters in countries like Brazil and China, their adoption in key cassava-producing regions in Sub-Saharan Africa remains limited (Muinga & Marechera, 2018).

Hypotheses Development

Performance expectancy and Agricultural Technology Adoption

Performance Expectancy (PE) refers to the user's belief that utilizing a system will enhance their job performance (Venkatesh et al., 2003). In essence, individuals are more inclined to adopt new technologies when they perceive that doing so will improve their work efficiency.

Venkatesh et al. (2003) synthesized five concepts from various models into the construct of performance expectancy: perceived usefulness, extrinsic motivation, job-fit, relative advantage, and outcome expectations. Perceived usefulness, introduced by Davis (1986) in the Technology Acceptance Model and adapted by Taylor and Todd (1995) in the C-TAM-TPB, aligns closely with the definition of performance expectancy. It reflects an individual's perception of the system's potential to enhance job performance (Davis, 1986; Taylor & Todd, 1995). Extrinsic motivation, as delineated by Davis et al. (1992), pertains to external incentives such as rewards or punishments, like salary increases, grades, or promotions, driving individuals to engage in certain activities. Job-fit, as a third concept, underscores the belief that adopting a new technology will yield job performance gains (Thompson et al., 1991). Relative advantage, elucidated by Rogers (1995),

measures the extent to which individuals perceive new technology as superior to previous ones. Bandura (1986) introduced outcome expectations in his Social Cognitive Theory, distinguishing between performance-related and personal-related outcomes, such as self-esteem. Various researchers have acknowledged the interrelation and significance of these concepts (Davis, Bagozzi, & Warshaw, 1989; Plouffe, Hulland, & Vandenbosch, 2001).

The relationship between performance expectancy and the intention to use or the actual use of new technologies in healthcare settings has garnered significant research attention. Studies encompass a wide array of techniques or technologies, from electronic medical records to robotic-assisted surgery (Arman & Hartati, 2015; Ben Messaoud, Kharrazi, & MacDorman, 2011). The majority of these studies hypothesize that performance expectancy influences IT acceptance in healthcare organizations, with most finding supportive evidence (Phichitchaisopa & Naenna, 2013; Vander Vaart, Atema, & Evers, 2016). However, some researchers have failed to detect a statistically significant effect of performance expectancy on behavioral intention or actual use (Schaperen, Pervan, 2007; Vanneste, Vermeulen, & De Clercq, 2013). Devolder et al. (2012) discovered that the Unified Theory of Acceptance and Use of Technology (UTAUT) predictions varied across different subgroups, suggesting the need for tailored approaches. Thus, we hypothesize as follows:

Ho1: Performance expectancy does not exert a positive and significant effect on agricultural Technology Adoption Behavior.

Effort Expectancy and Agricultural Technology Adoption Behaviour

The second concept, effort expectancy, can be defined as "the degree of ease associated with the use of the system" (Venkatesh et al., 2003). Similar to performance expectancy, Venkatesh et al. (2003) incorporated three constructs from other models into this concept, namely perceived ease of use, complexity, and ease of use. Perceived ease of use, derived from the Technology Acceptance Model (Davis, 1986), pertains to an individual's perception that using the new technology will be effortless. The second integrated concept in effort expectancy, complexity of the MPCU (Thompson et al., 1991), refers to the perceived difficulty of using a system. Ease of use, as the final concept, is a fundamental construct of the Innovation Diffusion Theory (Rogers, 1995), with its definition being almost identical to that of complexity. Complexity concerns a general system, whereas ease of use focuses on an innovation (Venkatesh et al., 2003).

The hypothesis that effort expectancy positively influences the behavioral intention to use, as well as the actual use of a technique or technology, has been consistently formulated in previous studies (Arman & Hartati, 2015; Chang, Hwang, Hung, & Li, 2007; Phichitchaisopa & Naenna, 2013). While most researchers found support for this relationship (Chang et al., 2007; Phichitchaisopa & Naenna, 2013), others concluded that effort expectancy had no significant influence (Arman & Hartati, 2015; Bennani & Oumlil, 2013). Arman and Hartati (2015) suggest that sample characteristics could explain this discrepancy. Approximately 70% of the participants were under the age of 50, and 67% were experienced specialists. As age and experience both moderate the

effect of effort expectancy (Arman & Hartati, 2015; Venkatesh et al., 2003), they might have influenced the outcomes. Based on the foregoing, we hypothesized as follows:

Ho2: Effort expectancy does not impact a positive and significant effect on the adoption of agricultural technology among cassava farmers.

Social influence and Agricultural Technology Adoption Behaviour

According to the UTAUT, social influence is the third determinant of individuals' intention to adopt new technology (Venkatesh et al., 2003). It includes subjective norm, social factors, and image, all emphasizing the impact of the social environment on behavior (Venkatesh et al., 2003). Researchers often investigate its positive effect on technology adoption, but findings vary (Arman & Hartati, 2015; Chang et al., 2007; Phichitchaisopa & Naenna, 2013). Social group membership significantly correlates with technology adoption (Benedito, 2009). Belonging to such groups enhances social capital, facilitating information exchange (Mignouna et al., 2011). Social networks play a crucial role in agricultural innovation adoption (Uaiene et al., 2009). Household members' support for innovation can also influence adoption (FAO, 1994). Based on this, the hypothesis proposed is:

Ho3: Social Influence does not have a positive and significant effect on Agricultural Technology Adoption Behavior.

Facilitating Condition and Agricultural Technology Adoption Behaviour

Facilitating conditions encompass consumers' perception of the technical infrastructure available to support technology utilization (Venkatesh, 2012; Yeoh & Chang, 2011; Brown, 2005). In the Unified Theory of Acceptance and Use of Technology (UTAUT), facilitating conditions are posited to influence technology adoption. Thus, we propose the following hypothesis:

Ho4: Facilitating conditions do not have a positive and significant effect on Agricultural Technology Adoption Behavior.

Hedonic Motivation and Agricultural Technology Adoption Behaviour

Hedonic Motivation is delineated as "the enjoyment or pleasure derived from utilizing a technology" (Venkatesh & Thong, Xu, Brown, 2012). Previous investigations into technology acceptance have highlighted its pivotal role in determining technology adoption (Brown & Venkatesh, 2005). Building upon this premise, we posit the following hypothesis:

Ho5: Hedonic motivation does not exert a positive and significant influence on Agricultural Technology Adoption Behavior.

Nexus Between Price Value and Agricultural Technology Adoption Behaviour

In marketing research, the monetary cost is usually conceptualized together with the quality of products or services (Zeithaml, 1988), we follow these ideas and define price value as consumers' cognitive tradeoff between the perceived benefits of the applications and the monetary cost for

using them (Dodds, 1991). Unlike organizational technologies, individuals pay for the cost of adopting and using a technology or product on their own (Zhou, 2013). On the basis of the foregoing, we hypothesized as follows:

Ho6: Price value has a positive and significant effect on the Agricultural Technology Adoption Behaviour

Prior Experience and Agricultural Technology Adoption Behaviour

When the farmers are already having experience on cultivations in their lands for a longer time, they might have a better understanding of the impact of the problem that the technology is addressing to. Furthermore, the long-term experience will facilitate the farmers in making the best option. Therefore, it might have a positive relationship with positive factors of the technology. But negative experiences with similar technologies will affect negatively on the adoption of the introduced technology. Thus, the level of and proper awareness with regard to the technology introduced is a prominent issue in influencing the adoption of the technology. It is closely associated with the prior experience that the farmer has (Senanayake and Rathnayaka, 2015). Based on the foregoing, we therefore hypothesized as follows:

Ho7: Prior Experience has no positive and significant effect on the Agricultural Technology Adoption Behaviour.

Empirical Review

The empirical review provides a comprehensive examination of various studies pertaining to agricultural technology adoption behavior, encompassing diverse contexts and methodologies. Adirinekso, Purba, and Budiono's (2020) research underscores the influence of performance expectancy, effort expectancy, facilitating conditions, hedonic motives, and habit on technology adoption, with social influence showing no significant impact. Similarly, Nuriska, Asakdiyah, and Setyawan (2018) explored factors influencing behavior intention towards technology adoption, revealing significant effects of habit, facilitating conditions, and price value on the interest in utilizing specific technologies, a finding supported by Siahaan and Legomo (2019).

In the realm of renewable energy technology acceptance, Cheng and Yao (2017) employed the Technology Acceptance Model (TAM) to investigate solar photovoltaic technology acceptance among Malaysian energy consumers, demonstrating significant influences of perceived ease of use, attitude towards use, and perceived usefulness on behavioral intentions. Ahmad, Tahar, Sardianou, and Genoudi (2013) delved into consumers' willingness to adopt renewable energies in the residential sector of Athens, Greece, highlighting the significance of financial incentives and energy subsidies. Similarly, Ntanos et al. (2018) focused on public opinion and willingness to pay for renewable energy sources in Nikaia, Greece, identifying positive relationships between perceived advantages of renewable energy sources and willingness to pay.

Kotilainen and Saari (2018) explored consumers' attitudes towards renewable energy technology adoption across five European countries, revealing the influential role of both economic and non-

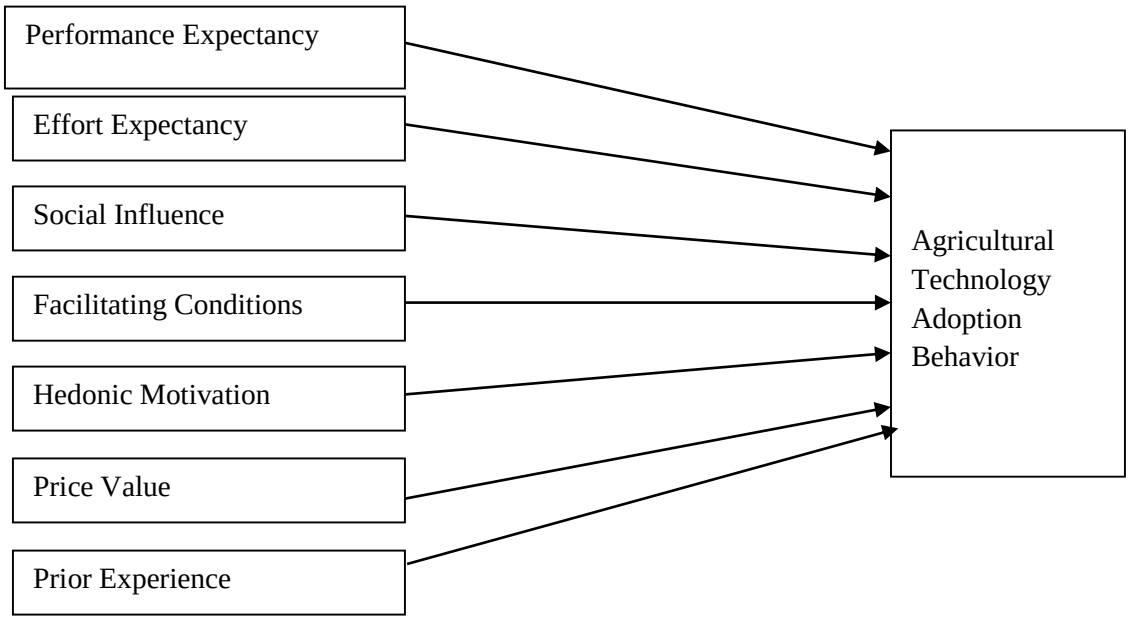
economic policies in shaping consumer attitudes. Komendantova, Yazdanpanah, and Shafiei (2018) investigated the deployment of renewable energy sources among young people in Iran, emphasizing the positive influence of self-rewarding and social outcome expectations on energy transition participation.

Focusing on intentions to adopt renewable energy technologies in Taiwan, Feng (2012) identified innovation acceptance and subjective norm as significant predictors, while Leijten et al. (2014) examined factors influencing consumers' acceptance of future energy systems in the Netherlands, highlighting preferences for self-adjustments over reliance on technology. Zahari and Esa (2016) investigated drivers of renewable energy adoption behavior among residents of Klang Valley in Malaysia, revealing perceived utility and benefit of new technology as influential factors.

In the agricultural domain, studies such as those by Emeoya et al. (2012), Baba et al. (2014), and Adekarami et al. (2022) shed light on the acceptance, adoption, and usage of e-agriculture and improved cassava technologies in Nigeria, emphasizing the significant effects of performance expectancy, effort expectancy, social influence, and habit on technology adoption. Furthermore, research by Baba et al. (2014) and Adekarami et al. (2022) demonstrated the profitability and effectiveness of adopting improved agricultural technologies among farmers in Niger and Ogun States, Nigeria, respectively.

Additionally, institutional arrangements and public investments in agricultural extension services were found to play a crucial role in facilitating technology transfer and adoption among rural farmers, as evidenced by studies conducted in Zimbabwe (Owens et al., 2003), Ethiopia (Dercon et al., 2009), and Nigeria (Abdoulaye et al., 2013; Sodiya et al., 2007). Furthermore, studies by Otubo and Molnar (2021) and Banful et al. (2010) emphasized the importance of farmer-to-farmer technological diffusion and extension messaging in promoting technology adoption and dissemination.

Proposed Research Schema



Source: Researcher's Conceptualisation.

Theoretical Framework

The UTAUT2 model represents an advancement of the original UTAUT framework developed by Venkatesh, Morris, Davis, and Davis (2003). As elucidated by Venkatesh, Thong, and Xu (2012), the primary refinement of the UTAUT2 model is its adaptation to explore technology acceptance within a consumer-oriented context, aiming to provide enhanced precision in delineating user behavior (Venkatesh et al., 2012). The model posits that individual technology usage is influenced by three additional constructs: hedonic motivation, price value, and habit, with government policies serving as the moderator in the context of this study.

The inclusion of hedonic motivation stems from empirical evidence across previous research in technology and marketing domains, indicating that the perceived hedonic aspects, such as enjoyment, significantly predict consumer technology adoption (Brown & Venkatesh, 2005; van der Heyden, 2004). Similarly, the integration of cost considerations, or price value, in the UTAUT2 model is justified by the greater relevance of this factor in consumer product utilization compared to its significance in workplace technology usage scenarios. Unlike organizational settings where users typically bear no direct financial responsibility for technology expenses, cost implications play a more salient role in consumer contexts (Venkatesh et al., 2012).

Furthermore, the introduction of the habit construct demonstrates an alternative theoretical mechanism for understanding technology usage patterns (Bagozzi, 2007). Notably, the UTAUT2 model exhibits robust predictive validity, explaining 74% of the variance in behavioral intention and 52% of the variance in technology use, underscoring its efficacy when applied within the consumer segment.

The documented effects of price value, hedonic motivation, and habit underscore their significance as pivotal drivers of both consumer intentions to use and actual use of technology (Venkatesh et al., 2012). However, in the current study, prior experience is substituted for habit to better align with the research context. Consequently, the UTAUT2 model, as postulated by Venkatesh et al. (2012), assumes relevance in elucidating the determinants of cassava farmers' adoption of agricultural technology in North Central Nigeria.

MATERIALS AND METHODS

This study employed a quantitative survey research design to investigate the relationship between independent and dependent variables within a population. In quantitative survey research, the primary objective is to ascertain the association between variables, with the design categorized as either descriptive or experimental (Michael, Des-Oparaku, & Oparaku, 2012). The present study adopted a descriptive research design.

Quantitative descriptive survey research involves the solicitation of responses through questioning, followed by the collection and analysis of data from a sample purportedly representative of the population of interest, at a single time point. The overarching aim is to assess the prevailing circumstances within the population concerning one or more variables under scrutiny (Okeke, Olise, & Eze, 2008). The questions posed are structured to elicit responses conducive to addressing the research inquiries and fulfilling the research objectives.

Thus, the overarching objective of this research is to evaluate predictors influencing cassava farmers' adoption of agricultural technology in North Central Nigeria, with a specific focus on the moderating influence of government policies. To achieve this, respondents will be selected from among cassava farmers in the North Central region, encompassing the states of Benue, Kwara, Nassarawa, Plateau, Niger, and Kogi. The study population comprises cassava farmers within these six states, as documented by the Federal Ministry of Agriculture, Abuja.

Table: 1 Population of the Study

Benue	1,575,000
Kogi	1,005,000
Kwara	950,000
Plateau	1,600,000
Nassarawa	545,000
Niger	810,000
Total	**6,485,000**

Source: Federal Ministry of Agriculture, Abuja 2021.

The sample size is expected to act as a representative of the whole population. The sample size will be determined using Taro Yamane formula for finite population.

Given as: $n = \frac{N}{1+N(e)^2}$

Where:

n = sample size sought
e = level of significance (0.05)
N = population size
1 = constant

Therefore, we have:

$$n = \frac{6485000}{1 + 6485000(0.05)^2} = \frac{6485000}{1 + 6485000 \times 0.0025}$$

$$= \frac{6485000}{1+16.213} = \frac{6485000}{17.213} = 376.75$$

= 377 sample size.

Sample Allocation

The researcher used Bourley's allocation formula to determine individual geopolitical sample size.

Given: $nh = \frac{Nh \times n}{N}$

Where:

nh = individual allocation sought
n = sample size
Nh = individual population
N = total population

Thus:

Benue: $\frac{1585000 \times 377}{6485000} = \frac{597545}{6485000} = 92$

Kogi: $\frac{1005000 \times 377}{6485000} = \frac{378885}{6485000} = 58$

Kwara: $\frac{950000x377}{6485000} = \frac{358150}{6485000} = 55$

Plateau: $\frac{1600000\times377}{6485000} = \frac{603200}{6485000} = 93$

Nassarawa: $\frac{545000x377}{6485000} = \frac{205465}{6485000} = 32$

Niger: $\frac{810000\times377}{6485000} = \frac{305370}{6485000} = 47$

Total = 92 + 58 +55+ 93 + 32 + 47 = 377

Given the finite and well-defined population with a sampling frame, the researchers employed a stratified random sampling technique. This method was chosen due to the heterogeneous nature of the population across various geographical locations. The population was stratified into homogeneous subsets, delineated by states, followed by the application of a simple random sampling procedure to select respondents from each subset for inclusion in the sample. Proportionate stratified sampling ensured that each state's representation in the sample corresponded to its proportion within the overall population.

The data collection instrument utilized for this study comprised a structured questionnaire with two sections. Section A encompassed personal and demographic inquiries, while Section B constituted the measurement instrument comprising Likert scale items ranging from 1 (strongly disagree) to 5 (strongly agree). All measurement items were gauged using a 5-point scale adapted from prior studies (Chuana, 2011; Kim, Park & Jeong, 2004).

Prior to questionnaire dissemination, content validity was ascertained through the submission of draft copies to the supervisor and several research experts. Additionally, construct validity was established by administering the draft questionnaires to diverse groups with both supportive and opposing perspectives regarding the theory of planned behavior. Responses from these groups informed the refinement of the final questionnaire. Internal consistency (reliability) of the multiple-item scales was assessed using Cronbach's alpha coefficient, with values exceeding 0.70 deemed acceptable, those surpassing 0.80 indicating good reliability, and values exceeding 0.90 considered excellent.

Subsequent to administering the research instrument via random sampling, data collection occurred as scheduled with respondents across the six states of North Central Nigeria (Benue, Kwara, Nassarawa, Plateau, Niger, and Kogi). A total of three hundred and seventy-seven (377) completed questionnaires were anticipated for collection.

For data analysis, both descriptive and inferential statistics were employed. Initially, collected data were organized into grouped frequency distributions. Factor analysis was subsequently conducted for data reduction, aiming to identify key variables capable of absorbing other variables. Any factor loading below 0.5 was eliminated, while those exceeding 0.5 were retained (Hair, Bush & Ortinau, 2006). Multiple Linear Regressions (MLRs) were then employed to assess the significance of the formulated hypotheses. MLRs facilitate the identification of predictors for a specific dependent variable based on statistical criteria, indicating the relative importance of each independent variable in predicting the outcome.

ANALYSIS AND RESULTS

Regression table on the relationship between predictor variables and technology adoption

Table 2 **Model Summary[b]**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.754[a]	.569	.559	.394

a. Predictors: (Constant), govpoliciesperformanceexp, pricevalue, hedonicmot, effortexp, facilitating con, socialinfuence, priorexp
b. Dependent Variable: adoptionbeh

Table 3 **ANOVA[a]**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	64.214	7	9.173	59.210	.000[b]
	Residual	48.648	314	.155		
	Total	112.862	321			

a. Dependent Variable: adoptionbeh
b. Predictors: (Constant), performanceexp, pricevalue, hedonicmot, effortexp, facilitating con, socialinfuence, priorexp

Table 4 Coefficient[a]

Model	Unstandsrdized B	Coefficient. Std Err	Standardized Co-Eff	t	Sig
Constant	.021	.248		.086	.931
Priorexp	.383	.060	.304	6.343	0.000
Hedonic mot	.207	.040	.228	5.115	0.000
Pricevalue	.126	.031	.161	4.033	0.000
Fac.condit	.165	.039	.202	4.198	0.000
Socio Inf	-.096	.030	-.150	-3.026	0.001
Effort Exp	.114	.035	.147	3.211	0.001
Perf Exp	.112	.030	.163	3.396	0.000

Dependent Variable: adoptionbeh
Coefficients[a]

Interpretation

In this study, a regression analysis was employed to investigate the relationship between seven independent variables and the adoption of agricultural technology in North Central Nigeria. The aim was to ascertain the impact of these variables on technology adoption, assess the model's overall fitness using t-tests and probability values, and determine the significance of the independent variables in influencing adoption behavior. The coefficients of each variable were compared to theoretical or economic expectations outlined a priori.

Table 4 presented the parameter estimates, with particular focus on performance expectancy, effort expectancy, social influence, facilitating conditions, price value, hedonic motivation, and prior experience. The positive intercept of the regression line (c = 0.021) indicated a baseline level of technology adoption when all predictor variables were zero.

Results indicated that performance expectancy, effort expectancy, social influence, facilitating conditions, price value, hedonic motivation, and prior experience significantly influenced technology adoption ($p < 0.05$). Notably, the unstandardized coefficients provided insights into the magnitude of impact, while standardized coefficients (Beta) delineated the strength of these relationships.

Furthermore, the F-statistic (59.210, $p = 0.000$) underscored the overall significance of the regression model, leading to the rejection of null hypotheses and the acceptance of alternative hypotheses, which highlighted the substantial impact of the independent variables on technology adoption.

DISCUSSION

The primary objective of this study was to ascertain the influence of various factors on the adoption of technology within the agricultural sector in North Central Nigeria. Each factor was systematically examined, starting with performance expectancy. It was hypothesized that performance expectancy significantly and positively affects technology adoption. The construct was initially assessed using a Likert-scale questionnaire comprising five items. Statistical analyses confirmed the normality and reliability of the data, with significant results obtained from both factor analysis and regression modeling.

The findings revealed a significant relationship between performance expectancy and technology adoption ($p < 0.05$). Specifically, the regression analysis indicated a β coefficient of 0.112 ($t = 3.396$), with all values being statistically significant at $p = 0.000$. Consequently, the null hypothesis (Ho1), positing no significant effect of performance expectancy on technology adoption in North Central Nigeria, was rejected in favor of the alternative hypothesis (HA).

Similarly, subsequent objectives focused on effort expectancy, social influence, facilitating conditions, price value, hedonic motivation, and prior experience. For each construct, hypotheses were formulated regarding their respective impacts on technology adoption. Prior to analyses, the constructs were assessed using Likert-scale questionnaires, and data normality and reliability were established through appropriate statistical tests.

Results from regression analyses consistently demonstrated significant relationships between each construct and technology adoption ($p < 0.05$). Effort expectancy, social influence, facilitating conditions, price value, hedonic motivation, and prior experience all exhibited statistically significant coefficients, supporting their substantial impacts on adoption behavior within the region.

In summary, the study provides robust empirical evidence of the multifaceted determinants of technology adoption in North Central Nigeria. These findings contribute to a deeper understanding

of the factors influencing adoption behavior among agricultural stakeholders and underscore the importance of addressing performance expectancy, effort expectancy, social influence, facilitating conditions, price value, hedonic motivation, and prior experience in promoting technological uptake within the region.

CONCLUSIONS

Based on the empirical findings of this study, several conclusions can be drawn regarding the relationship between various factors and the adoption of agricultural technology in North Central Nigeria. Firstly, it is evident that performance expectancy significantly influences the adoption of agricultural technology within the region. Secondly, the positive impact of effort expectancy on technology adoption is notable.

Thirdly, social influence plays a significant and positive role in shaping the adoption behavior of agricultural technology among stakeholders in North Central Nigeria. Fourthly, facilitating conditions exert a substantial positive effect on technology adoption within the region. Furthermore, the positive and significant relationship between price value and technology adoption underscores the importance of pricing strategies in facilitating adoption processes. Similarly, hedonic motivation emerges as a significant determinant influencing technology adoption behavior among agricultural stakeholders in North Central Nigeria.

Additionally, prior experience is identified as a significant factor contributing to the adoption of agricultural technology within the region. Moreover, it is observed that government policies moderate the relationship between predictors of technology adoption, particularly among cassava farmers. These policies provide essential support, skills, and technical assistance necessary for the advancement of the agricultural sector in North Central Nigeria.

In summation, these conclusions highlight the intricate interplay between various factors and the adoption of agricultural technology in the region, underscoring the significance of addressing performance expectancy, effort expectancy, social influence, facilitating conditions, price value, hedonic motivation, prior experience, and governmental interventions in fostering technological uptake within the agricultural sector of North Central Nigeria.

Recommendations

Based on the comprehensive analysis and conclusions derived from this research, the following policy recommendations are put forth to address the specific objectives aimed at fostering the adoption of agricultural technologies among cassava farmers in the study area. These recommendations are aligned with the overarching goal of facilitating a transition from subsistence cassava farming to commercial cassava farming, thereby enhancing agricultural productivity and socio-economic development within the region.

Government Support for Availability of Improved Cassava Seedlings: Given the confirmed efficacy of improved cassava seedlings in enhancing performance expectancy among respondents, expedited governmental action is advised to ensure their widespread availability to cassava farmers. This proactive measure will contribute to augmenting the production capacity of farmers in the region.

Duty-Free Importation of Sprayers and Parts: Considering the positive reception and effectiveness of sprayers and their components among cassava farmers, it is recommended that the government grant duty-free importation privileges for these agricultural implements. This initiative aims to facilitate easier access and affordability, thereby advancing agricultural productivity.

Procurement and Distribution of Tractors: The utilization of tractors for cassava farming has been shown to bolster social influence and enable large-scale cultivation. In light of this, governmental policies should encompass the procurement and distribution of tractors to agricultural departments at both state and local government levels within the study area. This strategy will enable farmers to readily access and utilize tractors for enhanced productivity.

Expansion of Extension Services: Recognizing the pivotal role of extension services in facilitating the transition to commercial cassava farming, it is imperative to increase the deployment of extension staff to rural areas. These personnel, serving as government agents, will provide crucial training, monitoring, supervision, and dissemination of innovative agricultural practices to cassava farmers, thereby fostering agricultural advancement.

Expansion of Fertilizer Production Facilities: The utilization of fertilizers to augment cassava production serves as a hedonic motivation for farmers. Hence, governmental policies should prioritize the establishment of additional fertilizer production plants across regions with significant cassava production, particularly in North Central Nigeria. This initiative aims to ensure consistent availability of fertilizers to support agricultural productivity.

Subsidized Procurement of Agricultural Machinery: Despite the demonstrated efficacy of agricultural machinery such as cassava planters and harvesters, their high procurement costs pose a barrier to individual farmers. Therefore, it is recommended that government policies focus on subsidizing the procurement and provision of such equipment within the study area. This measure will facilitate their widespread utilization among cassava farmers.

Enhanced Importation Policies for Agro-Chemicals: The substantial contribution of agro-chemicals, including herbicides, to cassava production underscores the importance of facilitating their importation. In this regard, governmental policies should be geared towards increasing import permits for environmentally friendly agro-chemicals. This proactive approach aims to support the paradigm shift towards sustainable cassava production and enhance competitiveness in the global market.

Suggested Areas for Further Studies

In light of the identified limitations, this section offers suggestions for future research endeavors aimed at advancing the existing knowledge base within the literature on agricultural technology

adoption behaviour in Nigeria. The current study was delimited to the six North Central states of Nigeria. Consequently, it is recommended that future research endeavors extend such investigations to encompass the remaining five geopolitical zones within the country. By broadening the geographical scope, researchers can attain a more comprehensive understanding of the adoption of agricultural technologies across diverse regional contexts. Furthermore, it is proposed that the structural model employed in the present study be extrapolated to other agricultural sectors beyond cassava farming. This expansion would serve to validate the efficacy of the model and enable further refinements to enhance its applicability. It is essential to acknowledge the potential divergence in the relevance of measures utilized in the current study's predictors when transposed to different contexts. Thus, researchers should exercise caution in adapting constructs to ensure their appropriateness within alternative agricultural settings. Moreover, future studies should prioritize the analysis of additional variables capable of influencing commercial farming practices. Furthermore, investigating potential moderating factors that may impact the relationship between predictors and the adoption of agricultural technology is warranted. These may encompass contextual factors specific to varying agricultural landscapes and socio-economic conditions. In conclusion, future research endeavors should seek to expand the geographic scope, diversify the agricultural sectors under examination, and explore additional variables and moderating influences pertinent to the adoption of agricultural technology. Through addressing these avenues, scholars can contribute to a more nuanced understanding of agricultural technology adoption behaviour and inform evidence-based policy interventions aimed at enhancing agricultural productivity and sustainability in Nigeria.

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