

Research Article

Factors Influencing the Adoption of Urban Agriculture and Its Effects on Household Food Security in Southwestern Nigeria

Akinsola Temitope Oyeibanji* 

Department of Agricultural Economics, Obafemi Awolowo University, Ile-Ife, Nigeria

Abstract

Given Nigeria's growing population and the rapid rural-to-urban migration, it is crucial to examine various initiatives that can consistently support and improve food security in urban areas. This study examined one of these initiatives, which has proven to be an effective strategy in some areas of the world. Factors influencing the adoption of urban agriculture and its effect on the food security of households were examined in this study. A multi-stage sampling technique was used for data collection among 325 respondents. The analysis was conducted using descriptive statistics, probit, and ordered probit regression models. The descriptive statistics revealed that about 59% of respondents are engaged in urban agriculture. Among the determinants of urban agriculture adoption, age, land ownership, land size, and association membership were observed to positively determine the adoption of urban agriculture, while years of education, access to credit, and income negatively influence its adoption. The ordered probit regression model was used to assess the factors that influence the food security of farming households. Covariates including age and household sizes were found to negatively influence food security. Conversely, gender, education, land ownership rights, land size, credit access, association membership, and urban agriculture positively influence household food security. It was therefore concluded that urban agriculture is an effective means to improve household food security in Southwestern Nigeria. However, increasing awareness and education about the benefits of urban agriculture is crucial, as people often abandon this practice when they have increased access to credit and income. Furthermore, policies toward promoting land ownership and equality in access to resources should be implemented, as this will promote easy participation in urban agriculture.

Keywords

Urban Agriculture, Food Security, Nigeria, Ordered Probit Regression Model

1. Introduction

The alarming situation of food insecurity in Nigeria needs urgent intervention with the rising population of people suffering from chronic food insecurity. Nigeria ranks highly in food insecurity, ranking as the 6th most food-insecure country

out of 113 countries [1]. The country continues to experience a significant increase in the number of people suffering from food insecurity with a 6% rise in statistics between 2023 and 2024 [2]. This situation has become worrisome and of great

*Corresponding author: akinsolaoyebanji@gmail.com (Akinsola Temitope Oyeibanji)

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concern to policymakers and various non-governmental organizations as the population growth continues to increase without a proportionate increase in food production, resulting in many lacking physical and economic access to sufficient, safe, and nutritious food [3]. Consequently, a situation where food demand exceeds supply is commonly experienced with the effect mostly felt in the urban communities due to the concentration of the largest Nigerian population in these areas.

The Nigeria urban centre is experiencing a rapid rural-to-urban migration shift. According to the United Nations [4], about 53% of the Nigerian population currently lives in urban areas, which is expected to rise to 17% in 2050. As rural-to-urban migration intensifies, the need to increase food production is paramount in this region which is known for low agricultural activities. Currently, only 25% of the urban population households are directly or indirectly engaging in agriculture, whereas 80% of the rural households are involved in agricultural practices [5]. This low involvement has resulted in a threat to the sustainability of food security in the urban region, as heavy reliance is placed on the rural community for food supply. Furthermore, volatility in prices of agricultural commodities are experienced in the urban areas due to the high cost incurred in transporting agricultural commodities from the rural areas which serve largely as the major agricultural production region in Nigeria [6, 7]. This makes the need for the adoption of alternatives and sustainable solutions important for urban dwellers. Adopting urban agriculture can be an effective strategy to mitigate these issues.

Urban agriculture entails different forms of agriculture including the production of crops and raising of livestock in the backyard, community gardens, hydroponics, rooftops, and vertical farming in urban and peri-urban centers [8]. Urban agriculture seems to be one of the critical strategies to ensure a local and resilient food supply. Furthermore, it will not only provide a solution for the immediate food insecurity crisis but will also serve as a proactive measure to address the urbanization surge projected to occur in Nigeria in the coming years. Urban agriculture is a sustainable system of farming that increases sources of income among households. However, the choice of its adoption depends on several factors including the availability of space, resources, infrastructure, and knowledge about the production [9]. Additionally, urban agriculture adoption faces challenges related to urban planning and zoning and the need for appropriate policies and regulations to support its development [10].

Although urban agriculture has been a long-term practice that has gained recognition in developing and developed countries, the reasons for its adoption are quite different between these countries. The latter engage in urban agriculture for social purposes and environmental sustainability, while the former mainly practice UA as a means of poverty allevi-

ation, and improving food security [11, 12]. Several empirical studies Poulsen *et al.* [13]; Warren *et al.* [14]; Siegneret *et al.* [15] have been conducted to evaluate the effect of urban agriculture, however, a limited study focused on the impact of urban agriculture on household food security in developing countries including Nigeria. The majority of these empirical studies [14, 15] conducted in this field were systematic reviews. These reviews have further identified the need for an actual study to fill this research gap. In light of this, this study will examine the factors influencing the adoption of urban agriculture and its effect on household food security. This study will also identify areas for improvement to enhance increased participation in urban agriculture..

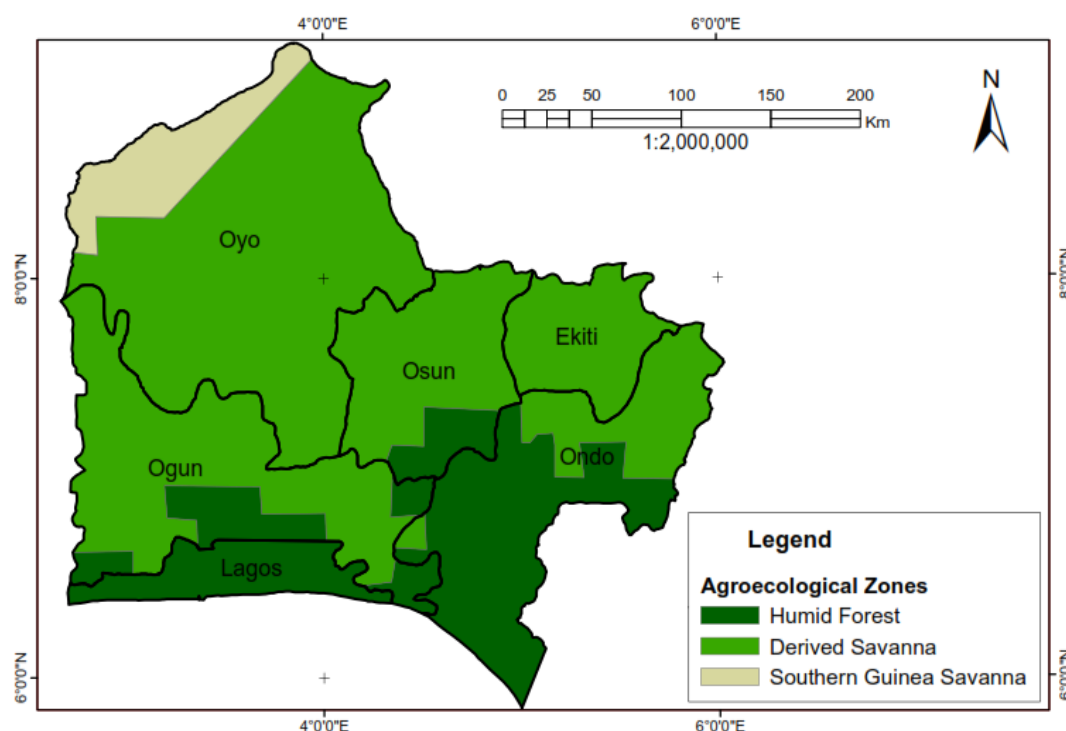
2. Materials and Methods

2.1. Study Area

The study was conducted in the urban areas of Southwestern Nigeria. The Southwestern zones comprises Oyo, Osun, Ondo, Ogun, Ekiti, and Lagos State. The zone is located between the latitude $6^{\circ}21'N$ and $8^{\circ}37'N$, and longitude $2^{\circ}31'E$ and $6^{\circ}00'E$ with a population of about 45 million [16]. The zone has an estimated land area of 77,818 km² and is bounded in the South by the Atlantic Ocean, in the North by Kogi and Kwara States, in the West by the Republic of Benin, and in the East by Edo and Delta States. The weather conditions in the zone vary between distinct seasons with the rainy season occurring between March to November and the dry season from November to February. The temperature ranges between 25 degrees and 35 degrees, while the annual rainfall ranges between 1300mm and 2500mm. the major occupation in in southwestern Nigeria is farming with about 75% obtaining their primary source of income from farming activities [17]. However, agricultural activity is predominantly dominated in the rural areas of this zone.

2.2. Sampling Procedure

A multistage sampling technique was used for the selection of respondents in the study area. A purposive selection of two states (Oyo, and Osun State) from Southwestern Nigeria was done at the first stage. In the second stage, the state capitals of these states were selected due to the high rate of urban migration experienced in these Local Government Areas. The third stage involved the use of a random sampling technique in selecting 150 and 175 respondents from Oyo and Osun States respectively, totaling 325 respondents. However, only 300 contained information needed for conducting the analysis.



Source: Google Map, 2020.

Figure 1. Map of Southwestern Nigeria.

2.3. Analytical Technique

The study employed the use of descriptive statistics, the Household Food Insecurity Access Scale (HFIAS), probit, and ordered probit regression model to analyse the objectives of this study. Descriptive statistics was used to describe the socioeconomic characteristics and profile the food security

status of households who participated and did not participate in urban agriculture.

The Household Food Insecurity Access Scale (HFAIS) was used to assess the food security status among households. The HFAIS was built on 9 questions on the food quality consumed by households in a month. The households are classified into different levels of food insecurity based on their responses to the survey items as shown in [Table 1](#).

Table 1. Occurrence questions for recent food insecurity in your households due to lack of resources/ inadequate food.

Occurrence questions for recent food insecurity in your households due to lack of resources/ inadequate food	No	Rarely	Sometimes	Often
Worry about not having enough food	72	120	96	12
Not able to eat the kinds of foods you preferred	70	38	132	60
Eat a limited variety of foods	80	36	108	76
Eat some foods that you really did not want to eat	84	72	132	12
Eat a smaller meal than you felt you needed	96	84	108	12
Eat fewer meals in a day	100	48	128	24
was there ever no food to eat of any kind	168	36	88	8
sleep at night hungry	240	24	32	4
whole day and night without eating anything	276	12	11	1

The probit regression model was used to analyse the determinants for urban agriculture adoption in Southwestern Nigeria. The adoption of urban agriculture is treated as a dummy variable of 1 for adopters and 0 for non-adopters. The Factors influencing the severity of food insecurity were measured using the ordered probit regression model. This model was used by Hlatshwayo *et al.* [18] in studying the factors influencing household food insecurity. The ordered probit regression model was used due to the categorization of dependent variables into four orders; food secure, mildly food insecure, moderately food insecure, and severely food insecure. The model is specified as.

$$Y_i^* = \beta'X_i + \varepsilon_i$$

Where Y_i^* represents the continuous measure of the severity of food insecurity, β is the parameter estimate, X_i is the vector of the explanatory variables (socio-economics characteristics such as age, gender, education, household size, land ownership, land size, association membership, credit access), and ε_i is the random error term.

Following studies of Hlatshwayo *et al.* [18], the observed and coded discrete food insecurity severity variable, Y^* is determined from the model as follows:

- $Y_i = 0$ if $-\infty \leq Y_i^* \leq \mu_1$ (Food secured)
- 1 if $\mu_1 < Y_i^* \leq \mu_2$ (Mildly to food secured)
- 2 if $\mu_2 < Y_i^* \leq \mu_3$ (moderate to food insecure)
- 3 if $\mu_3 < Y_i^* \leq \infty$ (severely food secured)

where the μ_i represent thresholds to be estimated (along with the parameter vector β).

3. Results and Discussion

3.1. Socioeconomic Characteristics of Households

The socioeconomic characteristics of households in the metropolitan area of Southwestern Nigeria are shown in Table 2. The average age of the household head was 47.91 years, implying that the respondents are still in their productive age. Hence, they are capable of being involved in the tedious task of farming activities. This conforms with the findings of Ikudayi *et al.* [19]. About 41% and 85% of the respondents were male and married respectively. The average household size of the respondents was 5.25, with the household head spending 14.54 years in school. This suggests that household heads are literate, which might positively influence household decision-making, socioeconomic status, and adoption of innovations. In terms of land ownership, 37% of the respondents owned land, while approximately two-thirds had access to land through renting and borrowing. About 63% of the respondents had access to credit, while only 26% and 11% of the respondents had access to extension services and government input support. The majority belonged to an association; this conforms with the findings of Ikudayi *et al.* [19]. In terms of the adoption of urban agriculture, 59% of the households adopted the practice of urban agriculture, and 30% of the respondents are food secure.

Table 2. Socio-economic characteristics.

Variables	Description of variables	Mean	Std. Dev.
Outcome variables			
Urban agriculture adopters	1 for adopters, 0 for non-adopters	0.59	0.49
Food security	1 if food secure, 0 for food insecure	0.30	0.47
Independent variables			
Age	Age of the HH head (years)	47.81	8.36
Gender	1 if HH head is male, 0 if female (dummy)	0.41	0.49
Marital status	1 if the household head is married, 0 if otherwise (dummy)	0.85	0.36
Household size	Number of people living in the household (count)	5.25	1.94
Years spent in school	Number of years spent in school	14.54	7.23
Land ownership	Type of land ownership, 1 if owned, 0 if rented	0.37	0.48
Access to credit	1 if HH head has credit access, 0 if otherwise	0.63	0.48
Access to extension	1 if HH head has access, 0 if otherwise	0.26	0.44
Cooperative membership	1 if the HH head has access, 0 if otherwise	0.63	0.48
Access to Information	1 if the HH head has access, 0 if otherwise	0.93	0.26

Variables	Description of variables	Mean	Std. Dev.
Access to government input support	1 if the HH head has access, 0 if otherwise	0.11	0.31
Access to good road networks	1 if the HH head has access, 0 if otherwise	0.56	0.50

3.2. Analysis of Food Insecurity Occurrence by Household Characteristics Using HFIAS Categories

The analysis of occurrence of household food insecurity is shown in Figure 2 using the Household Food Insecurity Access Scale (HFIAS). The scale classifies respondents into four categories; food secure, mildly food insecure, moderately food insecure, and severely food insecure. Only 37.7% and 22.2% of the adopters and non-adopters of urban agriculture respectively were food secure. This implies that adopters of urban agriculture were more food secure than the

non-adopters. The findings further showed that about 50.3% and 12% of adopters were mildly and moderately food insecure, while 22.2% and 44.4% of non-adopters had mild and moderate food insecurity respectively. Severe food insecurity was exclusively observed among the non-adopters, accounting for 11.1%. The findings in Figure 2 reveal that while both the adopters and non-adopters had relatively low food security, the majority (78%) of UA adopters fall between the categories of food secure and mildly food insecure. In contrast, the majority (55.5%) of the non-adopters fall between moderately and severely food insecure.

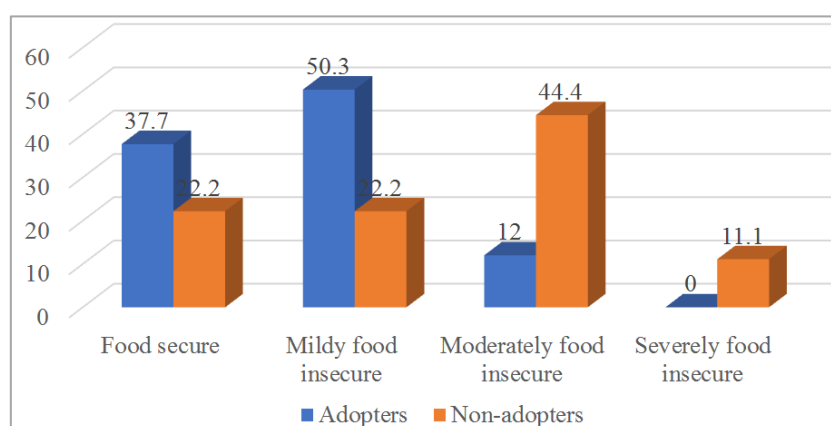


Figure 2. Food security status of the adopters and non-adopters of urban agriculture.

3.3. Factors Influencing the Adoption of Urban Agriculture

Table 3 reveals the determinants of urban agriculture adoption. Variables including age, land ownership, land size, and association membership were found to positively determine the adoption of urban agriculture, while years of education, access to credit, and income negatively influence UA adoption. The marginal effect further showed gender to have a positive and significant influence on the adoption of urban agriculture. This implies that more male-headed households practiced urban agriculture. Spending more years in school negatively influences the adoption of urban agriculture at a 10% significant level, which might be attributed to the perception of agriculture as a work of uneducated and lowly

educated people in the study area. The literates prefer to search for white-collar jobs rather than engage in urban farming.

Land ownership and land size positively and significantly influence the adoption of UA. This conforms with the finding of Ola [20] on the positive role land ownership and tenure security play in adopting urban in building food resilience. Owning a large size of land positively influences practicing UA due to several usage rights constraints faced by owning through renting. Similarly, belonging to a form of association positively influenced the adoption of urban agriculture. This might be because these associations provide access to information and teach their members about innovations and technology that can improve their well-being and income. This is in line with the study conducted by Omodara *et al.* [21], who noted that belonging to associations improved farmers' access

to various programs aimed at improving food security such as outgrowers programs.

In contrast to the A prior expectation, Access to credit and income negatively influence the adoption of urban agriculture.

This might be due to households depending more on market purchase rather than production as income increases. The reliance on market purchases decreases the motivation to invest time and resources into urban agriculture.

Table 3. Factors influencing the adoption of urban agriculture.

UA Adoption	Probit		Marginal effects	
	Coefficient	Std. Err.	dydx	Std. Err.
Age	0.044	0.043	0.008	0.007
Gender	2.276***	0.743	0.392***	0.11
Marital status	0.962	1.772	-0.166	0.305
Years of education	-0.135*	0.076	-0.023**	0.013
Land ownership	4.891***	1.256	0.842***	0.194
Land size	2.161***	0.674	0.372***	0.107
Household size	-0.311	0.259	-0.054	0.044
Association membership	0.883**	0.366	0.152**	0.062
Access to credit	-1.899***	0.512	-0.327***	0.079
Income	-0.159*10 ⁻⁴ ***	0.530*10 ⁻⁵	0.274 e-05***	0.853 e-06
Constant	5.922**	3.368		
Log-likelihood	-41.888			
Pseudo R2	0.508			
Prob > chi2	0.000			

*, **, *** represent significant level at 1%, 5% and 10% respectively

3.4. Factors Influencing Severity of Household Food Insecurity

The factors influencing household food security were estimated in Table 4 using an ordered probit model. From the result obtained, a positive coefficient of the ordered probit regression indicates the increasing severity of food insecurity, while a negative coefficient indicates being more food secure. The marginal effect was conducted to ascertain the effect of these variables across the four categories of household food insecurity access.

The age of the respondents had a positive influence on household food insecurity at a 1% significant level. This might be caused by the reduced earning potential and low economic opportunities of aged people in the study area. Most of the employment opportunities are made available for the youths and middle-aged individuals, rather than for aged people. This finding supports those of Akinaboade and Adeyefa [22].

The gender of the household head had a significant negative influence on Household food insecurity severity, implying that female-headed households tend to be more food insecure. This conforms with the findings of Akerele *et al.* [23]; and Roberts *et al.* [24]. Results from the marginal effects showed gender to have a positive relationship with food security and mild food insecurity, while negatively influencing moderate and severe food insecurity. This implies that male-headed households had better outcomes of food security.

Years spent in school negatively influence the severity of household food insecurity. Households who are educated and have high education levels are more food secure. This agrees with the findings of Obayelu and Oyekola [25] on the role secondary education plays in increasing urban households' food security status. A negative and significant relationship exists between land ownership and food insecurity. Respondents who had the right to their land ownership were more food secure than those who had access to land through renting. This might be influenced by the sense of security and stability that come with land ownership which enables owners

to be expressive in the use of land for various activities including urban agriculture.

Household size had a positive and significant relationship with household food insecurity access, which suggests that respondents with large household sizes are more food insecure. This is in line with the findings of Agboola and Balcilar [26]. Educating the households and encouraging practices such as family planning can be adapted to checkmate this problem.

Association membership and Credit access were negative and significantly influenced HFIS at 1% and 5% respectively. Belonging to an association provides opportunities for access to relative information, credit, and collective assistance to its members. This conforms with the findings of Obayelu and Oyekola [25].

One of the main objectives of this study is to examine the

influence of urban agriculture on household food security. The adoption of UA had a significant negative effect on the severity of households' food insecurity at a 1% significant level, suggesting that respondents engaging in UA are more food secure. The practice of urban agriculture serves as a means of additional sources of income for households and provides an opportunity for households to grow their crops and rear animals per their nutritional needs. Furthermore, urban agriculture practice will increase household resilience to various shocks including the volatility in prices of food, and shortage in food supply among others. Additionally, UA adopters must prioritize climate-smart agricultural practices to ensure sustainability in their operations. This approach will not only strengthen resilience to climate shocks and variations but also promotes environmentally conscious farming, contributing to long-term food security in urban areas [27, 28].

Table 4. Factors influencing the severity of household food insecurity.

Household Food Insecurity Access Scale	Ordered Probit	Marginal Effect			
		Food Secure	Mildly Food Insecure	Moderately Food Insecure	Severely Food Insecure
Age	0.710*** (0.028)	-0.139*** (0.005)	-0.006** (0.003)	0.013*** (0.005)	0.007** (0.003)
Gender	-1.111*** (0.320)	0.217*** (0.059)	0.086** (0.038)	-0.198*** (0.059)	-0.105*** (0.041)
Education	-0.110*** (0.311)	0.022*** (0.006)	0.009** (0.004)	-0.019*** (0.007)	-0.010*** (0.003)
Land ownership	-0.764* (0.425)	0.149* (0.088)	0.059 (0.039)	-0.136 (0.094)	-0.072** (0.032)
Land size	-0.048 (0.087)	0.009 (0.017)	0.004 (0.007)	-0.009 (0.015)	-0.005 (0.008)
Household size	0.279** (0.115)	-0.055*** (0.021)	-0.022* (0.013)	0.049*** (0.020)	0.026** (0.013)
Cooperative	-1.627*** (0.364)	0.317*** (0.074)	0.127** (0.050)	-0.290*** (0.088)	-0.153*** (0.042)
Credit access	-0.521** (0.324)	0.102** (0.063)	0.041* (0.025)	-0.093* (0.052)	-0.049** (0.036)
Urban agriculture	-1.279*** (0.336)	0.249*** (0.069)	0.099** (0.041)	-0.228*** (0.079)	-0.121 (0.034)
Cut 1	-1.696 (1.512)				
Cut 2	-0.242 (1.559)				
Cut 3	1.608 (1.492)				
Log-likelihood	-115.846				
Pseudo R2	0.262				
Prob > chi2	0.000				

Stand error in parentheses;

*, **, *** represent significant level at 1%, 5% and 10% respectively

4. Conclusion

The study examined the determinants of urban agriculture adoption and its effect on household food security in South-

western Nigeria. The adopters of urban agriculture were more food secure, with a difference of 15.5% in food-secure households between the two groups. Severe food insecurity was exclusive to only non-adopters. Variables including gender, years spent in school, land ownership, association membership,

credit, and income simultaneously affect the adoption of urban agriculture and food security. Years spent in school negatively influence urban agriculture adoption, while positively influencing food security. While higher education levels may deter some from engaging in urban agriculture due to perceived social status or career preferences, it concurrently enhances understanding of sustainable farming practices and food management, leading to improved food security outcomes. Land ownership and association positively influence the adoption of urban agriculture. surprisingly, credit access and income positively influence urban households' food security but negatively influence the adoption of urban agriculture. This contrasting view stems from the fact that households purchasing power increases with credit access and increased income, simultaneously discouraging participation in urban agriculture due to the perception of agriculture. It is therefore recommended that policies should be driven towards encouraging participation in urban agriculture by the Government. Policymakers should establish various credit facilities and simultaneously create awareness of the importance of engaging in urban agriculture. Furthermore, Policies toward promoting land ownership and equality in access to resources should be implemented. Having recognized the positive effect of urban agriculture on increasing food security, future research should prioritize assessing the environmental effects of these practices to ensure a sustainable agricultural system in urban areas.

Abbreviations

UA Urban Agriculture

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Author Contributions

Akinsola Temitope Oyeibanji is the sole author. The author read and approved the final manuscript.

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Data Availability Statement

The data will be made available upon request.

Conflicts of Interest

The author declares no conflicts of interest.

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