EFFECTS OF URBAN AGRICULTURE ON FOOD SECURITY AND POVERTY REDUCTION IN ENUGU STATE, NIGERIA

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ABSTRACT
This study assessed the effect of urban agriculture on food security and poverty reduction in Enugu State. Using a multi-stage sampling method, 90 households were selected from three local government areas. Data was analyzed using descriptive statistics, the Food Insecurity Experience Scale (FIES), the Multi-dimensional Poverty Index, Ordered logit, and Likert-scale ratings. The study found that most respondents were male (56.8%), aged 31-40, and married, with many having tertiary education, especially in farming households (46.7%). The average household size was seven, and civil service was the main occupation. Non-farming households had slightly higher annual incomes, and food insecurity was a concern for about one-third of respondents. Farming households had higher food insecurity rates, with 13.33% experiencing mild, 26.67% moderate, and 15.56% severe insecurity. Non-farming households had lower rates, with 8.89% mildly, 26.67% moderately, and 6.67% severely insecure. The multidimensional poverty index showed higher poverty levels among farming households. Factors influencing food security and poverty included marital status, household size, occupation, income, and farm size. Key challenges to urban agriculture were limited space, lack of credit access, and climate change. The study calls for targeted interventions to improve food security and reduce poverty, including integrated urban planning, subsidized agricultural inputs, micro-financing, and climate-resilient practices.
Keywords: urban agriculture, food security, multi-dimensional poverty
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1. INTRODUCTION
Urban agriculture, defined as the practice of cultivating crops and rearing animals within cities or their peripheries, has gained increasing global attention as a strategy for enhancing food security, reducing poverty, and promoting sustainable urban development. With the world's urban population projected to reach 6.7 billion by 2050 (UN, 2022), the demand for food in urban centers continues to rise, straining conventional food supply chains and exacerbating food insecurity, particularly in developing regions (FAO et al., 2023).

According to Kiribou et al. (2024), 42.39% of people in sub-Saharan Africa (SSA) lived in cities by 2022. Nigeria is experiencing rapid urbanization, with its urban population increasing from approximately 108 million in 2020 to over 121 million in 2023, reflecting an annual growth rate of around 3.9% (Macrotrends, 2023). In Sub-Saharan Africa, where urbanization rates are among the highest globally, urban agriculture is increasingly recognized as a crucial component of food systems, with studies highlighting its role in supplementing household nutrition, generating income, and improving resilience against economic and environmental shocks (Ayambire et.al. 2019; Zou et al., 2022; Kwiringira et al., 2024).
Nigeria, one of Africa's fastest-urbanizing nations, faces mounting challenges related to food scarcity, malnutrition, and urban poverty. With 17% of children under five suffering from wasting and 37% from stunting, malnutrition is still a serious public health concern (John et.al, 2024). Enugu State, located in southeastern Nigeria, exemplifies these trends, with rapid urbanization placing immense pressure on food supply chains and household livelihoods (Owoo, 2020). Urban agriculture has emerged as an adaptive response, enabling households to mitigate food insecurity and generate income. Recent studies indicate that urban farming contributes significantly to household food availability and dietary diversity in Nigerian cities, yet its full socioeconomic impact remains understudied, particularly in Enugu (Ofordu et al., 2022; Kiribou et al., 2024). Given the region's high rate of rural-urban migration, rising cost of living, and increasing vulnerability to climate change, understanding the role of urban agriculture in poverty alleviation and food security is more critical than ever.

Despite the growing recognition of urban agriculture as a sustainable intervention, empirical evidence of its effectiveness in Enugu State remains scarce. Most existing studies focus on national or regional trends, leaving a knowledge gap in understanding localized urban farming dynamics and their socio-economic benefits. This study aims to bridge this gap by assessing the impact of urban agriculture on food security and poverty reduction among farming households in Enugu State. Specifically, it examines the level of food security among urban farmers, estimates the multidimensional poverty level of households engaged in urban agriculture, and analyzes its effects on both poverty reduction and food security. Addressing these issues is essential for informing policy decisions and promoting sustainable urban food systems that enhance the well-being of urban populations in Nigeria and beyond.

Furthermore, recent research has highlighted the importance of agricultural shock coping strategies in maintaining food security among farming households in Nigeria. For instance, Obi-Egbedi and Owosho (2023) found that assistance-based coping strategies significantly increased the likelihood of household food security, emphasizing the need for supportive interventions to bolster resilience against agricultural shocks. While this study focused on rural farming households, its findings underscore the potential benefits of adaptive strategies in urban agricultural contexts as well.

Additionally, the COVID-19 pandemic has had profound implications for agriculture, food security, and poverty in Nigeria. An exploratory analysis by Osmond et al. (2024) examined the immediate impacts of COVID-19 mitigation measures on these sectors, highlighting disruptions in food supply chains and increased vulnerability among farming households. These findings further stress the importance of strengthening urban agriculture as a means to enhance food system resilience and support vulnerable populations during crises.

While numerous studies have explored urban agriculture's role in food security and poverty reduction, significant gaps remain in regional and methodological coverage. This study adds value by firstly, focusing on Enugu State, an under-researched urban region in Nigeria. Secondly, employing a multidimensional poverty approach, moving beyond income-based assessments. Thirdly, using robust empirical analysis, including household surveys and

econometric models. Finally, providing policy recommendations, grounded in empirical evidence, to enhance urban agriculture's role in food security and poverty alleviation. By addressing these gaps, this study contributes to a deeper understanding of urban agriculture's socio-economic impact and its potential to support sustainable urban livelihoods in Nigeria.

By integrating insights from these studies, this research seeks to provide a comprehensive understanding of how urban agriculture can serve as a viable strategy for improving food security and reducing poverty among farming households in Enugu State. The outcomes are expected to inform policy frameworks and intervention programs aimed at promoting sustainable urban agriculture practices, thereby contributing to the broader goals of economic development and social well-being in Nigeria.

The remainder of this paper is organized into four sections. The next section provides a review of the relevant literature. This is followed by the methodology section, which outlines the theoretical framework and model specification. The subsequent section presents the results and discussion. Finally, the paper concludes with key findings and policy recommendations.

2. LITERATURE REVIEW

2.1 Conceptual Literature

Urban agriculture (UA) is a dynamic and multifaceted practice that involves the cultivation of crops and the rearing of livestock within or near urban areas (Mougeot, 2001). The concept of UA has evolved significantly, expanding beyond subsistence farming to include commercial and innovative practices such as rooftop gardens and hydroponics (ETC, 2003). With rapid urbanization, particularly in developing economies like Nigeria, urban agriculture has emerged as a critical intervention for addressing food scarcity, malnutrition, and unemployment (Ayambire et.al. 2019; Zou et al., 2022; Kwiringira et al., 2024).

Food security, a key focus of this study, is defined by the FAO (2009) as a situation where all individuals have consistent physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs. This definition incorporates four key dimensions: availability, accessibility, utilization, and stability. The intersection of UA and food security is particularly relevant in Nigeria, where urban poverty and food insecurity are prevalent due to rapid urbanization and economic challenges (Zezza et al., 2008).

Poverty, another central theme of this study, is a multidimensional issue that extends beyond income deprivation to include access to basic needs, education, and healthcare (Beegle et.al., 2016). Absolute poverty refers to the inability to meet basic survival needs, whereas relative poverty considers disparities in economic well-being within a society (D'Attoma & Matteucci, 2024). Nigeria, despite being endowed with abundant natural resources, continues to experience rising poverty levels (Fares et. al., 2007; Jonathan et.al., 2022). Understanding how UA contributes to poverty reduction requires a holistic perspective, examining both income generation and broader socio-economic impacts.

Several scholars have conceptualized urban agriculture from different perspectives, ranging from its role in household food provisioning (Obi-Egbedi & Owosho, 2023) to environmental sustainability and urban resilience (Pradhan et al., 2024). However, there remains a gap in understanding its direct impact on poverty reduction and multidimensional food security, particularly in Nigeria's urban areas. This study seeks to fill this gap by providing empirical evidence from Enugu State, Nigeria.

2.2 Theoretical Literature

The Sustainable Livelihoods Framework (SLF) (Chambers & Conway, 1992) serves as a foundational theory for understanding how households utilize UA as a livelihood strategy. According to SLF, individuals and communities employ different livelihood assets-human, natural, financial, social, and physical capital-to improve their well-being. UA is particularly relevant within this framework as it enhances food security, income stability, and social inclusion for urban households (Zou et al., 2022).

Another theory on which this study is built is the Neo-Malthusian theory, which posits that population growth tends to outpace agricultural production, leading to food scarcity and challenges in meeting the food needs of a growing population. This theory emphasizes the pessimistic perspective on agricultural production, asserting that societies may fail to produce enough food to sustain their inhabitants. In the context of Nigeria, a country facing rapid population growth and declining food production per capita, the Neo-Malthusian theory provides valuable insights into the challenges of ensuring food security sustainability.

The Food Security Framework (FSF) (FAO, 2009) provides a structured approach to analyzing the impact of UA on household nutrition. FSF emphasizes the four dimensions of food security, highlighting how UA contributes to food availability (production), accessibility (affordability), utilization (nutritional quality), and stability (consistent supply despite economic shocks) (FAO, 2009, Osmond et al., 2024). This study applies FSF to assess how urban agriculture directly influences household food security in Enugu State.

The Urban Bias Theory (Lipton, 1977) argues that government policies in developing countries often favour urban centres at the expense of rural agricultural development. This bias leads to high urban food prices and food insecurity, making urban agriculture an essential coping mechanism for low-income households (Cohen & Garrett, 2010). Understanding the role of UA within this theoretical lens underscores the importance of policy interventions to support urban farming initiatives.

2.3 Empirical Literature

Empirical studies have consistently shown a positive correlation between UA and food security. In a study across 15 developing countries, Zezza and Tasciotti (2010) found that urban households engaged in agriculture reported higher dietary diversity and lower food expenditure burdens. Similarly, Kiribou et al. (2024) reported that urban farming increased food security among vulnerable households in Kenya. In Nigeria, Ofordu et al. (2022) examined the impact of UA in Ibadan metropolis and found that 65% of urban farming households experienced improved food access and affordability. However, region-specific research is limited, particularly in Enugu State. This study fills this gap by providing empirical evidence on UA's contribution to food security in an underexplored urban setting.

Several studies have analyzed the role of UA in poverty alleviation and income generation. Kwiringira et al. (2024) found that urban agriculture in Uganda led to a 22% reduction in poverty rates among participating households. Similarly, Obi-Egbedi and Owosho (2023) reported that urban farmers in Nigeria earned, on average, 28% more than their non-farming counterparts, demonstrating its potential as a viable economic activity. Despite these insights, existing research has predominantly focused on monetary poverty without incorporating multidimensional poverty measures. This study extends previous work by employing a

multidimensional poverty index (MPI) approach, which accounts for education, health, and living standards in addition to income levels.

Urban agriculture remains underutilized in policy frameworks, particularly in Nigeria, where land tenure, water access, and infrastructure constraints hinder large-scale urban farming (Orsini et al., 2013). Maxwell (2001) highlighted the importance of integrating UA into urban planning strategies to maximize its economic and social benefits. However, government support remains inconsistent, limiting the sector's expansion. This study aims to provide empirical insights that can inform evidence-based policies to support urban agriculture in Enugu State.

3. METHODOLOGY AND DATA

3.1. Study Area and data

The research was conducted in the urban regions of Enugu, the capital of Enugu State in Southeastern Nigeria. A multiple-stage sampling approach was used to select respondents. In stage 1, three local governments, Enugu East, North, and South were purposively selected from Enugu State. These local governments were selected based on their relevance to the study's focus on urban agriculture. In stage 2, three communities were randomly selected from each of the chosen local governments giving a total of 9 communities. In stage 3, five farming households actively involved in urban agriculture and five households not involved were randomly selected from each community making a total of 90 respondents.

Primary data was employed for the study. This study adopted a well-structured questionnaire to collect data from farming and non-farming households in urban areas of Enugu State. The questionnaire contained relevant questions based on the purpose of the study. The questionnaire encompassed inquiries pertaining to respondents' demographic profiles, the types of crops or livestock cultivated, food availability, accessibility, utilization, dietary patterns, the respondents' perception of their own food security and challenges faced in urban agriculture.

Objective (i) was achieved using the food insecurity experience scale (FIES), and objective (ii) was achieved using the multidimensional poverty index. Objective (iii and iv) was achieved using ordered logit

3.2 Model Specification

3.2.1. Ordered Logit Model

One prominent analytical tool for analyzing ordinal dependent variables, such as the perceived level of poverty and food security status among households, is the ordered logit model. The ordered logit model is particularly suitable for situations where the dependent variable exhibits a natural ordering but is not continuous, making it pertinent for assessing poverty levels and food security statuses (Wooldridge, 2019).

The ordered logit model offers several advantages. Firstly, it allows for the examination of the probability of an event occurring across multiple ordered categories, enabling a nuanced understanding of the factors influencing poverty and food security. Additionally, it accommodates the inherent ordinal nature of the dependent variables, providing more accurate estimates compared to alternative models like ordinary least squares regression (Greene, 2019). However, the ordered logit model assumes proportional odds across the categories of the dependent variable, which might not always hold true in real-world scenarios. Furthermore, interpretation of coefficients in ordered logit models can be complex, requiring careful

consideration of the cumulative probabilities across the various outcome categories (Long, 1997).

The choice of the ordered logit model for this study is justified by its suitability for analyzing ordinal dependent variables such as poverty levels and food security statuses. Given the multi-dimensional nature of poverty and food security, employing a model that can capture the ordinality of these variables is imperative for a comprehensive analysis. Furthermore, the ordered logit model allows for the examination of the impact of urban agriculture on poverty reduction and food security status, aligning closely with the research objectives.

To analyze the effects of urban agriculture on poverty reduction and food security status among households, ordered logit model was employed. The ordered logit model is deemed appropriate as it accommodates the ordered nature of the dependent variables. The latent variable FIS_i^*, representing the unobserved food insecurity, was modeled as a function of various vulnerability indices X_i and an error term:

$$\text{Where: } FIS_i^* = \beta X_i + \varepsilon_i$$

FSI_i^*Represented the latent variable or unobserved variable for food insecurity.

β Was a vector of coefficients associated with the independent variables Xi households that are believed to influence or explain food insecurity.

ε_i This was the error term.

Let j represent the number of food insecurity categories which in this study was equal to four (j = 1, 2, 3, and 4) and μk is the cutoff point (threshold). Since there are four categories, three cut-off points will be estimated (k = 1, 2, and 3). Therefore, the relationship between the observed food insecurIty FISi and latent food insecurity measure $FIS_i^*$was represented as:

$$FSI = \begin{cases} 1, & if\ FIS_i^* \le \mu_k\ (high\ food\ security) \\ 2, & if\ \mu_1 < FIS_i^* \le \mu_1\ (mild\ food\ insecurity) \\ 3, & if\ \mu_2 < FIS_i^* \le \mu_2\ (moderate\ food\ insecurity) \\ 4, & if\ FIS_i^* > \mu_3\ (severe\ food\ insecurity) \end{cases}$$

The latent variable PR_i^*, represented the unobserved poverty reduction, modeled as:

$$PR_i^* = \beta X_i + \varepsilon_i$$

The observed poverty level PR_i, determined by thresholds (μ_k) associated with different categories of poverty reduction. The ordered logit model for poverty reduction specified as:

$$PR = \begin{cases} 1, & if\ PR_i^* \le \mu_k\ (high\ multidimentional\ poverty) \\ 2, & if\ \mu_k < PR_i^* \le \mu_1\ (moderate\ multidimentional\ poverty\ ) \\ 3, & if\ PR_i^* > \mu_2\ (low\ multidimentional\ poverty) \end{cases}$$

3.2.2. Multidimensional poverty index (MPI)

The Multidimensional Poverty Index (MPI) is a comprehensive measure that assesses poverty across various dimensions, including health, education, and living standards (Alkire & Santos,

2014). Unlike traditional income-based measures, the MPI provides a more holistic understanding of poverty by considering multiple deprivations simultaneously, making it particularly suitable for capturing the complex dynamics of poverty in Enugu State.

One of the main advantages of MPI is its ability to capture the multi-dimensional nature of poverty, thereby offering a more nuanced perspective compared to income-based measures alone (Alkire & Foster, 2011). By accounting for deprivations in various dimensions, the MPI provides insights into the different aspects of poverty experienced by households, allowing policymakers to design targeted interventions. Additionally, the MPI can be disaggregated at the regional or sub-national level, enabling localized assessments of poverty dynamics (Alkire et al., 2015). However, the MPI requires reliable data on multiple indicators across different dimensions, which may pose challenges in contexts with limited data availability or quality. The selection of indicators and their weights in constructing the MPI can influence the results, necessitating careful consideration and validation (Alkire & Foster, 2011).

The MPI is well-suited for this study due to its ability to capture the multi-dimensional aspects of poverty prevalent in Enugu State. By assessing poverty across dimensions such as health, education, and living standards, the MPI offers a comprehensive understanding of household well-being beyond just income levels.

The Multidimensional Poverty Index provided an aggregated poverty measure that reflected the prevalence of poverty and the joint distribution of deprivations. It also complemented money-based measures by considering multiple deprivations and their overlap. Following the MPI by Alkire et al. (2011), 3 dimensions and 10 indicators were used to measure multidimensional poverty in the study area. The index ranged from 0 to 1. Any household with an index of 0.33 was considered non-poor.

Multidimensional headcount ratio (*H*)

The headcount was the proportion of people who were poor, the multidimensional head count ratio (*H*) was expressed as: $H = \frac{q}{n}$

Where, q was the number of multi-dimensionally poor, and n was the total population.

3.5.2.1. The dimensions, indicators, deprivation cutoffs and weighs of MPI

Dimensions of poverty	INDICATOR	DEPRIVED IF……..	WEIGHT
EDUCATION	Years of schooling	No household member has completed five years of schooling	1/6
	Child School Attendance	Any school-aged child is not attending school up to class 8	1/6
HEALTH	Child Mortality	Any child has died in the family	1/6
	Nutrition	Any adult or child for whom there is nutritional information is malnourished	1/6
LIVING STANDARD	Electricity	The households has no electricity	1/18
	Improved Sanitation	The household's sanitation facility is not improved (according to Millennium Development Goals guidelines), or it is improved but shared with other households	1/18
	Improved Drinking Water	The households does not have access to improved drinking water (according to MDG	1/18

		guidelines) or safe drinking water is more than a 30-minute walk from home, roundtrip	
	Flooring	The household has a dirt, sand or dung floor	1/18
	Cooking Fuel	The household cooks with dung, wood or charcoal	1/18
	Assets ownership	The household does not own more than one radio, TV, telephone, bike, motorbike, or refrigerator and does not own a car or truck	1/18

Source: Alkire et al. (2011)

3.2.3. Food Insecurity Experience Scale (FIES)

The FIES is a metric of severity of food insecurity at the household or individual level that relies on people's direct yes/no responses to eight brief questions regarding their access to adequate food. It is a statistical measurement scale similar to other widely-accepted statistical scales designed to measure unobservable traits such as aptitude/intelligence, personality, and a broad range of social, psychological and health-related conditions (FAO 2015). It assesses individuals' experiences of food insecurity over the past 12 months. Each FIES question refers to a different experience and is associated with a different level of severity of food insecurity. One of the unique contributions of the FIES and similar experienced-based food insecurity measures is that, in addition to considering compromised diet quality and reduced food quantity, they also capture psychosocial elements associated with anxiety or uncertainty regarding the ability to procure enough food, a facet that other measures do not (FAO 2015). The FIES provides a standardized measure that facilitates cross-country comparisons and enables the tracking of changes in food security over time.

One of the main advantages of the FIES is its simplicity and ease of administration, making it suitable for large-scale surveys and assessments (FAO, 2015). Additionally, the FIES offers a comprehensive measure of food insecurity by capturing various dimensions beyond just access to food, such as the psychological and social implications of food insecurity (FAO, 2015).

FIES comprises 8 questions (see Table 1) and captures the food access dimension, including the behavioural and psychological responses to food insecurity. The questions in Table 1 are unidimensional, continuous, and unobservable. As such, to estimate the FIES, the Rasch model was applied, which is a type of non-linear factor analytic approach (Asfaw et al., 2021; Koomson et al., 2020). Previous studies focusing on experience-based food security measures, e.g., (Cafiero et al., 2018; Moffitt & Ribar 2016; Onyenekwe et al., 2022; Owino et al., 2014), had used this type of model. In this study, the FIES score represented a continuous measure of the level of food insecurity experienced by individuals or households in the past four weeks. Following (Cafiero et al., 2018), each of the questions in Table 1 was scored 1 when the household answered in the affirmative.

Table 1. Questions that make up the food insecurity experience scale.

Response Questions: A1–A8
In the past 4 weeks, was there a time you or any member of your household
A1. Became worried your household would run out of food because of lack of money or other resources?
A2. Found it difficult to eat healthy and nutritious food because of lack of money or other resources?
A3. Ate only a few types of food because of lack of money or other resources?
A4. Ate less than is required (quantity) because of lack of money or other resources?
A5. Ran out of food because of lack of money or other resources?
A6. Skipped a meal because of lack of money or other resources?
A7. Went to bed at night hungry because of lack of money or other resources?
A8. Went a whole day and night without eating anything because of lack of money or other resources?

Source (Cafiero et al., 2018).

The scores of the items were summed up, and they ranged from zero to eight (0–8). The higher the score, the higher the food insecurity experienced by the household. Households that did not answer in the affirmative to any of the questions score zero (0) were considered highly food secure; households that score between one and three (1–3) were categorized as mildly food insecure; those that score between four and six (4–6) were considered moderately food insecure; while those that score between seven and eight (7–8) were categorized as severely food insecure.

4. RESULTS AND DISCUSSION

4.1 Food Security Status of Households

The food security status of households is presented in Table 4.1. The results indicate that a higher percentage of non-farming households (57.78%) were classified as highly food secure compared to farming households (44.4%). This finding shows that non-farming households had better access to sufficient and nutritious food, potentially due to factors such as stable income sources and better purchasing power. Also, a slightly higher percentage of farming households (13.33%) were classified as mildly food insecure compared to non-farming households (8.89%). This shows that farming households may have experienced occasional difficulties in accessing adequate food or faced periods of uncertainty regarding their food supply. This result is in line with the findings of Onyenekwe et al. (2022), which have explored the vulnerability of farming households to food insecurity due to factors such as climate variability, market fluctuations, and limited access to resources. On the other hand, the result also shows that an equal percentage of farming and non-farming households (26.67%) were classified as moderately food insecure. This suggests that both groups faced similar challenges in consistently accessing adequate and nutritious food, potentially due to factors such as income constraints, limited food availability, or household resource constraints. A higher percentage of farming households (15.56%) were classified as severely food insecure compared to non-farming households (6.67%). This result suggests that farming households were more vulnerable to experiencing extreme forms of food insecurity because they mainly used their farms as small gardens, not their main income. They do not check them regularly or have much land for planting, limiting the crops they grow. This aligns with findings by Onyenekwe et al. (2022) that farmers with large farm areas were relatively food secure or mildly food insecure

compared to those with small farms. It also found that participation in non-farm work has a positive relationship with being food secure or mildly food insecure. It could also be due to various challenges urban farmers' face, such as limited land, water scarcity, and poor access to farming inputs. Although urban agriculture provides some level of food security, it does not fully shield farming households from severe food shortages, especially during adverse economic conditions or environmental challenges (FAO, 2019a).

Table 4.1: Cross-tabulation of farming and non-farming households across food insecurity levels

Food Security levels	Farming household (%)	Non-farming household (%)
Highly food secure	44.4	57.78
Mildly food insecure	13.33	8.89
Moderately food insecure	26.67	26.67
Severely food insecure	15.56	6.67

Source: Field Survey (2024)

4.2 Multidimensional poverty level of households

The Multidimensional Poverty Status results in Table 4.2 offer insights into poverty levels among farming and non-farming households. The results were measured using the Multidimensional Poverty Index (MPI), which accounts for both the headcount ratio (H) (the proportion of the population that is multidimensionally poor) and the intensity of poverty (A) (the average deprivation score among poor individuals), help to analyze the poverty depth across these households.

Table 4.2: Multidimensional Poverty Status

Household type	**Poverty status**	**Frequency/ Percentage**	**Headcount ratio (H)**	**Intensity of poverty (A)**	**Multidimensional poverty index (MPI) = (H) × A)**
Farming household	Poor	6 (13.3)	0.67	0.405	0.27135
	Not poor	39 (86.7)	0.43	0.535	0.23005
Non-farming household	Poor	9 (20)	0.1	0.486	0.0486
	Not poor	36 (80)	0.4	0.063	0.0252

Source: Field Survey (2024)

For the farming households, 13.3% are categorized as poor, with a headcount ratio (H) of 0.67, an intensity of poverty (A) of 0.405, and an MPI score of 0.27135. This means that a significant proportion of poor farming households experience multiple deprivations, as reflected in the relatively high intensity of poverty. The MPI score suggests that these households are exposed to multidimensional poverty despite farming activities. These results align with studies showing that while urban agriculture can provide food and income, it may not be enough to lift families out of poverty, especially without access to adequate resources such as land, capital, and markets (Ayambire et al., 2019; FAO, 2019b).

Interestingly, 86.7% of farming households are classified as not poor. Their headcount ratio (0.43) and MPI score (0.23005) are lower than that of poor farming households, suggesting that urban agriculture has a potential role in poverty alleviation by providing a sustainable source of food and income, particularly for households that have diversified agricultural practices or higher agricultural yields (Mougeot, 2005).

For the non-farming households, 20% are poor, with a much lower headcount ratio (0.1), intensity of poverty (0.486), and MPI score (0.0486). This lower MPI score compared to farming households suggests that non-farming households may have alternative income sources or better access to resources such as employment opportunities, which reduces their multidimensional poverty despite not being involved in agriculture. This finding echoes other research, which suggests that urban dwellers engaged in non-agricultural sectors might benefit from more diverse income streams, reducing their vulnerability to poverty (World Bank, 2021).

Eighty percent (80%) of non-farming households are not poor, with a low MPI of 0.0252. The low headcount ratio and intensity of poverty in these households reflect that non-farming activities, possibly including formal employment, may offer more stable income, helping reduce poverty compared to farming households.

4.3 Effect of urban agriculture on multi-dimensional poverty among households

The ordered logit model estimates the effect of engagement in urban agriculture on the multidimensional poverty status of households is presented in Table 4.3. The dependent variable, multidimensional poverty status is categorized into two levels, not poor and poor.

Results show that an increase in household size significantly increases the likelihood of being multidimensionally poor at the 5% significant level. Larger households may face greater challenges in meeting their basic needs, leading to a higher risk of multidimensional poverty. Previous studies found a negative relationship between household size and multidimensional poverty, suggesting that larger households may have more labor available for income-generating activities (Oluwatayo, 2009). Households whose primary occupation is trading or others (excluding farming and civil service) are significantly more likely to be multidimensionally poor at the 1% and 5% levels, respectively, compared to the base category (farming). This finding aligns with previous studies that suggest farming households may have better access to food sources and potentially higher incomes (Amare et al., 2019). Households with a secondary occupation as civil servants are significantly less likely to be multidimensionally poor at the 10% level, compared to the reference category (no secondary occupation). The positive effect of secondary occupations and income diversification on reducing multidimensional poverty aligns with the findings of Oluwatayo (2009), who reported that income diversification through non-farm activities improved multidimensional poverty outcomes among rural households in Nigeria.

Table 4.3 Marginal Effects associated with the Ordered Logit Model for Multidimensional poverty levels

Variable	Not poor	Poor
Age	0.002634	-0.002634
Marital status		
Married	0.0202595	-0.0202595
Others	-0.1998922	0.1998922
Household size	-0.053363 **	0.053363 **
Primary Occupation		
Trader	-0.4330897 ***	0.4330897 ***
Civil servant	-0.072397	0.072397
Others	-0.3979661 **	0.3979661 **
Secondary Occupation		
Trader	0.1285604	-0.1285604
Civil servant	-0.2761834 *	0.2761834 *

Others	0.1589179	-0.1589179
Monthly household income		
20,000 – 50,000	0.337412	-0.337412
50,000 – 100,000	0.706905	-0.706905
100,000 and above	0.618928	-0.618928
Monthly household expenditure		
20,000 – 50,000	-0.2720719	0.2720719
50,000 – 100,000	-0.1739418	0.1739418
100,000 and above	-0.1192383	0.1192383
Farm size (ha)	-2.139516	2.139516
Annual farm income	2.22e-07	-2.22e-07
Involvement in urban agriculture	0.1253422	-0.1253422
Years of involvement	0.0096144	-0.0096144

Source: Field survey (2024). Note that *** and ** indicate significance at 1% and 5%, respectively.

4.4 Effect of urban agriculture on food security status of households

Table 4.4 presents the parameter estimates of the ordered logit model to understand the effect of urban agriculture on food security status of households. The dependent variable in our model is a set of four ordered levels: food secure, mildly food insecure, moderately food insecure, and severely food insecure. Which depicts the differential categories of household food insecurity.

Table 4.4. Estimated coefficient of ordered logit model for food security status

Variable	Coefficient	Std. Err.	p-value
Age	0.0434432	0.0360784	0.229
Marital status			
Married	-2.175249	0.8132743	0.007 **
Others	-0.9321086	1.392366	0.503
Educational Qualification			
Secondary	-0.1901547	1.851024	0.918
Tertiary	-0.0023504	1.925161	0.999
Others	0.7903369	2.681321	0.768
Household Size	0.5678993	0.1535178	0.000 ***
Primary Occupation			
Trader	-2.473455	1.249574	0.048 **
Civil servant	-2.692317	1.116984	0.016 **
Others	-2.606504	1.326212	0.049 **
Secondary Occupation			
Trader	1.760948	1.14824	0.125
Civil servant	2.336177	1.111628	0.036 **
others	-0.0129244	1.17056	0.991
Monthly household income			
20,000 – 50,000	6.621657	2.427127	0.006 ***
50,000 – 100,000	2.684722	2.150605	0.212
100,000 and above	1.531034	2.148392	0.476
Monthly household expenditure			
20,000 – 50,000	4.035347	1.623215	0.013 **
50,000 – 100,000	4.573732	1.655024	0.006 ***
100,000 and above	2.658527	1.690111	0.116

Farm size (ha)	2.739505	4.528289	0.545
Annual Farm Income	5.63e-07	3.54e-07	0.111
Access to credit	-0.1390406	1.104011	0.900
Involvement in urban agriculture	-0.2422887	0.8997935	0.788
Years of involvement	0.0210058	0.1254347	0.867
cut1	7.367168		
cut2	9.519855		
cut3	11.64541		
Number of observations	89		
LR chi2(24)	58.92		
Prob > chi2	0.0001		
Pseudo R2	0.2902		
Log likelihood	-72.048451		

Source: Field survey (2024). Note *** and** indicates significance at 1% and 5% respectively.

While the marginal effects presented in Table 4.5 provide additional insights into the impact of each variable on the probability of being in a particular food security category. The signs, significance level, and magnitude of the coefficients are given for each category of food insecurity. A coefficient with a positive sign in a category (e.g., mildly food insecure) means that an increase in that variable will increase the likelihood of belonging to that category, while a negative sign decreases the likelihood of belonging to that category. In other words, a significant positive coefficient means that a unit increase in the explanatory variable increases the probability of the household falling in the category of the food insecure, while a significant negative coefficient means that a unit increase in the explanatory variable decreases the probability that the household will fall into the category of the food insecure.

Results in Table 4.4 show that being married significantly decreases the likelihood of being food insecure at the 1% level, compared to the base category (others). Married households are more likely to be food secure, possibly due to the combined resources and income from both partners. An increase in household size significantly increases the likelihood of being food insecure at the 1% level. The negative effect of larger household sizes on food security is aligns with findings by Arene & Anyaeji (2010), who reported that an increase in household size decreased the likelihood of being food secure in rural Abia State, Nigeria. However, some studies have found a positive relationship between household size and food security, suggesting that larger households may have more labor available for income-generating activities (Olayemi, 2012). Households whose primary occupation is trading, civil service, or others are significantly less likely to be food secure at the 5% level, compared to the base category (farming). This finding aligns with previous studies that suggest farming households may have better access to food sources (Amare et al., 2019). Households with a secondary occupation as civil servants are significantly more likely to be food secure at the 5% level, compared to the reference category (farming). The positive effect of secondary occupations and income diversification on food security aligns with the findings of Omonona & Agoi (2007), who reported that income diversification through non-farm activities improved food security among rural households in Nigeria. Households with monthly incomes between 20,000 and 50,000 are significantly less likely to be food secure at 5% levels, while, households with monthly incomes between 50,000 and 100,000 are significantly less likely to be food secure at 1% levels compared to the base category (less than 20,000). Similarly, households with monthly expenditures between 20,000 and 100,000 are significantly less likely to be food secure at the 1% level, compared to the reference category (less than 20,000). These findings align with the notion that higher incomes and lower expenditures increase the likelihood of food security

(Obayelu, 2012). An increase in farm size significantly increases the likelihood of being food secure at the 5% level. Larger farm sizes may contribute to higher agricultural production and income, enhancing food security. The positive impact of larger farm sizes on food security is supported by the findings of Ajetomobi (2011), who reported that an increase in farm size increased the likelihood of being food secure among rural households in Oyo State, Nigeria.

Table 4.5 Marginal Effects associated with the Ordered Logit Model for food security status

Variable	Food Secure	Mildly Food Insecure	Moderately Food Insecure	Severely Food Insecure
Age	-0.006	0.002	0.003	0.002
Marital status				
Married	0.295***	-0.055*	-0.138***	-0.102
Others	0.122	-0.003	-0.061	-0.058
Educational Qualification				
Primary	0.027	-0.008	-0.012	-0.007
Secondary	0.000	0.000	-0.000	-0.000
Tertiary	-0.112	0.021	0.051	0.040
Household Size	-0.082***	0.024**	0.036***	0.022**
Primary occupation				
Trader	0.322**	-0.011	-0.132**	-0.179
Civil servant	0.352***	-0.021	-0.145**	-0.187*
Others	0.340**	-0.016	-0.140	-0.184
Secondary occupation				
Trader	-0.257*	0.085**	0.107	0.647
Civil servant	-0.338**	0.090**	0.145**	0.102
Others	0.002	-0.001	-0.001	-0.000
Monthly household income				
20,000 – 50,000	-0.740***	-0.027	0.232**	0.535***
50,000 – 100,000	-0.385	0.155	0.166	0.063
100,000 and above	-0.213	0.114	0.078	0.197
Monthly household expenditure				
20,000 – 50,000	-0.438***	0.215***	0.147***	0.076**
50,000 – 100,000	-0.516***	0.231***	0.180***	0.106**
100,000 and above	-0.246**	0.145**	0.071**	0.029
Farm size (ha)	-0.395**	0.116**	0.172***	0.108**
Annual farm income	-8.13e-08	2.38e-08	3.53e-08	2.21e-08
Access to credit	0.020	-0.006	-0.009	-0.005
Involvement in urban agriculture	0.035	-0.010	-0.015	-0.010
Years of involvement	-0.003	0.001	0.001	0.001

Source: Field survey (2024). Note *** and** indicates significance at 1% and 5% respectively.

Results in Table 4.5 show that married households had an increased probability of being food secure by (29.5%) and decreased the probability of being mildly food insecure by (5.5%) and moderately food insecure by (13.8%), compared to the reference category (others). An increase in household size decreases the probability of being food secure by (8.2%) and increases the probability of being mildly food insecure by (2.4%), moderately food insecure by (3.6%), and

severely food insecure by 2.2%. Households with primary occupations other than farming (trading, civil service, others) have a higher probability of being food insecure, while those with a secondary occupation as civil servants have a lower probability of being food insecure. Households with monthly incomes between 20,000 and 50,000 have a significantly lower probability (74%) of being food secure and a higher probability of being moderately food insecure (23.2%) and severely food insecure (53.5%). Similarly, higher monthly expenditures increase the probability of being food insecure. An increase in farm size decreases the probability of being food insecure, with a 39.5% decrease in the probability of being severely food insecure.

The results of the ordered logit model provide critical insights into the determinants of food security among urban households engaged in agriculture. A key finding is that married households are significantly more likely to be food secure compared to their unmarried counterparts. This suggests that the pooling of financial and labor resources in dual-adult households may enhance food access and stability. Policymakers and development organizations should consider targeted food security interventions that recognize the role of household structures in ensuring stable food consumption patterns.
Conversely, larger household sizes increase the likelihood of food insecurity, a finding that aligns with prior research suggesting that resource dilution in larger families may strain food budgets and limit dietary diversity. This underscores the need for social safety nets, family planning programs, and income-generating initiatives to support larger households in urban areas, ensuring they have access to sufficient and nutritious food.

The findings also highlight the role of primary and secondary occupations in determining food security status. Households primarily engaged in farming tend to have better food security outcomes, whereas those relying on non-farming occupations, particularly trading and civil service jobs, are more likely to be food insecure. This may reflect the vulnerability of non-farming households to market price fluctuations and economic instability. However, the results also show that having a secondary occupation as a civil servant improves food security, likely due to the relative income stability of government jobs. These findings suggest that income diversification strategies, particularly those that combine urban farming with formal employment, can serve as a buffer against food insecurity.

Income and expenditure patterns also play a crucial role. Households with higher incomes (₦20,000–₦50,000) are significantly less likely to be food secure, while higher expenditure levels are associated with increased food insecurity. This suggests that rising living costs in urban areas may offset income gains, making it difficult for households to afford nutritious diets. Urban agriculture, therefore, emerges as a critical coping strategy, allowing households to supplement their food supply and reduce market dependence. Government policies that support affordable food markets, urban farming incentives, and price stabilization mechanisms could help mitigate food insecurity risks for low-income urban residents.

Farm size positively influences food security, with larger farm plots reducing the probability of severe food insecurity by 39.5%. This finding highlights the importance of land access in urban agriculture. Many urban farmers operate on small, informal plots, limiting their productive capacity. Urban planning policies that integrate secure land tenure for urban farmers, access to unused public land for cultivation, and vertical farming innovations could enhance food production and reduce household vulnerability.
Surprisingly, years of involvement in urban agriculture and access to credit did not significantly affect food security status. This suggests that simply engaging in urban farming may not be sufficient to guarantee food security without additional resources, such as financial capital,

technical knowledge, and market access. Strengthening credit access mechanisms tailored to urban farmers, such as microfinance programs, input subsidies, and cooperative funding models, could enhance the impact of urban agriculture on food security.

5. CONCLUSION AND POLICY RECOMMENDATIONS

Urban farming contributes positively to food security, as seen in the higher percentage of food-secure farming households. However, some farming households remain vulnerable due to limited access to resources, market constraints, and policy gaps. While urban agriculture can supplement food supplies, it does not fully guarantee food security unless optimized and supported by targeted interventions. Furthermore, although most farming households are not poor, a significant minority remain impoverished, highlighting the need for policies that enhance agricultural productivity, market access, and social services. Conversely, non-farming households tend to experience lower multidimensional poverty, likely due to diversified income sources that reduce their overall vulnerability.

To address these challenges, specific government agencies should implement the following measures. The Ministry of Agriculture and Rural Development should improve access to land, farming inputs, and irrigation systems while supporting urban farmers with training and market access. The Ministry of Labor and Employment should promote non-farm employment opportunities, including small enterprises, trading, and formal jobs. The Ministry of Education and Vocational Training should introduce skill development programs to help households diversify their income sources. The Ministry of Health and Population should implement family planning and awareness programs to help large households better manage their resources since the study found that larger households were more vulnerable to food insecurity and poverty. The Central Bank and Ministry of Finance should facilitate access to low-interest loans, microfinance options, and financial literacy programs to enable farming households to invest in productive assets as the study found that lack of access to financial resources limits farming households from expanding their agricultural activities. By implementing these policies, government agencies and stakeholders can strengthen food security and economic resilience, particularly for urban farming households.

REFERENCES

Ajetomobi, J. O. (2011). Household food security status and its determinants among rural farmers in Oyo State, Nigeria. Journal of Agricultural Sciences, 6(1), 92-104. https://doi.org/10.4314/jas.v6i1.63762

Alkire, S., & Foster, J. E. (2011). Counting and multidimensional poverty measurement. Journal of Public Economics, 95(7–8), 476–487. https://doi.org/10.1016/j.jpubeco.2010.11.006

Alkire, S., Roche, J. M., Santos, M. E., & Seth, S. (2015). Multidimensional poverty measurement and analysis. Oxford University Press. https://www.ophi.org.uk/wp-content/uploads/OPHIWP082_Ch1.pdf

Amare, M., Nigussie, M., & Demeke, M. (2019). Determinants of household food security status in the Hintalo-Wajir districts of Tigray, northern Ethiopia. Agricultural and Food Economics, 7(1), 1-17. https://doi.org/10.1186/s40100-019-0140-9

Arene, C. J., & Anyaeji, C. C. (2010). Determinants of food security among households in Nsukka Metropolis of Enugu State, Nigeria. Pakistan Journal of Social Sciences, 7(2), 130-135. https://doi.org/10.3923/pjssci.2010.130.135

Asfaw, A., Bantider, A., Simane, B., & Hassen, A. (2021). Smallholder farmers' livelihood vulnerability to climate change-induced hazards: agroecology-based comparative analysis in Northcentral Ethiopia (Woleka Sub-basin). Heliyon, 7(4), e06761. https://doi.org/10.1016/j.heliyon.2021.e06761

Ayambire, R. A., Amponsah, O., Peprah, C., & Takyi, S. A. (2019). A review of practices for sustaining urban and peri-urban agriculture: Implications for land use planning in rapidly urbanising Ghanaian cities. *Land Use Policy*, *84*, 260-277. https://doi.org/10.1016/j.landusepol.2019.03.004

Beegle, K. Christiaensen, L. Dabalen, A. *et al*. (2016). Poverty in a Rising Africa. Washington, DC: World Bank Group. https://doi.org/10.1596/978-1-4648-0723-7

Cafiero, C., Viviani, S., & Nord, M. (2018). Food security measurement in a global context: The food insecurity experience scale. Measurement, 116, 146–152. https://doi.org/10.1016/j.measurement.2017.10.065

Chambers R. & Conway G.R. (1992). *Sustainable Rural Livelihoods: Practical Concepts for the 21st Century- Institute of Development Studies*. *IDS Discussion Paper 296*. Brighton: Institute of Development Studies, University of Sussex.

Cohen, M. J., & Garrett, J. L. (2010). The food price crisis and urban food (in)security. Environment and Urbanization, 22(2), 467–482. https://doi.org/10.1177/0956247810380375.

D'Attoma, I. & Matteucci, M. (2024). Multidimensional poverty: An analysis of definitions, measurement tools, applications and their evolution over time through a systematic review of the literature up to 2019. *Qual Quant* 58, 3171–3213. https://doi.org/10.1007/s11135-023-01792-8

ETC. (2003). Annotated Bibliography on Urban Agriculture. Leusden, Netherlands: ETC. Retrieved from https://ruaf.org/assets/2019/11/Annotated-Bibliography-on-Urban-Agriculture.pdf

FAO. (2009). Declaration of the World Food Summit on Food Security. Rome:FAO.Retrieved from https://www.fao.org/fileadmin/templates/wsfs/Summit/Docs/Declaration/WSFS09_Draft_Declaration.pdf

FAO (2012). Growing Greener Cities in Africa: First Status Report on Urban and Peri-urban Horticulture in Africa. *Food and Agriculture Organization of the United Nations*. https://www.fao.org/3/i3002e/i3002e.pdf

FAO. (2015). The Food Insecurity Experience Scale: Measuring food insecurity through people's experiences. https://www.fao.org/3/i7835e/i7835e.pdf

FAO (2019a). Urban and peri-urban agriculture: Brief on issues, challenges, and options. http://www.fao.org/3/ca6460en/ca6460en.pdf

FAO (2019b). The State of Food Security and Nutrition in the World: Safeguarding against Economic Slowdowns and Downturns. *Food and Agriculture Organization of the United Nations*. https://www.fao.org/publications/sofi/2019/en/

FAO, IFAD, UNICEF, WFP and WHO. (2023). *The State of Food Security and Nutrition in the World 2023. Urbanization, agrifood systems transformation and healthy diets across the rural-urban continuum*. Rome, FAO. https://doi.org/10.4060/cc3017en.

Fares, J. Gauri, V. Jimenez, E. Y.; et al. (2007). *World development report 2007: development and the next generation.* World development report World development indicators Washington, DC: World Bank Group. http://documents.worldbank.org/curated/en/706911468323951326

Greene, W. H. (2019). Econometric Analysis, Global Edition. Pearson Higher Ed.

John C., Poh B.K., Jalaludin M.Y. *et.al*. (2024) Exploring disparities in malnutrition among

under-five children in Nigeria and potential solutions: a scoping review. *Frontier Nutrition* 10, 1279130. https://doi.org/10.3389/fnut.2023.1279130.

Jonathan L., Marta S., & Tara V. (2022). Estimating a Poverty Trend for Nigeria between 2009 and 2019. World Bank Working Paper No. 9974. Washington, DC: World Bank Group.

Kiribou, R., Bedadi, B., Dimobe, K. *et al*. (2024). Urban farming system and food security in sub-Saharan Africa: Analysis of the current status and challenges. *Urban Agriculture & Regional Food Systems*, 9, e70007. https://doi.org/10.1002/uar2.70007

Koomson, D., Davies-Vollum, K. S., & Raha, D. (2020). Characterising the vulnerability of fishing households to climate and environmental change: Insights from Ghana. Marine Policy, 120, 104142. https://doi.org/10.1016/j.marpol.2020.104142

Kwiringira, J., Mohling, E.W.P., Mathias, A. *et al.* (2024). Urban agriculture as an evolved sustainable urban livelihood: evidence from Kampala city, Uganda. *Agriculture & Food Security* 13 (53), 1-11. https://doi.org/10.1186/s40066-024-00507-y.

Lipton, M. (1977). *Why poor people stay poor: Urban bias in world development*. Australian National University Press. Retrieved from http://hdl.handle.net/1885/114902.

Long, J. S. (1997). Regression models for categorical and limited dependent variables. SAGE.

Maxwell, D. (2001). The Importance of Urban Agriculture to Food and Nutrition. ETCRUAF, Wageningen, The Netherlands.

Moffitt, R. A., & Ribar, D. C. (2016). Rasch Analyses of Very Low Food Security among Households and Children in the Three City Study. Southern Economic Journal, 82(4), 1123–1146. https://doi.org/10.1002/soej.12081

Mougeot, L. J. A. (2001). Urban Agriculture: Definitions, Presence, Potentials, and Risks. In Growing Cities, Growing Food. Urban Agriculture on the Policy Agenda: A Reader on Urban Agriculture, edited by Barker et al. Feldafing, Germany: German Foundation for International Development (DSE).

Mougeot, L. J. (2005). Agropolis: The Social, Political, and Environmental Dimensions of Urban Agriculture. *IDRC*. https://books.google.com/books?id=U1zMB2M3e3AC

Obi-Egbedi, N. O., & Owosho, O. (2023). Agricultural Shock Coping strategies and food security among farming households in Nigeria. Journal of Economics and Allied Research, 8(2), 2536-7447. Retrieved from https://jearecons.com/index.php/jearecons/article/view/307.

Ofordu, C. S., Oyewole, A. L., Adedoyin, E.D. *et.al*. (2022). Participation of Households in Urban Agriculture and Perceived Effect on Livelihood in Ibadan Metropolis, Oyo State of Nigeria. Journal of Meteorology and Climate Science, 21(1): 15-28. Retrieved from https://www.ajol.info/index.php/jmcs/article/view/235458.

Osmond, N.O., Ogwuru, H.O.R., Ihugba, O. A. *et al.* (2024). *Implications of COVID-19 for agriculture, food security, and poverty in Nigeria. Journal of Economics and Allied Research*, 7(2), 33-41. Retrieved from https://jearecons.com/index.php/jearecons/article/view/204.

Owino, A. Y., Wesonga, R., & Nabugoomu, F. (2014). Determining Food Insecurity: An Application of the Rasch Model with Household Survey Data in Uganda. International Journal of Food Science, 2014, 1–8. https://doi.org/10.1155/2014/121269

Owoo, N.S. (2021). Demographic considerations and food security in Nigeria. *Journal of Social and Economic Development,* 23, 128–167. https://doi.org/10.1007/s40847-020-00116-y

United Nations (UN). (2022). *World urbanization prospects 2018: Highlights*. Department of Economic and Social Affairs, Population Division. https://www.un.org/development/desa/pd/content/World-Population-Prospects-2022.

Obayelu, A. E. (2012). Households' food security status and its determinants in the North-Central region of Nigeria. Food Economics, 9(4), 241-256. https://doi.org/10.1080/16507541.2012.707553

Olayemi, A. O. (2012). Effects of family size on household food security in Osun State, Nigeria. Asian Journal of Agriculture and Rural Development, 2(2), 136-141.

Oluwatayo, I. B. (2009). Poverty and income diversification among households in rural Nigeria: A gender analysis of livelihood patterns. In 2nd Instituto de Estudos Sociais e Econômicos (IESE) Conference on "Dynamics of Poverty and Patterns of Economic Accumulation: Continuity and Economic Change" (pp. 1-24).

Onyenekwe, C. S., Okpara, U. T., Opata, P. I., Egyir, I. S., & Sarpong, D. B. (2022). The triple challenge: food security and vulnerabilities of fishing and farming households in situations characterized by increasing conflict, climate shock, and environmental degradation. Land, 11(11), 1982. https://doi.org/10.3390/land11111982.

Orsini, F., Kahane, R., Nono-Womdim, R., & Gianquinto, G. (2013). Urban agriculture in the developing world: a review. Agronomy for Sustainable Development, 33(4), 695–720. https://doi.org/10.1007/s13593-013-0143-z

Pradhan, P., Subedi, D. R., Dahal, K., *et.al.* (2024). Urban agriculture matters for sustainable development. *Cell Reports Sustainability*, 100217. https://doi.org/10.1016/j.crsus.2024.100217.

Wooldridge, J. M. (2019). Introductory econometrics: A modern approach. Cengage Learning. https://economics.ut.ac.ir/documents/3030266/14100645/Jeffrey_M._Wooldridge_Introductory_Econometrics_A_Modern_Approach__2012.pdf

World Bank (2021). Poverty and Shared Prosperity 2021: Reversals of Fortune. *The World Bank*. https://www.worldbank.org/en/publication/poverty-and-shared-prosperity

Zezza, A., Davis, B., et al., 2008. The Impact of Rising Food Prices on the Poor. FAO ESA. Working Paper 08-07

Zezza, A., & Tasciotti, L. (2010). Urban agriculture, poverty, and food security: Empirical evidence from a sample of developing countries. Food Policy, 35(4), 265–273. https://doi.org/10.1016/j.foodpol.2010.04.007.

Zou, T., Cheshmehzangi, A., Dawodu, A., & Mangi, E. (2022). The Role of Urban Agriculture in Enhancing Urban Food System Sustainability and Resilience: A Literature Review. *Journal of Resilient Economies (ISSN: 2653-1917)*, *2*(1), 1-9. https://doi.org/10.25120/jre.2.1.2022.3906.