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Constraints to urban agriculture in southeast Nigeria

Chukwudi Charles Olumba [1]✉, Cynthia Nneka Olumba[2] & Jonathan Okechukwu Alimba[1]

Urban agriculture (UA) is promoted as a viable strategy to support the food demands of the increasing urban population in the global south. However, UA faces severe constraints that could undermine this potential. To sustain urban food production, there is a research need to identify the main factors deterring UA activities. This study, therefore, aims to examine the constraints faced by urban farmers in carrying out their UA production activities. Two hundred and eighty urban farmers selected through a multi-stage sampling technique were used for the study. Data were collected using a questionnaire/interview schedule and analysed using descriptive statistics and principal component analysis (PCA). The study shows that the urban farmers were engaged in four main types of agro-enterprises. They include crop production, livestock production, agro-processing, and the supply of farming inputs. The majority of the UA farmers indicated that they were into maize production (75%), poultry production (60%), and 25% were into fish farming. The PCA result suggests three key constraints to UA, namely infrastructural constraints, socio-economic/environmental constraints, and institutional constraints. For UA in southeast Nigeria to reach its full potential, the study recommends proactive policy responses in support of UA. Also required is infrastructural support in terms of good road networks and marketing facilities to best support UA activities.

[1] Department of Agricultural Economics, Management and Extension, Ebonyi State University, Abakaliki, Nigeria. [2] Department of Agricultural Economics, University of Nigeria, Nsukka, Enugu State, Nigeria. ✉email: charlesolumba206@gmail.com

Introduction

Globally, the population in urban areas is growing rapidly (Arbolino et al., 2018). Projections indicate that the world population living in urban areas will increase by 68% by 2050 (UN-DESA, 2018). This urbanisation, however, is happening at different rates across the globe. The projection by the World Health Organisation (WHO) indicates that the mean annual growth rate of population in the global south cities is four times the rate recorded in the global north (WHO, 2015). Most notably, the cities of sub-Saharan Africa countries where most of the world's population growth is expected to occur are projected to grow annually at a growth rate of 4.1%, and exceeding the global average of 1.84% (WHO, 2015). In the specific case of Nigeria, the annual urban population growth is about 4.3% and it is projected that by 2037, the population living in cities will be doubled (UN-DESA, 2018).

In light of the unprecedented rate of urbanisation and its negative implications for urban food security especially in the global south countries (Gwan and Kimengsi, 2020), several authors have called for holistic research efforts towards the development of UA as a strategy for sustaining the food supplies within urban areas (Adeyemo et al., 2017; Diehl et al., 2020). Simply defined, UA is the cultivation of crops and rearing of livestock for own consumption or commercialisation within or on the fringe of a metropolis. UA encompasses a range of activities such as the production, processing, marketing, and distribution of agricultural produce in the urban setting (Orsini et al., 2013). Across the world, UA provides employment opportunities to urban residents in varying forms and degrees. In the global north, UA is usually practiced on a wide range of land areas, including allotments, private domestic gardens, community gardens, and commercial market gardens (Foster et al., 2017; Schmutz et al., 2018), producing predominantly fruits and vegetables (Orsini et al., 2013). Whereas, in the global south, urban food production is practiced on privately owned or rented land, vacant or open spaces, greenhouses, and as well as in rivers, ponds, and lakes (Ibitoye et al., 2016; Olumba et al., 2019). Moreover, contrasting motivations for practicing UA exists across the globe. In the global north countries, UA is practiced mainly for recreational or social purposes (Mok et al., 2014), whereas, in the global south countries, UA is practiced mainly for food security and poverty alleviation (Zezza and Tasciotti, 2010).

More generally, UA is gaining popularity in many countries in the world and the subject continues to gain prominence as a research and policy issue on the international development agenda (Horst et al., 2017). The multiple social, economic, and environmental benefits of UA are evidenced in the literature. As a source of food security, UA contributes to household food availability and dietary diversity (Salau and Attah, 2012; Alimba et al., 2018). As a livelihood strategy, Binns and Nel (2019) suggest that UA provides significant employment opportunities for both urban farmers and other services providers along the supply chain. In terms of its environmental impact, UA contributes to the reduction of energy use and greenhouse gas emissions, given the lesser distance food travels before getting to the consumers (De Zeeuw et al., 2011). Moreover, trees maintained on land meant for UA contributes positively to the quality of the urban environment and serve as adaptive and mitigation measures for climate change impact (De Zeeuw et al., 2011).

While UA may indeed offer the potential to support the urban population and the food systems in the global south, the sector itself faces severe constraints to its sustainability that could undermine this potential. An often-cited constraint to UA is the urbanization-induced displacement of prime agricultural land in urban areas (Amponsah et al., 2015, 2016). The rapid and uncontrolled urban population growth and development has led to extensive land-use changes with adverse implications for UA sustainability, especially for the global south countries (Ayambire et al., 2019). The core of the challenge is that the increasing urban population and the expansion of urban spaces have led to a concomitant growth in demand for urban land, consequently leading to the loss of agricultural land to non-agricultural land use (Wu et al., 2011). Indeed, in the wake of appreciating land values and land competition in and around cities induced by rapid urbanisation, prime agricultural lands are encroached by more competitive land uses (Bonye et al., 2021). This phenomenon is underpinned by the poor regulatory framework of the land markets in peri-urban areas into which cities expand which typically do not favour agriculture (Yaro, 2010). The effect of this is that the urban farmers who have limited financial capacity are unable to compete in the urban land market (Amponsah et al., 2015) and this presents a threat to the food security of the urban population.

Apart from the conflicting use of urban land and the land-use change, another constraint to UA arises from tenurial arrangements around available land spaces for UA (Chah et al., 2010; Asadu et al., 2016). Farmers are confronted with a multitude of socio-economic and institutional constraints in their attempt to gain access to farmland in the urban areas, and thus are unable to optimally carry out their production activities (Odudu and Omirin, 2012; Olumba et al., 2019). Moreover, the lack of access to credit facilities, vulnerability to theft, and crop damaged by passing livestock are also highlighted constraints to UA (Asadu et al., 2016). To the extent that agricultural insurance is central to cushioning the effects of losses and damages in the UA system, however, farmers typically exhibit an unfavourable attitude towards agricultural insurance schemes (Ajieh, 2012). In Nigeria, for example, farmers engage poorly in agricultural insurance schemes because they lack trust in the system (Ajieh, 2012), while some farmers are either not aware or do not fully understand the benefits the scheme offers (Okeke-Agulu and Salihi, 2019).

Furthermore, assessing the constraints to UA in Enugu metropolis, Nigeria, Chah et al. (2010) note that lack of information reflecting inadequate extension assistance represents a serious problem faced by the UA farmers. Rohit et al. (2017) found the unavailability of inputs, labour shortages, marketing, economic and environmental challenges are key challenges for peri-urban farming. In Burkina Faso, Ouédraogo et al. (2019) found that shortages in agricultural inputs and equipment, inadequate water for irrigation and poor soil quality were major problems for urban farmers. Rathva et al. (2020) in their analysis of the constraints faced by the dairy urban farmers in India revealed that the high cost of construction of housing, and animal feed, and the lack of timely insemination facilities were major constraints for UA. Duguma et al. (2011) show that diseases, lack of extension services, credit services, improved animal breeds, and access to artificial insemination were important constraints limiting urban dairy production in Ethiopia.

Our study aims to contribute to the growing body of literature on UA constraints in the global south region, with a specific focus on southeast Nigeria owing to its growing urban population. Moreover, there is evidence of increased interest in UA activities in many parts of the urban towns in this region, and that UA output (both crop and livestock production) plays an important role in promoting food security for the urban farming households (Alimba et al., 2018). This makes it pertinent to examine the constraints faced by the urban farmers in carrying out their UA production activities. This research is significant for reasons of scholarship and of public policy. On the academic front, firstly, we extend the empirical evidence on the constraints in UA systems from the global south perspective. Secondly, we provide a

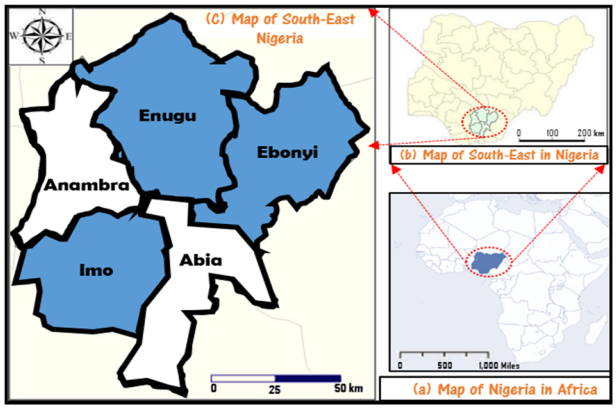

Fig. 1 Geographical map of the study area. Map of Southeast region of Nigeria showing the sampled States—Ebonyi, Enugu and Imo (inset: Africa showing Nigeria and Nigeria showing the Southeast region).

current appraisal of UA agro-enterprises, which could serve as a basis for future research and development. And thirdly, our study takes place in a country experiencing rapid urbanisation and where UA is gaining formal recognition in the policy arena. From a policy standpoint, this research is significant for providing policy recommendations to guide the municipal authorities and urban planners in sustainably mainstreaming UA into urban development planning thereby ensuring urban food security. The over-arching objectives of the research are to:

i. ascertain the types of agro-enterprises that the urban farmers engage in; and
ii. examine the constraints faced by the urban farmers.

Materials and methods

Study area. The area for this study is the urban areas in the southeast region of Nigeria. The southeast region comprises five states namely Enugu, Imo, Anambra, Abia, and Ebonyi states (see Fig. 1). Southeast Nigeria lies between latitude 4°47′35″N and 7°7′44″N, and longitudes 7°54′26″E and 8°27′10″E and occupies a total land area of ~78,612 km^2 representing 8.5% of the country's total land area (Okoye et al., 2010). It is mainly agrarian, and inhabitants depend more on land resources, due to its dense population averaged to about 1000 people/km^2. The population of the area is estimated at 22.3 million people, who are predominantly of Igbo tribal extraction (NPC, 2007).

In terms of its climatic feature, southeast Nigeria is influenced by the three major air masses namely; the equatorial Maritime, the Equatorial Estuaries and the Tropical continental air masses (Mbakwe et al., 2004). The region is classed as a humid tropical area, with mean annual rainfall varying from 1500 mm in the northern fringes of Enugu and Ebonyi states to over 200 mm in the southern areas of Anambra, Imo and Abia states. The annual seasons experienced in the area are mainly the rainy season starting around April and ending in October and dry seasons from November to March. Loamy soil is the predominant soil type while mixed cropping is the major cropping system, (Unamma et al., 2004). The economic activities in the area include farming, civil service, trading, handicraft and artisanal works. In terms of agricultural production activities, cassava, maize and, vegetables are the dominant food crops cultivated while poultry is the dominant livestock raised in the area.

In terms of urbanisation, the southeast region of Nigeria has a considerable number of highly urbanised settlements with a growing population, some of which are Enugu, Aba, Umuahia, Owerri, Awka, Orlu, Abakaliki, Okigwe, Onitsha, Nsukka, and Afikpo. Studies show that a lot of urban agricultural activities take place in these urban towns (Asadu et al., 2021). Urban crop production activities take place on roadsides, near refuse dumpsites, and open spaces within the towns. Many of the urban households also keep farm animals including poultry, sheep/goats, and pigs (Asadu et al., 2021). The authors decided to study the southeast region of Nigeria because it has a long history of UA (Anikwe and Nwobodo, 2002) and offers an excellent case to explore the research questions. Another motivation for studying this region is based on the fact that the region provides an opportunity to investigate formally recognised[1] and commercial forms of UA systems that are increasingly becoming a priority on the Nigeria government agenda, as opposed to the informally practiced UA activities that pervade much of Nigeria.

Sample size, sampling techniques, and research instrument. The population of the study comprised all contact farmers operating within the urban areas in southeast Nigeria. The identification of urban areas in Nigeria can be defined by one or more of the following: population size (e.g. if the settlement has a threshold population size of 20,000 people); administrative or legal criteria (e.g. if the headquarters of the local government area and state is located in the area); and population density (Ofem, 2012; Bloch et al., 2015). For this study, urban areas are defined as settlements located within the state capital territory and the urban farmers are those involved in crop and livestock production, operating within the state capital territory.

A multi-stage sampling technique was employed in selecting the sample for the study. At the first stage, the purposive sampling technique was used to select three states namely Ebonyi, Enugu, and Imo from the five states in the zone. The choice of these states was based on the availability of the updated information on the urban contact farmers at the state's Agricultural Development Programme (ADP) and Fadama III offices. At the second stage, from each of the selected states, three urbanised settlements were randomly selected. Specifically, in Ebonyi state—Abakaliki, Afikpo North, and Ezza South urban settlements were selected; in Enugu state—Enugu North, Enugu South, and Enugu East urban settlements were selected, while in Imo state—Owerri municipal, Orlu, and Okigwe urban settlements were selected. The lists of urban contact farmers retrieved were used as the sampling frame for the study. The sampling frame was 931 urban farmers (Table 1). Specifically, in Ebonyi, Enugu, and Imo states there were 202, 192, and 537 urban farmers on the list, respectively. At the third stage, proportional sample size was also used to randomly select 280 urban farmers (61, 58, and 161 urban farmers from Ebonyi, Enugu, and Imo states, respectively) (Table 1).

Data collection procedure. Primary data for the study were collected from urban farmers between April and September 2018. Interview schedules facilitated by a paper-based semi-structured questionnaire were used to collect information from the sampled urban farmers. The interviews were conducted face to face with the respondents. Prior to the actual survey, the research instruments were first pre-tested to ensure their adequacy and to customise the instruments to the local conditions of the farmers. The pre-test survey conducted also provided an avenue to ensure the research assistants understood the data collection process. Data were collected on the types of agro-enterprises the farmers engaged in and the constraints faced by the urban farmers in UA. Specifically, the farmers were presented with an exhaustive list of urban agro-enterprises gleaned from the literature review. They were asked to indicate "Yes" if they engage in a particular agro-enterprise or "No" to indicate otherwise. There was an

Table 1 Proportionate distribution of urban farmers according to states.

Southeast region	Estimated number of urban farmers	Proportion	Number selected	Urban settlement	Number of farmers surveyed
Ebonyi	202	(202/931) × 280	61	Abakaliki	23
				Afikpo North	18
				Ezza South	20
Enugu	192	(192/931) × 280	58	Enugu North	27
				Enugu South	16
				Enugu East	15
Imo	537	(537/931) × 280	161	Owerri municipal	56
				Orlu	53
				Okigwe	52
Total	931				280

opportunity for multiple responses in the case where the farmers engage in more than one agro-enterprises.

To ascertain the constraints to UA in the area, the farmers were presented with an exhaustive list of constraints to UA identified from previous related literature. Also, we included in the list an additional variable—"challenges posed by cattle invasion on farmland", that has not been previously investigated especially in the context of UA. We considered this variable necessary given the recurrent tensions between crop farmers and herdsmen at the time of the study. The survey questionnaire asked the farmers to rate the extent of the UA constraints on a 4-point Likert-type scale. The scale was assigned values as follows: very low extent = 1, low extent = 2, great extent = 3 and 4 = very great extent, with a side choice of 0 (do not know). The framing of the question is similar to the way other researchers investigate the factors considered as constraints to UA (Salau and Attah, 2012). For sake of clarity and to ensure that the farmers get the right meaning of the specific constraint, each constraint was described with illustrations to which the farmers can relate. To gain further insights into the realities of the farmers, they were encouraged to pass further comments on the constraints as well as suggest other constraints that might be missing from the list. Their responses were included in the list and scored for each respondent on a 4-point Likert type scale as explained above. Also, the urban farmers were asked to point out if there are any inappropriate barriers on the list. After the interviews, the researchers find that all previously listed constraints informed by the literature were relevant.

Six trained research assistants were recruited to administer the validated questionnaire instrument. The 2-day training of the research assistants ensured they were well acquainted with the study concept and on their ethics around the data to be collected.

Data analysis. Data collected were analysed with descriptive statistical tools including frequency, and percentages. Factor analysis using the principal component analysis model (PCA) was performed by using IBM SPSS version-22 and STATA version-15 analytical software. The two main approaches to factor analysis (exploratory and confirmatory) were applied for the data analysis. First, the exploratory factor analysis was used to analyse the constraints associated with UA (hereafter referred to as constraining variables) using IBM SPSS version-22. Next, confirmatory factor analysis was used to elicit information regarding interrelationships among the latent variables[2] (hereafter referred to as factors) and also to check its discriminant validity using STATA version-15.

PCA model. The factor analysis using PCA was employed to examine the constraints faced by urban farmers. The PCA is a special case of the more general FA. The PCA technique used in this study is similar to the procedures outlined by Otitoju and Enete (2016). The aim of the PCA technique is to reduce a set of interdependent variables, X_j's ($j = 1, 2, \ldots, k$) to a smaller set of composite variables called principal components (Pi), which are the linear combination of the X's:

$$P_1 = a_{11}X_1 + a_{12}X_2 + \cdots + a_{1k}X_k$$
$$P_2 = a_{21}X_1 + a_{22}X_2 + \cdots + a_{2k}X_k$$
$$* \quad * \quad * \quad *$$
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$$P_k = a_{k1}X_1 + a_{k2}X_2 + \cdots + a_{kk}X_k$$

where $P_1, P_2, \ldots, P_k$ = unobserved underlying factors constraining urban farmers from participating in UA. $a_1 - a_k$ = factor loadings or correlation coefficients. $X_1, X_2, \ldots, X_k$ = observed variables/constraints to UA.

Therefore, choosing a's implies the following: (i) the constructed principal components are uncorrelated, and (ii) the highest proportion of the total deviation in all sets of X's is absorbed by the first principal component P_1. Moreover, according to Koutsoyiannis (2001), the remaining maximum variation in the X's is absorbed by the second principal component. The associated assumptions were applied accordingly while the suitable number of factors were subjectively selected based on varimax rotated factor loading obtained using IBM SPSS version-22. The Kaiser rule of thumb which stipulates that factor loading of 0.40 and above should be used as the minimum decision rule for classifying a given variable was adopted (Kaiser, 1958).

Table 2 KMO and Bartlett's test.

Kaiser–Meyer–Olkin measure of sampling adequacy	0.523	
Bartlett's test of sphericity	Approx. Chi-square	2564.533
	Df	210
	Sig.	0.000

[a]Cronbach's alpha = 0.754.

However, to confirm the suitability of the data for a PCA analysis, the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy (MSA), and Bartlett's Test of Sphericity was conducted. From Table 2, the KMO value for the reduced dataset is deemed 'satisfactory' (0.523) according to Kaiser (1974). The significance of the result of the Bartlett test of sphericity suggests interdependencies among the variables and provides confidence to proceed to PCA (Chi-square value of 2564.533; $p \leq 0.05$; with a degree of freedom of 210). The result of the correlation matrix suggests that no variable correlated highly ($r > 0.7$). Also, a Cronbach's alpha of 0.754 was realised, suggesting an acceptable level of internal consistency and reliability in the measures and

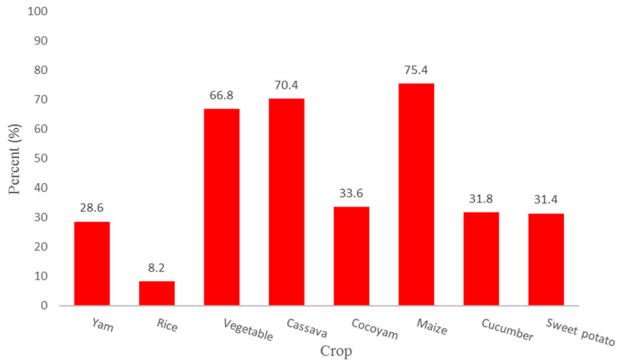

Fig. 2 Surveyed urban farmers engagement in crop enterprise ($n = 280$). Figure basically indicates the percentage distribution of the various types of crop enterprise engaged by the urban farmers in the study area generated from the field survey.

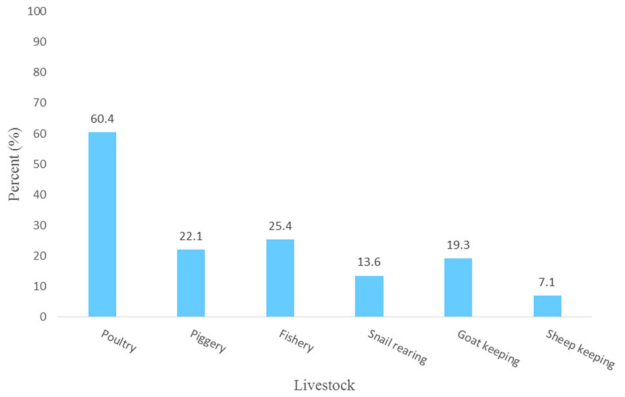

Fig. 3 Surveyed urban farmers engagement in livestock enterprise ($n = 280$). Figure indicates the percentage distribution of livestock enterprise engaged by the urban farmers in the study area generated from the field survey.

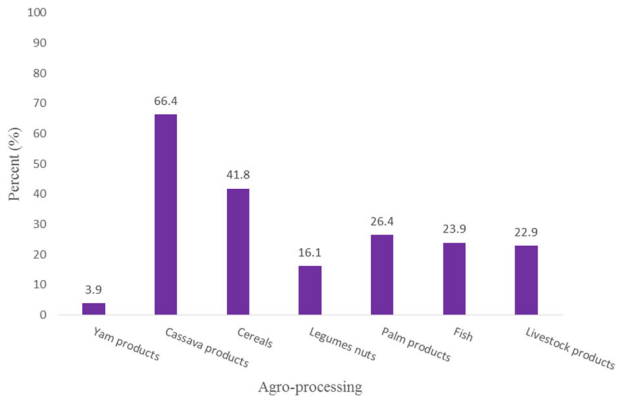

Fig. 4 Surveyed urban farmers engagement in agro-processing enterprise ($n = 280$). Figure shows the percentage distribution of agro-processing enterprise engaged by the urban farmers in the study area generated from the field survey.

the scale (Field, 2009). PCA was therefore a suitable method for the analysis of the constraints to UA.

Results

Agro-enterprises engaged by the urban farmers. Figs. 2–5 show the various types of agro-enterprises engaged by the urban farmers. Four main types of agro-enterprises engaged by the

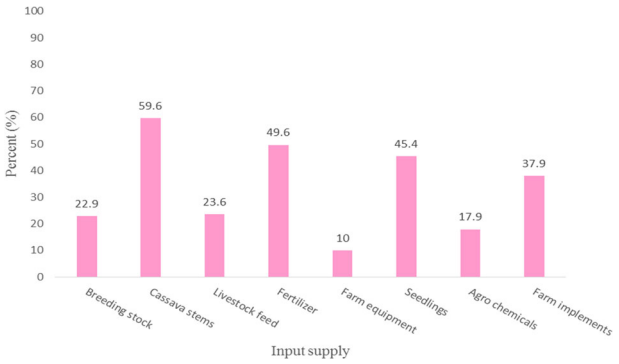

Fig. 5 Surveyed urban farmers engagement in input supply enterprise ($n = 280$). Figure indicates the percentage distribution of input supply enterprise engaged by the urban farmers in the study area generated from the field survey.

urban farmers were identified. They include crop, livestock, agro-processing, and the supply of farming inputs enterprises. Multiple responses were observed for each farmer suggesting that the urban farmers engaged in more than one agro-enterprise[3].

In terms of crop production, the majority (75%) of the farmers indicated that they were involved in maize production, while only 8% of the urban farmers were farming rice. Focusing on the engagement in livestock enterprise in the study area, a large percentage (60%) of the respondents indicated they were involved in poultry production while 25% were practicing fish farming. This is closely followed by 22% who indicated that they were involved in the business of pig rearing. Meanwhile, in the study area, 19%, 14% and 7% of the urban farmers indicated to be engaged in goat rearing, snail production, and sheep rearing respectively.

Agro-processing enterprise was practiced largely by 66% of the urban farmers who indicated that they were engaged in the processing of cassava; 42%, 26%, 24%, 23%, and 16% of the farmers were involved in the processing of cereals, palm produce, fish, livestock, and legumes and nuts, respectively. Only 4% of the urban farmers were engaged in agro-processing of yam tubers into yam flour. Regarding the supply of farm inputs, about 60% supply cassava stems, 50% were into the supply of fertilizers, 45% were engaged in seedlings supply, and 38% supply farm implements. Also, it is observed that 24%, 23%, 18% and 10% of the farmers were engaged in livestock feed supply, breeding stock supply, agro-chemicals, and farm equipment respectively.

Constraints faced by the urban farmers in southeast Nigeria. PCA was employed to identify the major constraints faced by the urban farmers in their practice of UA in the area. Table 3 presents the result of the varimax rotated PCA analysis indicating the major constraints to UA in the study area. As suggested by Kaiser (1958), the factor loadings of the individual variables should be absolute values not <0.4. In consequence, 3 out of 24 variables were dropped from the initial pool and the remaining 21 variables were grouped into three distinctive components (factors). These three main factors correspond to the dominant constraining factors to UA in the study area. These factors (1, 2, and 3) have eigenvalues above 1.0, and together explained a total of 61.35% of the data variance (see Appendix A). Factor 1 with 7 variables represents socio-economic/environmental constraints (SE)—the most influential factor. Factor 2 with 9 variables represents infrastructural constraints (IF), while Factor 3 with 5 variables represents institutional constraints (IN). Furthermore, the factor correlation matrix reveals the interrelationships between the three factors (see Appendix B).

Table 3 PCA result showing the constraints to UA in Southeast Nigeria.

S/N	Constraints	Components		
		Factor 1	Factor 2	Factor 3
1	Low household income	0.688		
2	Inadequate information to farmers	0.672		
3	Climate change and variability	0.661		
4	Reduced availability of labour	0.592		
5	Rapid population growth	0.554		
6	Unaffordability of land	0.520		
7	High food prices	0.477		
8	Capital intensive nature of technologies		0.621	
9	Cattle invasion		0.599	
10	Lack of access to labour saving devices		0.594	
11	Poor feeder roads		0.582	
12	Use of crude farm implement		0.575	
13	Inadequacy and lack of access to improved agricultural inputs		0.532	
14	Lack of basic amenities (electricity and clean water)		0.521	
15	Poor post-harvest processing and storage technologies		0.447	
16	Poor market infrastructure		0.424	
17	Poor governance			0.759
18	Low priority for urban farming			0.732
19	Poor credit facilities			0.586
20	Land grabbing			0.550
21	Weak extension service delivery			0.528

Extraction method: principal component analysis. Rotation method: Varimax with Kaiser. The authors report statistical significance using Kaiser Normalisation of factor loadings of ±0.4 and above (Kaiser, 1958). Normalisation: Rotation converged in 5 iterations. Factor 1 = socio-economic/environmental constraints; Factor 2 = infrastructural constraints; and Factor 3 = institutional constraints.

Table 4 Measurement model evaluation.

Factor	Items	Cronbach's alpha	Composite reliability
SE	Low household income	0.735	0.795
	Inadequate information to farmers		
	Climate change and variability		
	Reduced availability of labour		
	Rapid population growth		
	Unaffordability of land		
	High food prices		
IF	Capital intensive nature of technologies	0.721	0.792
	Cattle invasion		
	Lack of access to labour saving devices		
	Poor feeder roads		
	Use of crude farm implement		
	Inadequacy and lack of access to improved agricultural inputs		
	Lack of basic amenities (electricity and clean water)		
	Poor post-harvest processing and storage technologies		
	Poor market infrastructure		
IN	Poor governance	0.66	0.771
	Low priority for urban farming		
	Poor credit facilities		
	Land grabbing		
	Weak extension service delivery		

The variables that loaded high under Factor 1 (socio-economic/environmental constraints) include low household income (0.688), inadequate information to farmers (0.672), climate change and variability (0.661), reduced availability of labour (0.592), rapid population growth (0.554), unaffordability of land (0.520) and high food prices (0.477).

Under Factor 2 (infrastructural constraints), the constraining variables against practicing urban agriculture are the capital intensive nature of technologies (0.621), cattle invasion (0.599), lack of access to labour saving devices (0.594), poor feeder roads (0.582), use of crude farm implements (0.575), inadequacy and lack of access to improved agricultural inputs (0.532), lack of basic amenities (electricity and clean water) (0.521), poor post-harvest processing and storage technologies (0.447) and poor market infrastructures (0.424).

The constraining variables that loaded high under Factor 3 (institutional constraints) are poor governance (0.759), low priority for urban farming (0.732), poor credit facilities (0.586), land grabbing by land speculators and government (0.550), and weak extension service delivery (0.528).

Validating the PCA results. Tables 4 and 5 show the validation results of the constraining variables to UA. The Cronbach's alpha coefficient and composite reliability score provide information on the reliability of the scale and are usually interpreted in the same

Table 5 Discriminant validity assessment (comparison of AVE and the squared correlations).

Factors	Average variance extracted based on rotated component matrix in Table 3
SE	0.360
IF	0.300
IN	0.408
Factor correlation	**Squared correlation based on the factor correlation matrix in Table 5**
SE–IF	0.203
SE–IN	0.027
IF–IN	0.015

Note: When AVE values ≥ squared correlation values there is no problem with discriminant validity.

way (Aibinu and Al-Lawati, 2010). Acceptable composite reliability scores should be above 0.70 (Hair et al., 1998) while the Cronbach's alpha coefficients should be 0.70 or higher (Nunnally, 1978). From the result in Table 4, this study finds that for the IN factor, the composite reliability score was >0.70 but the Cronbach's alpha coefficient was less than the standard 0.70. Nevertheless, we judge that its constraining variables have an acceptable level of internal consistency reliability based on Fornell and Larcker's (1981) assertion of the superiority of the composite reliability score over Cronbach's alpha. Cronbach's alpha is criticised for underestimating the internal consistency reliability based on its sensitivity to the number of constraining variables within the scale (Hair et al., 2014a). Moreover, unlike Cronbach's alpha, the composite reliability score does not assume equal loadings for all constraining variables (Hair et al., 2014a).

Furthermore, the scale is assessed to check its discriminant validity, that is, the degree to which measures of different factors are unrelated (Alarcón et al., 2015). To assess discriminant validity, Fornell and Larcker (1981) recommend that the variance that a factor shares with its constraining variables should be above what it shares with any other factor. In this light, each factor's average variance extracted (AVE) should be above the highest squared correlation with other factors. Hair et al. (2014a, 2014b) define AVE as the grand mean value of the squared loadings of a set of constraining variables corresponding to a factor's communality. As shown in Table 5, no squared correlation amongst any two factors exceeded their AVEs, indicating the three factors are validly discriminant.

Discussion

Agro-enterprises engaged by the urban farmers. From Figs. 2 to 5, it is observed that there are four major types of agro-enterprises (crop farming, livestock production, agro-processing, and the supply of farming inputs) engaged by this sample of urban farmers. A critical look at the figures shows that the farmers were engaged in more than one of these highlighted agro-enterprises, thus indicating that the urban farmers that were sampled are involved in enterprise diversification. The practice of diversification of their farm enterprises could play a key role in boosting farm income as well guaranteeing farm income security (Sen et al., 2017). Moreover, on-farm diversification offers an important risk management strategy for the farmers to deal with price, input, and output uncertainty (Vihi et al., 2018). The gain behind the idea of diversification is that the profit from one enterprise can offset losses in another enterprise.

The result indicates that maize is the most popular crop grown by the majority (75%) of the surveyed urban farmers. This is closely followed by a comparatively large percentage of the sample urban farmers (70% and 67%) who grow cassava and vegetables, respectively. This result is consistent with the reports that staples such as maize, cassava, and vegetables are the most grown crops in southeast Nigeria (Asadu et al., 2016) and in other regions of the country (Olaniyi, 2012; Salau and Attah, 2012). From the pattern of the dominant crops produced in the urban areas, it could be implied that the farmers were more involved in the production of short-duration crops. For example, it is observed that fruit trees like orange, plantain and banana were not grown by many of the farmers. A plausible reason for this could be due to insecurity of land used for cultivation in urban areas (Chah et al., 2010; Asadu et al., 2016). Farmers are more likely to cultivate high-value labour-demanding crops on land with secure tenure and grow staple crops such as cassava and maize on plots with lower tenure security (Brock and Foeken, 2006).

Furthermore, we found that the urban farmers were involved in raising livestock, although this enterprise is found to be less common than crop cultivation. The multiple responses of the farmers indicate that they raised more than one type of livestock; with poultry production being the most prominent and engaged by more than half (60%) of the farmers. This is similar to the findings of Olaniyi (2012) who found poultry as the prominent livestock raised by urban farmers in Oyo state Nigeria. Again, this study asserts that scarcity of land might have been the reason for the dominance of raising smaller livestock like poultry in the study area. Foeken et al. (2004) in their study found inadequate space as a disincentive for urban farmers to raise larger livestock. Also, the higher percentage in poultry farming could be related to the significant socio-cultural role of poultry in the African societies (used as a gift to relatives and highly consumed during festive periods) and the rapidly increasing demand for poultry products such as eggs and poultry meats (Heise et al., 2015). The urban farmers are also involved in agro-processing of farm produce, of which the farmers involved in the processing of cassava products form the largest percentage reaching up to 66%. Also, the farmers were involved in the supply of farm inputs, with prominent farm inputs being supplied found to be cassava stem by about 60% of the urban farmers.

Constraints faced by the farmers in practicing urban agriculture. The extent to which the farmers can achieve their production activities is constrained by several factors (Table 3). These factors are related to socio-economic/environmental constraints (Factor 1), infrastructural constraints (Factor 2), and institutional constraints (Factor 3).

Socio-economic/environmental factors. The surveyed urban farmers reported that their farming activities were negatively affected by the unpredictable rainfall patterns, pest and disease outbreaks and heat stresses resulting in decreased farm yield and income. A similar result was reported by Odewumi et al. (2013) in their study on UA in Ibadan Metropolis, south-western Nigeria. Their study found the negative effects of climate change on UA as water scarcity, disease outbreaks, and delays in harvesting periods. Other studies underscored the intensifying climate risks as a significant concern for urban production activities in developing countries, owing to social and environmental stresses such as rapid population growth, systemic poverty, and poor governance (Lwasa, 2014; Lwasa et al., 2014; Revi et al., 2014).

Socio-economic factors affecting UA in the area include the unaffordability of land both due to high land prices and income constraint, which make it difficult for the urban farmers to access land. This finding is in line with studies of Odudu (2015),

Ibitoye et al. (2016), and Edeoghon and Izekor (2017) who identified some of the constraints to the development of UA in Nigeria to include poor access to land and inadequate capital. Frayne et al. (2014) argue that access to land and other economic resources are necessary preconditions for UA to deliver benefits to households including urban food security.

Moreover, the land access constraint may also relate to the conflicting use of land for development and agricultural purposes and the rapid urbanisation stimulated by rural–urban migration and population growth (Onyebueke et al., 2020), leading to a decline in the available prime urban agricultural land. This assertion is in line with the study finding of Rimal et al. (2018), citing how land fragmentation and urbanisation stimulated by rural–urban migration and population growth threaten prime farmlands in the Tarai districts, Nepal. As demonstrated by Bonye et al. (2021), urban area expansion and development have largely occurred at the detriment of agricultural land. This urbanisation-induced displacement of agricultural land may explain the growing popularity of using marginal land and open spaces for UA among the urban farmers (Olumba et al., 2019) and cultivating small plot sizes (Taiwo, 2014). This observation is sustained by Odudu (2017), who report that urban farmers in Lagos state, Nigeria operate on marginal lands to avoid competition and land use conflict, and with adverse implication on their productivity. Indeed, operating UA on roadside verges and open spaces, put the urban farmers in a land insecurity situation that impedes their agricultural investment propensity (Houessou et al., 2020).

Another highlighted constraint to UA in the area is the shortage of labour, which has implications for UA productivity. Farm labour scarcity reported in the study area could be linked to the perceived views of youth preference for engaging in non-agricultural activities than in farming activities (Ayinde et al., 2014). This finding agrees with Egbuna (2008) who underscored the high cost of labour as a major constraint to UA in Nigeria. Salau and Attah (2012) argued that the high cost of labour is capable of lowering farm productivity, thus impacting negatively on household income and food security. Furthermore, Table 3 indicates high food prices and the lack of income pose a constraint to UA practice in the study area. This finding is in line with the report of Chah et al. (2010) who reported the lack of capital as an important constraint to UA.

Infrastructural factors. The inadequacies and lack of infrastructural facilities including processing and storage activities, road networks, labour saving technologies, poor market infrastructure, and input supply to support UA activities emerged as important factors constraining UA in the area. The surveyed urban farmers reported that they have great difficulty accessing agricultural inputs, especially fertilizer, agro-chemicals, improved seeds, and as well as feed for livestock, as they sometimes had to travel as far as 15–20 km to access small quantities of these inputs. The finding is consistent with the findings of Edeoghon and Izekor (2017) who reported that poor storage facilities and distant markets are the important constraints confronting the urban farmers in Lagos Nigeria. Moreover, the input supply constraint is in line with Katongole et al. (2012) study which found feed scarcity as the first major constraint to livestock urban farmers in Uganda. Similarly, Salau and Attah (2012) underscored the lack of input supply as a barrier to UA. Mgbenka et al. (2016) identified that farmers in Nigeria, generally have little or no access to modern inputs and other productive resources.

Another highlighted constraint to UA is the poor market infrastructures, which has implications for the productivity of the urban farmers. Frayne et al. (2014) argue that for UA to potentially contribute to food security, the provision of inputs, production, and marketing infrastructure, are important preconditions to be put in place. The timely provision of farm inputs at affordable prices by governments is critical to agricultural productivity and food security. Furthermore, the urban farmers reported the lack of labour-saving technologies as a challenge to UA activities.

Institutional factors. The inefficiencies of critical institutional services in terms of governance for UA, extension delivery systems, low priority for urban farming, poor credit access and land grabbing represent major constraints to urban agricultural activities in the area. Weak institutional arrangement around urban land and its development by driving the gradual displacement of UA activities impact negatively on UA in the area. The PCA result indicates land grabbing as a major barrier to UA activities in the study area. From the interactions with the farmers during the survey, it was gathered that land speculators and government grab their land in the name of increasing foreign direct investment in agriculture. However, the land grabbed is either sold to foreign investors, fenced and left idle, or used for non-agricultural purposes. This finding is in line with Chah et al. (2010) who reported the harassment of urban farmers by government officials and plot owners as regards UA land as a major problem faced by the urban farmers. The authors related this occurrence to the high population densities in the urban areas leading to resource competition and land conflicts. This land grabbing situation in the study area could serve as a disincentive for the urban farmers to remain in the business of UA, given the adverse consequences land grabbing has on their farm income. Thus, they are more likely to convert their livelihood means from agricultural activities to non-agricultural activities (Nguyen et al., 2016).

Another highlighted constraint to UA is the weak extension service delivery to the urban areas. This finding is congruent with the findings of Edeoghon and Izekor (2017), who underscored the lack of extension services and inadequate information as a constraint to UA in Lagos state, Nigeria. Also, Salau and Attah (2012) found poor extension service as a constraint to UA in Nasarawa state, Nigeria. The absence of inadequate extension assistance may force the urban farmers to rely on their traditional knowledge or farming techniques from the rural areas which may not be suited to the urban condition (Visser, 2004). Otitoju and Enete (2016) demonstrate the significance of farmers' contact with agricultural extension agents in positively influencing their production levels, resource use efficiency, and profitability. However, in Nigeria, the agriculture extension officers are usually faced with overwhelming workloads, as they have to service a disproportionate number of farmers. Moreover, the deplorable conditions under which the extension agents work serve as a disincentive for them to provide extension services to farmers effectively (Fagariba et al., 2018).

The study identified poor governance as an important factor hindering UA activities in southeast Nigeria. Governance and politics in Nigeria are characterised by high rates of corruption, collusion and nepotism that impacts negatively on food access and utilisation. Egbutah (2009) observed that funds allocated to the agricultural sector are mostly diverted into the pockets of political office holders and government officials, leaving little funds which is hardly sufficient for any meaningful impact on agriculture. Furthermore, UA activities in the area have also been constrained by the skewed institutional and governmental structure that prioritises rural-based agricultural practices with lesser attention to urban farmers during development interventions. The farmers reported that most of the agricultural development interventions were mostly focused on rural areas. This finding is in tandem with Ibitoye et al. (2016) who reported

that most of the extension delivery services were devoted to rural farmers with little attention given to urban farmers. This lack of recognition affects investment and funding priorities for UA. Another plausible reason for the low priority of UA could be linked to the notion that UA is inappropriate as a "city business" (Simatele and Binns, 2008).

More so, poor access to credit facilities is a major factor hindering the development of UA in southeast Nigeria. This finding is congruent with the result of Edeoghon and Izekor (2017), who reported credit constraints as a limiting factor for UA. The same finding was reported for urban farmers in Nasarawa state, Nigeria, the lack of credit access posed significant constraints to their UA activities. This underscores the problem of lack of credit access to farmers and suggests the urgent need to improve farmers' access to credit facilities. Asadu et al. (2016) and Ibitoye et al. (2016) found that most of the urban farmers lack access to credit for investment. The finding on credit constraints among the urban farmers would imply that they are unable to purchase sufficient agricultural input to scale their production and boost their income.

Study limitations and future research. In this section, we highlight the limitations of this study. The present study investigates the constraints to UA with a particular focus on cities in the southeast region of Nigeria. Nevertheless, the policy recommendations from this study could be useful to other cities with comparable urbanisation experiences. Additionally, we appreciate the limitation in the data used for this study—in terms of small sample sizes aggregated across a range of agro ecological zones. Also, the dataset contained only registered farmers, hence there is a possibility of exclusion of other urban farmers (unregistered) operating in the study area. However, this study offers some interesting perspectives into the constraints urban farmers encounter in participating in UA. Also, this study offers useful guidelines for conducting similar case studies in other contexts.

As a suggestion for future research, this study can be replicated in other contexts and countries. Future research could also analyse whether constraints to UA differ according to the gender of the farmers or according to the region (south-west, south–south, north-central, and north-east) and/or the focus of agro-enterprise type. Another suggestion is to survey other stakeholders such as government agencies and consumers to determine how they perceive UA and identify policy actions that could enhance the broad implementation of UA. Finally, an avenue for future study is to analyse spatial and temporal dynamics of UA and the pattern of conversion of urban farmlands to other land uses using aerial images and Landsat images.

Conclusion and policy recommendations

The study assessed the various agro-enterprises engaged by the urban farmers in southeast Nigeria and the constraints faced in carrying out their UA activities. The result identified the four main types of agro-enterprises engaged by the urban farmers: crop production, livestock production, agro-processing and the supply of farming inputs. In the area, maize farmers dominate the crop production enterprise, engaged by 75% of the urban farmers. Poultry production is the most popular livestock enterprise engaged by 60% of urban farmers. Agro-processing enterprise are dominated by cassava product processors (66% of the urban farmers). In terms of the supply of farming inputs, the majority (60%) of the farmers were involved in the supply of cassava stems. The study result suggests that UA is evident and thriving in southeast Nigeria, with the farmers operating multiple UA enterprises. However, the extent to which urban farmers can achieve their production activities is constrained by several factors.

The PCA result suggests three principal constraints to UA in the area: socio-economic/environmental constraints, infrastructural constraints, and institutional constraints. Discovering a way to overcome these constraints constitutes a primary step to improve the urban farmers' conditions and enhance UA production in southeast Nigeria. One panacea for tackling UA challenges in the area is the improvement of the deficient infrastructural facilities including post-harvest processing, storage technologies, and road networks to enhance the viability of UA. Moreover, in response to the weak institutional services, such as the poor extension service delivery to the urban areas, the deployment of extension support services to the urban farmers is suggested. As a priority, extension agents should educate farmers on sustainable intensification methods of farming as a coping strategy for the land shortages and land access challenges in the area. Furthermore, in recognition of the land-use conflicts in the urban areas, UA can be practiced within public green spaces not earmarked for industrial redevelopments, such as community gardens and vacant lots. Also, from a policy standpoint, the development of proactive policy responses that explicitly supports and promotes UA is crucial. For instance, policies that incorporate UA into land-use planning and existing land-use policies, such as earmarking specific land areas for UA should be encouraged. Moreover, government intervention is needed in terms of providing inputs subsidies and incentives timely to farmers to enable them to overcome the high cost of inputs.

Data availability

The datasets generated during and/or analysed during the current study are not publicly available due to confidentiality issues but are available from the corresponding author on reasonable request.

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Notes

1 The sampled urban farmers are registered farmers with the Agricultural Development Programme (ADP) and Fadama III offices in the three selected states.
2 Latent variables are variables that cannot be directly measured and therefore are inferred from the constraining variables.
3 Multiple choice of agro-enterprise engaged by the farmer was possible, in consequence, the percentage does not add up to 100.

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Author Contributions

CCO conceptualised/designed the study, developed the study tools, led the data collection, cleaning and analysis, and contributed in writing, reviewing and editing the manuscript; JOA supervised the research and participated in reviewing and editing the manuscript; CNO participated in data collection, writing, reviewing and editing the manuscript. All authors read and approved the final manuscript copy before the submission..

Competing interests

The authors declare no competing interests.

Informed consent

Both written and oral informed consent was obtained from each of the respondents before the administration of the questionnaire and interview schedule. Confidentiality of respondents' information was strictly observed.

Ethical Approval

Ethical approval to carry out the study was obtained from the Department of Agricultural Economics, Management & Extension, Ebonyi State University, Abakaliki, Nigeria.

Additional information

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Correspondence and requests for materials should be addressed to Chukwudi Charles Olumba.