Determinants Of Participation In Urban Horticultural Technologies In Nairobi County, Kenya

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Abstract

High population in urban areas has led to decrease land for farming and thus posing serious challenge of food insecurity in most urban areas. Number of urban residents have tried to practice various innovations and utilization of the available spaces within urban areas to grow crops for survival. This paper tries to investigate the production technologies practiced in Nairobi, Kenya and determine the participation status of urban farmers in the select production technologies. A snowball method was used to select a purposive random sample of 385 urban farmers participating in select production technologies within the four the selected areas of Mathare, Kibera, Roysambu and Kasarani. Informative interviews and field observations were used to collect data. Data was analyzed using descriptive statistics and multivariate probit regression to identify factors influencing participation in select production technologies. The results shows that there is low participation in hydroponic, green house and roof top production technologies and results from multivariate probit regression model indicates that age, gender, monthly income, space ownership, farming groups and information sources influenced at least one production technology.

Keywords: *urban area, food insecurity, production technologies, participation*

1 Introduction

Urbanization of formerly agricultural terrain is caused by population growth, the desire of people to improve their employment situation and housing chances, and other factors (Veronique, et al., 2020). Human needs including food, housing for accommodation, educational institutions, and other social amenities are more in demand as cities grow. Almost 50% of urban people in poor nations, according to UN-Habitat estimates, lack access to enough food, water, and sanitation (McGranahan & Satterthwaite, 2014). Most often, urbanization leads to increased property values, changes in land usage, and strong demand for agricultural products (Satterthwaite, et al., 2010). Only the wealthy population, who can afford to buy property and engage in activities that provide them larger incomes, will benefit from the increase in land value.

Sub-Saharan Africa has continued to have a high level of poverty as a result of the GDP's poor expansion (Chauvin ND et al., 2012). In sub-Saharan African nations, agriculture has been determined to be the largest contributor to GDP. Notwithstanding the contribution of agriculture to the continent's economy, agricultural productivity needs to be raised in order to lower levels of poverty (Chauvin ND et al., 2012). In addition to poverty, malnutrition affects a huge portion of the population in African cities (World Health Organization, 2009). Around 200 million individuals are thought to have vitamin A deficiency, and over 1.6 billion people have iron deficiency. The growing population in cities has created a variety of problems for the locals.

Urban horticulture offers a chance to use abandoned lots, open spaces, and roofs in cities to grow food (Heather, 2012). Many advantages that help to sustainable urban development are brought about by the provision of green spaces in urban areas. Badami, M.G. & Ramankutty, N. (2015) mentioned that horticultural benefits are wide-ranging: urban horticulture provides employment opportunities to many younger generation, generates income for urban farmers, improves food security, whereas Llorach-Massana et al., (2017) indicated it reduces gender disparities, contributes to mental and physical health of the residents and it eliminates social exclusion. Urban horticulture uses a variety of production methods on the open spaces that are present in metropolitan environments. The available spaces in urban areas include; house backyards, below power lines, along the roads,

By 2030, there will be over 8.5 billion people living in cities and peri-urban areas worldwide (UN, 2015). The number of people moving to cities is on the rise, and by 2050, it is expected that 66% of the world's population will live in different cities (UN, 2014). According to the 2019 Kenya Population and Housing Census Report, Nairobi County has the largest urban population in Kenya, with over 4 million people living there. More than 60% of the population also lives in a number of slums within the city. Poor living conditions, inadequate water and sanitation facilities, poorly planned infrastructures, a lack of social amenities, and a high unemployment rate characterize the slums (Kimani et al., 2014).

When compared to rural residents, urban dwellers also face higher living costs, including those for education, health care, housing, transportation, and inflated food prices (Cohen & Garrett, 2010). Overreliance on packaged foods, the effects of climate change, and less agricultural land are all factors that contribute to food insecurity (Kimani et al., 2014). In addition to the increased demand for food, poverty and malnutrition are still a problem in many cities worldwide. According to FAO (2012), approximately 40% of urban residents survive on less than $1 per day and 70% on less than $2 per day. Essentially, (Cohen and Garrett, 2010) noticed that various metropolitan inhabitants spend between 60 percent and 80 percent of their complete pay on food, subsequently making them more powerless against food costs vacillations. Such brutal truth of neediness in the metropolitan regions require both short-and long haul procedures which will guarantee adequate food supply and all around facilitated circulation frameworks to address the raising degrees of food weakness in metropolitan regions.

Urban horticulture is influenced by a variety of factors, which have been the subject of numerous studies. Policy issues have been discussed in depth in studies on the determinants (Pölling, 2016). Other studies have examined the reasons why urban dwellers are interested in urban farming (Trendov, 2018). While some researchers have looked at how farmers' demographics affect how urban agriculture is done. Specht et al., (2019) used self-reported data supplied by agricultural professionals to investigate the factors influencing the implementation of urban agriculture and recommended that additional research be conducted to collect information from multiple sources from urban dwellers. He did, however, point out that a single research framework cannot cover all of the factors that influence urban agriculture. Restricted examinations have heightened examination in humanistic - financial elements, impression of the metropolitan ranchers, information dispersal and compels restricting green practices, creation and promoting of vegetables in metropolitan regions. Hence is meant to identify horticultural production technologies in Nairobi County, determine the participation status in various production technologies and investigates the determinants of participation in urban horticultural production technologies.

2 Materials and methods

2.1 Study area

The research was carried out in the city of Nairobi, which is estimated to have a surface area of 695.1 square kilometers and is bounded by the counties of Kajiado, Machakos, and Kiambu. Nairobi County is the most populous county in Kenya, with an estimated 4,397,073 people, according to the 2019 Kenya National Census. At an estimated longitude of 36°E latitude and 1°S latitude, Nairobi is about 480 kilometers from the Indian Ocean and 140 kilometers south of the Equator. According to Makokha & Shisanya (2010), Nairobi's elevation is approximately 1900 meters to the west and 1500 meters to the east. In this way, the west side of the Nairobi nation is the more elevated level, all around depleted and cooler while the eastern side which is more smoking. According to Makokha & Shisanya (2010), the average temperature is around 19°C and the annual rainfall is between 800 and 1000 millimeters. The long rains last from March to May, while the short rains last from October to December (Yang et al., 2015).

According to Ongoma et al., (2013) precipitations brought in by moisture from the Indian Ocean entering Nairobi are the primary cause of the predominant wind flow throughout the city (Ongoma et al., 2013). The prevalent breezes over the city are easterlies; they are linked to precipitation brought in by moisture from the Indian Ocean entering the country (Ongoma et al.,2013). According to Yang et al., (2015), Nairobi has a bimodal rainfall pattern with a "long rain" season from March to May (MAM) and a "short rain" season from October to December (Yang et al., 2015).

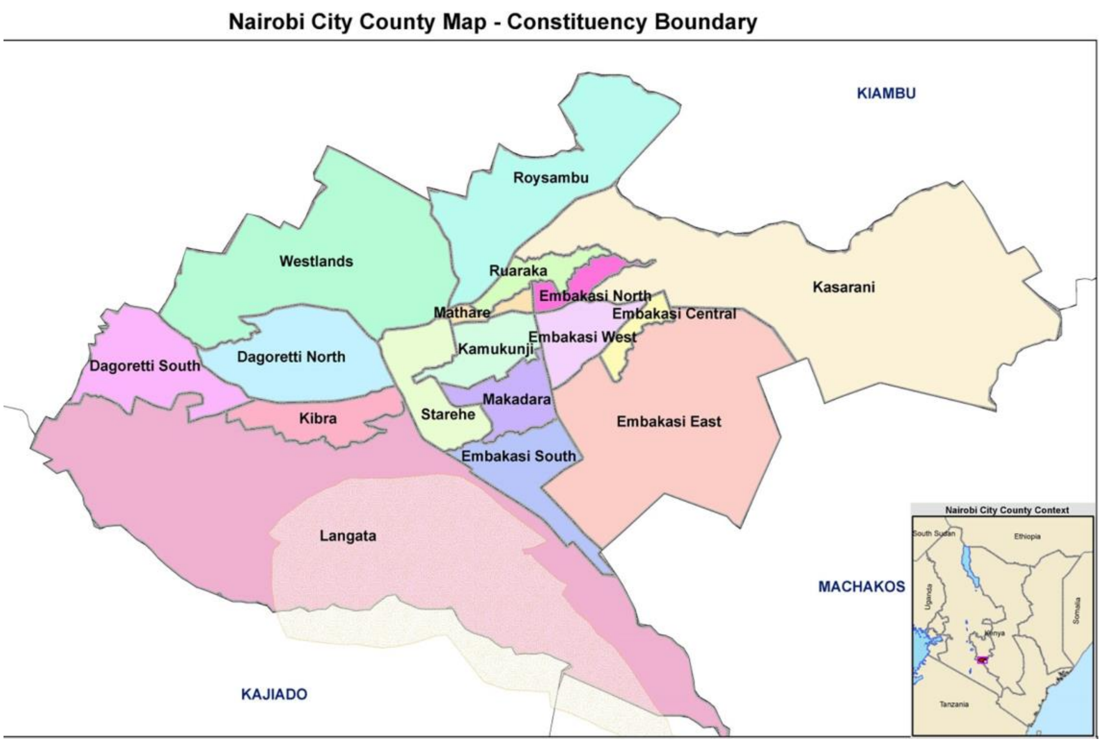

Figure 1: Nairobi City-County map showing constituencies and associated boundaries

Source: (Masime et al., 2013)

2.2 Data Collection

The target population was Nairobi County residents practicing various production technologies in Kibera, Mathare, Roysambu and Kasarani subcounties. A snow ball and purposive sampling was used to collect data. Mugenda & Mugenda, 1999 formula was used to obtain the sample size of 385 respondents as indicated below;

$$n = z^2pq/d^2 = (1.96)^2 *(0.5) * (0.5)/ (0.05)^2=385 \quad (i)$$

Respondent data was gathered using both closed- and open-ended questions. The respondents who were under 18 years were not interviewed since they may not have farming experience on the technologies and strategies. The information which was collected using questionnaires include demographic characteristics, production technologies, perceived challenges for production, the crops grown, the social economic factors and information sources

2.3 Data analysis

Data from the respondents was coded and entered for descriptive and inferential statistics. Frequency tables, means, and standard deviation were calculated to give simple summary of demographic characteristics of respondents and other independent variables. Multivariate probit model was used to find explanatory variables that participation in production technologies. A number respondents participated in more than one production technology, hence the MVP model was adopted to account for independence between practices (Coulibaly et al., 2015).The MVP is as indicated as below;

$$Y^*_{ij} = X'\beta_i + E0'_i + €_i \qquad j=1$$

$$Y^*_{ij} = \left\{ \begin{array}{ll} 1 & \text{if } Y^*ij \; >0 \\ 0 & \text{if otherwise} \end{array} \right\} j=1$$

Where; j = select production technologies

X' = Variables vector such farmers characteristics, credit provision, origin, and trainings

β_i = Computed coefficients vector that capture the participation in urban production technologies

$€_i$ = term error with zero mean and multivariate normal distribution

3 Results

3.1 Descriptive statistics

Among the 385 respondents, 54 % were male and while 46% were female. The oldest respondents was 66 years old and the youngest respondents were 18 years old. Majority of the respondents earned less than Ksh.15, 000 a month at 76%. None of the respondents in the survey made more than Ksh 100,000 a month. Around 50.55 percent of all respondents in Roysambu and 15.48 percent in Kibra, completed post-secondary education. Majority of the respondents were self-employed at 40%.

The average produce from the selected production systems in the study area was 13.13 kg, with Kasarani producing the highest average produce at 18.8 kg and Mathare the lowest at an average of 6.60 kg. About 18.96% of the respondents owned the space for practicing horticultural production technologies. Access to credit facility was 24% while no access to credit was 76%. Twenty percent of the respondents belonged to farming groups.

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Table 1: Description characteristics of the sample (N=385)

Variable	Description	Statistics	
		M	SD
Age	Age of the respondent	33.35	10.7
Production	Average number of Kilograms produced by respondent	13.13	12.9
		F	%
Gender	Gender of respondent is male	206	53.51
	Gender of respondent is female	179	46.49
Level of education	Informal education	6	1.56
	Highest level of education is primary	74	19.22
	Highest level of education is secondary	160	41.56
	Highest level of education is post-secondary	146	37.92
Monthly income	Less than 15,000	293	76.1
	15,001 to 30,000	72	18.7
	30,001 to 45,000	14	3.64
	45,001 to 100,000	6	1.56
	more than 100,000	0	0
Space crops grown	Back/front yard	68	17.66
	On vacant places	189	49.09
	In containers /sacks	24	6.23
	Along railways	35	9.09
	Below power lines	9	2.34
	along water lines	33	8.57
	School gardens	8	2.08
	Road strips	21	5.45
Space Ownership	The respondent rented the space	73	18.96
	The respondent own plot the space	73	18.96
	The respondent used public/unutilized space	239	62.08
Duration in Nairobi	Less than one-year	13	3.38
	1 to 5 years	74	19.22
	5 to 10 years	115	29.87
	more than ten years	183	47.53
Place of origin	Rural areas	161	41.82
	other places of Nairobi	131	34.03
	other urban areas	93	24.16
Farming groups	The respondent belonged to farming group	79	20.52
	The respondent did not belong to farming group	306	79.48
Trainings	The respondent received training	146	37.92
	The respondent Not received training	239	62.08
Credit facility	The respondent received credit facility	93	24.16
	The respondent Not received credit facility	287	75.55
Information sources	Print media	15	3.9
	Neighbor	61	15.84
	Family members	166	43.12
	NGOS	51	13.25
	Extension officers	92	23.9

Source: Field Survey Data, 2023

Table two below show descriptive statistics of the urban horticultural technologies practiced. The six technologies were identified, open field was more utilized at 60.8% followed by vertical gardens at 35.6% while hydroponics and green house were least with 2.9%, Table 2.

Table 2: Summary of urban horticultural technologies practiced

Production technology	Participation in production technology	
	Yes	No
Rooftop	16(4.2%)	369(95.8%)
Open field	234(60.8%)	151(39.2%)
Greenhouse	11(2.9%)	374(97.1%)
Vertical gardens	137(35.6%)	248(64.4%)
Hydroponics	11(2.9%)	374(97.1%)
Pallet	70(18.2%)	315(81.8)

3.2 Multivariate probit analysis

Table 3: Multivariate probit analysis on participation in urban horticultural technologies

	Rooftops /Balconies	Open field	Greenhous e	Vertical garden	Hydroponic s	pallet gardening
Age	0.014 (0.0100)	0.1300** (0.0072)	-0.138* (0.4998)	-0.023** (0.0087)	-0.038 (0.0264)	-0.019 (0.0159)
Gender	0.023 (0.2059)	-0.314** .1498	0.330 (0.4998)	0.261 (0.1739)	0.245 (0.4556)	0.260 (0.3373)
Level of education	0.316 (0.1501)	-0.073 (0.1025)	-0.179 (0.3090)	0.168 (0.1229)	-0.121 (0.2888)	-0.141 (0.2158)
Source of income	0.054 (0.0639)	-0.058 (0.1025)	0.109 (0.1923)	0.004 (0.0572)	0.169 (0.1605)	-0.180 (0.1578)
Monthly income	-0.110 (0.1697)	-0.488*** (0.1269)	1.305*** (0.4658)	0.334** (0.1355)	1.147*** (0.3420)	0.503** (0.2178)
Space Ownership	-0.646*** (0.1301)	0.367 (0.0914)	0.526* (0.3468)	0.013 (0.1078)	-0.206 (0.974)	-0.113 (0.2070)
Duration in Nairobi	0.279** 0.1227	0.048* (0.0998)	3.41* (0.2328)	0.095 (0.1202)	0.508 (0.4212)	0.067 (0.2137)
Place of origin	0.248 (0.1642)	-0.157 (0.1175)	-0.036 (0.3739)	0.002 (0.1361)	0.643 (0.3616)	0.088 (0.2734)
Farming groups	0.171 (0.3840)	0.699** (0.2473)	0.119 (0.6511)	-0.6605** (0.2665)	-0.680 (0.5989)	1.176* (0.7281)
Source of labour	-0.116 (0.1527)	0.115 (0.1050)	0.400 (0.2798)	-0.062 (0.1192)	-0.039 (0.5989)	-0.147 (0.2444)
Trainings	-0.051 0.3708	-0.332 (0.2745)	0.651 (0.7072)	0.150 (0.2998)	0.051 (0.1028)	0.197 (0.7276)
Credit facility	-0.357 (0.4100)	-0.156 0.2841	-0.621 (0.6541)	0.461 (0.3151)	0.607 (0.1684)	-0.367 (0.7453)
Information sources	-0.187* (0.1044)	-0.015 (0.0718)	0.574 (0.2507)	0.099** (0.0763)	0.127 (0.2034)	0.420*** (0.1693)
N	385	385	385	385	385	385

Source: Field survey Data 2023: Standard errors in parentheses *$*p<0.1$, $**p<0.05$, $***p<0.01$*

Table 3 demonstrates the multivariate probit estimates for participation in various horticultural technologies. The participation of open field technology was positively and significantly influenced by the respondent's age whereas the participation in green house and vertical gardens was negatively and significantly impacted by age. This could imply that the older respondents may have connections to open spaces in urban areas to participate in horticultural technologies. The gender of the respondent influenced the participation of open field negatively. Monthly income influenced green house, vertical, hydroponic and pallet technologies positively while it influenced open field negatively. Ownership of the space for farming influenced rooftop technology negatively while green house was influenced positively. Farming groups influenced open field and pallet technology positively.

4 Discussions

Most of the urban areas have been occupied with buildings thus reducing land for farming in Nairobi County. The strategies practiced by the urban residents were examined alongside with the factors influencing their practices. The findings indicated that among the technologies practiced to grow crops include vertical gardens, pallet gardens, open field, green house, hydroponics gardens and rooftop gardens. The results of Multivariate probit analysis indicates that information sources, farming groups, duration stay in Nairobi, space ownership, monthly income and age were the likely factors influencing participation in select production technology. In overall the participation in rooftop, green house and hydroponics production technologies was low.

Open field production technology was the most utilized production technology for the greater proportion of the respondents at 60.8% to grow crops such as kales and spinach. This could be, that among the six production technologies, open field technology is requires less input and infrastructures. The respondents ‘age, monthly income, duration stay in Nairobi and farming groups was a factor in participation in open field technology. The longer stay in Nairobi, it is assumed that the respondent had gained a lot of connections to enable them identify open spaces for farming. On the other hand, the farming groups, could provide opportunity to interact with other urban farmers hence increasing connection circle which may assist one to identify unutilized space for farming. The farming groups enhances social connectivity in terms of farmer’s access to available spaces for horticultural practices (Bizikova et al., 2020).

The respondent’s participation in Green house was motivated by space ownership and monthly income while hydroponic technology was motivated by income level. Green house and hydroponic technologies are perceived to be high tech production technology and a more ‘permanent’ structure and thus capital and the space where to set up the structure is key. The findings indicate the farmers who had high income and owned the spaces where more likely to participate in green house production technology. Vertical gardens technology were more likely driven by age of respondents, income level and information sources. The average age of respondents was 33 years, the respondents were youthful and energetic and as a result they can perform laboriousness work such as carrying load and soils.

However increase of income reduces the chances of the respondents participating in open field technology. Open field gardens sometimes are located away from the homestead along the loads, river banks and along the railways. Security of the crops is not guaranteed, animals destroying crops and neighbors harvesting crops without permission discourages participation in open field and the income which could have been invested in open field can be used to buy food staffs.

5. Conclusions

High population growth in urban areas has led to food insecurity in urban areas. Urban residents have come up with survival tactics among them is the practice of urban horticultural technologies. Multivariate Probit Model was used to identify the factors influencing the participation in urban horticultural technologies. The findings indicates that urban dwellers participated in a wide range of horticultural technologies depending on their demographic characteristics and other favorable opportunities available to them. The most common horticultural technology used was open field followed by vertical gardens. The key factors the influenced their choice of production system were age of the respondents, the level of income, duration stay in urban area, farming groups and information sources. The study recommends that both National and County Governments should educate urban residents on urban horticultural technologies and assist with financial support to increase horticultural practices in urban areas. Although the study did not focus in all urban horticultural technologies the findings from this study will be helpful for any future study looking how urban residents in Nairobi County and other urban areas will participate in horticultural technologies as a way forward for food security.

6. Conflicts of Interest

There is no conflicts of interest this research and the publication of this paper.

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