Journal of Sustainable Development in Africa (Volume 25, No.1, 2023)
ISSN: 1520-5509
Pennsylvania Western University, Clarion, Pennsylvania

THE CONTRIBUTION OF URBAN AGRICULTURE TO HOUSEHOLD FOOD SECURITY AMONG URBAN VEGETABLE PRODUCERS IN ADDIS ABABA, ETHIOPIA

Habtamu Serbessa[1, 3], Teferee Makonnen[2] and Meskerem Abi[1]

[1] College of Development Studies, Center for Food Security Studies, Addis Ababa University, Addis Ababa, Ethiopia[2]

[2]College of Social Sciences, Geography and Environmental Studies, Addis Ababa University, Addis Ababa, Ethiopia

[3]Technical Vocational Training and Technology Development Bureau, Addis Ababa, Ethiopia

ABSTRACT

This study was conducted to explore the contribution of urban agriculture to household food security among urban vegetable producers in Addis Ababa, Ethiopia. Focus group discussions, key informant interviews, survey questionnaires, desk reviews, the Household Food Insecurity Access Scale (HFIAS), and Food Consumption Score Analytical Tools were used to collect both qualitative and quantitative data. According to the findings of the analyses, the majority of respondents intended to engage in vegetable production for future food security sustainability. The HFIAS result showed 14.9% of households were food secure. Multinomial regression estimates the food security status of households: mildly food insecure in relation to shelter, moderately food insecure in relation to gender and employment, and severely food insecure in relation to marital status. Thus, in order to develop an effective vegetable cultivation system, the government should put in place a comprehensive urban agriculture plan while minimizing the problems associated with vegetable cultivation.

Keyword: Food security; vegetable production; urban farmers; urban economy; socioeconomic development; Addis Ababa

INTRODUCTION

Food insecurity continues to be a major concern for officials around the world. It is estimated that between 702 and 828 million people were affected by hunger in 2021, with Africa having the highest incidence of more than one-third (Bapolisi *et al.*, 2021; FAO, 2022). According to the World Food Summit, food security exists "when all people have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life at all times" (FAO,1996).

Food insecurity is a major issue in Ethiopia, and it has been steadily increasing (Teshager, 2020; Messay, 2020). Food insecurity is caused by a variety of factors, including, but not limited to, extreme weather conditions, environmental degradations, population pressure, less but improving government commitment, and policy flaws (Messay, 2020). Ethiopia ranks 90th out of 116 countries in terms of hunger, according to the 2021 Global Hunger Index (GHI, 2021). A combination of forces, including a predominantly market-based food supply, persistent chronic poverty, and rising food prices, are threatening household food security in large metropolitan areas such as Addis Ababa (Tesfay, 2014). According to Birhane *et al.* (2014), 79.9% of the population in Addis Ababa is food insecure. Some of the causes of high food prices include an imbalance in food supply and demand due to urban population growth (Miccoli *et al.*,2016) and land use and land cover change, which converts farmlands into built areas (Alemu, 2015; Abo-El-Wafa *et al.*,2017).

Urban agriculture (UA thereafter) occurs to varying degrees in both developing and developed countries worldwide, and its contribution to urban food security and poverty alleviation has recently piqued the interest of policymakers (Korth *et al.*,2014). Official attitudes in some countries are slowly but steadily changing as the potential benefits of UA for food security, environmental management, and economic development become better understood in policy circles (Arku *et al.*,2012). Urban farming can be one of the approaches to achieving sustainable agriculture and food security for city dwellers, in this regard; it can be one of the most important strategies for ensuring that each household has a sufficient supply of fresh food (Hayuningtyas, 2017).

According to Walters and Midden (2018), producing vegetables in cities has gained popularity in recent years as a means of promoting agricultural sustainability in urban areas. Urban agriculture enables urban areas to become more resource-efficient and to contribute to the development of food security for local residents.

UA appears to grow during economic crises, such as those caused by armed conflicts and structural adjustment, emphasizing its use as a coping mechanism while contributing to food availability in cities and thus to urban consumers' diets (FAO, 2001). UA was defined by Van-Veenhuizen (2006) as the growing of plants and the raising of animals for food and other uses within and around cities or towns, and related activities such as the production and delivery of inputs and the processing and marketing of products.

Local food production in urban areas reduces reliance on the global food system, reducing a region's vulnerability to food supply (Morgan, 2015). Concurrently, urban citizens' interest in and demand for locally produced food is growing (Winiewska-Paluszak and Grzegorz, 2021). Another aspect of local food production is the strong educational component, which promotes sustainability and holistic insights by reconnecting urban people with the place of origin of the food, the ecological and social links in food processes, and the limits of the ecosystem involved in food production (Gunilla *et al.*, 2016). Food production within urban environments could be part of the solution (Mougeot, 2000), as UA

allows food to be grown on land that may not otherwise be put to productive use, and, as the majority of the global population now resides in cities (UN, 2018), it can allow for food production closer to where it will be ultimately consumed (Mcdougall *et al.,* 2020). For example, Cairo reports that there are 80,000 heads of livestock within the city (UNDP, 1996); while in densely populated Hong Kong, intensive cultivation meets 45 percent of local vegetable needs on only 6 percent of the land area (Garnett, 1996).

In Ethiopia, UA provides many opportunities for urban dwellers to diversify employment, income, and dietary options, as well as recycle and reuse urban waste, thereby contributing to sustainable urban development. (Yalew, 2020). The majority of Ethiopian UA is focused on high-value vegetable crop production, which is expected to be an important mechanism for poverty alleviation in Addis Ababa and other cities (Ashebir *et al.,* 2007). Despite its potential, the sector continues to lack institutional and policy support (Yalew, 2020).

The Ministry of Urban Development and Housing's Ethiopian National Urban Green Infrastructure Standard (MUDHo, 2015) and the Addis Ababa City Structure Plan (AACA, 2020), include provisions for improving UA to ensure food security, economic empowerment through job opportunities, increased production that benefits urban dwellers, and environmental protection. Improving food provision by protecting agricultural sites in rural, peri-urban, and urban areas and proposing new suitable places for food production are critical for implementing these strategies and standards and ensuring food security (Abo-El-Wafa *et al.*,2017; Senait *et al.*,2021).

Urban farmers in Addis Ababa grow vegetables mainly for private consumption and profit (Yared *et al.,* 2019). According to AAFUADC (2021), there are currently around 106,280 registered urban vegetable producers in Addis Ababa, which provide roughly 60% of the city's vegetable consumption, especially leafy vegetables (Dejen, 2020). The city Addis Ababa also has suitable soil, altitude, and small rivers that flow year round as tributaries of the Akaki River which provides irrigation water to the majority of vegetable growers in the city (Assefa, 2016). As a result, it is necessary to assess the role of UA particularly in understanding the food security situation among urban farmers in the Nifas Silk Lafto Sub-region, a major vegetable farming hub in Addis Abeba, in order to shed light on the appropriate strategies to pursue in order to achieve two of the cardinal sustainable development goals of "no poverty" and "zero hunger" for all in Ethiopia's urban areas.

The study focuses on examining urban household vegetable production, describing food security status, and observing food security and socioeconomic relations in the study area. At the moment, there is very little information available on the contributions of vegetable production for household food security, and it is hoped that this paper will fill some of the information gaps for this region.

MATERIALS AND METHODS

Description of the study area

This study was conducted in the Nifas Silk Lafto Sub-city, on the edge (Fig. 1) of Addis Ababa, Ethiopia. The sub-city has a total land area of 5876.02 hectares (Fantahun, 2010). with a noticeable elevation difference in the landscape, 2074–2485 meters above sea level (Yeselamfire, 2021).

The climate in the area is Afro-Alpine temperate (Abraham, 2012). The rainy season lasts from June to September and accounts for roughly 70% of total annual rainfall, and the average annual rainfall is 1254 millimetres. The average annual temperature is 17.25 degree Celsius; with a range from 9.90 to 24.60 degrees Celsius (Deshu *et al.*, 2021).

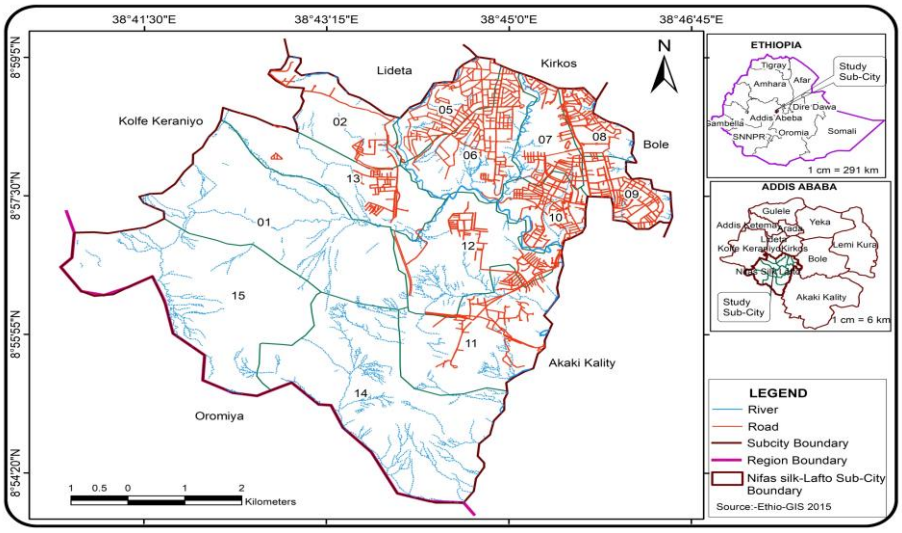

Fig. 1 Map of Nifas Silk Lafto sub city, Addis Ababa, Ethiopia (AACA, 2020).

The Little Akaki River, along with its tributaries, runs through the sub-city, through which many smallholder vegetable producers grow a variety of vegetable products (Deshu *et al.*, 2021). UA activities, particularly vegetable production, are common in the study area, including backyard, open spaces around houses, and riverside farming (Tewodros, 2007).

Sampling procedure and sample size

In the thirteen weredas (the smallest administrative unit in Ethiopia's urban hierarchy) of Nifas Silk Lafto Sub-city, there are 13,199 vegetable-producing households (AAFUADC, 2021). Using a simplified formula, the number of sample households was estimated to be around 388, assuming a 95% level of confidence and a 5% level of sampling error (Yamane, 1967).

$$n = \frac{N}{1 + N(e)2}$$

Where N, n and e stand for number of total vegetable-producing households in the sub-city, sample size and sample error, respectively.

Data sources and data collection tools

To collect quantitative and qualitative data for this study, primary and secondary data sources were used. Nifas Silk Lafto in the urban targeted vegetable producer areas provided primary data at the household level via questionnaires, key informant interviews, focus group discussions, and field observations. An intensive desk review of peer-reviewed journals, conference papers, government records, and research reports was used to collect secondary data from existing

sources. Household surveys were conducted with 388 vegetable producers to collect quantitative data in order to investigate and quantify these households' food security characteristics. In addition, a focus group discussion with six people was held using a pre-designed checklist.

Data analysis

The study used both qualitative and quantitative data analysis techniques. To analyze qualitative data gathered through focus group discussions, key informant interviews, and field observations, thematic content analysis was used. The Household Food Insecurity Access Scale (HFIAS hereafter) was used to determine food security at the household level. A logistic regression model was used to identify food security factors and assess their relative importance in determining the likelihood of a household being food insecure.

Measuring household food security status

The United States Agency for International Development (USAID) developed the HFIAS to assess the household food security status of households. The method is based on the assumption that incidents of household food insecurity result predictable reactions and responses that can be captured, quantified, and summarized on a scale using a survey.

The HFIAS score was determined by answering the nine frequency-of-occurrence questions. Each household head was asked if the condition in each question had occurred in the previous month.

If the condition occurred, households were asked to rate its frequency of occurrence as rarely, occasionally, or frequently. Participants were given one of three options: "never," "sometimes," or "often," with scores of 1, 2, or 3. when the scores for each sampled household were added up, the lowest score was 0, and the highest score was 27, indicating that the higher the score, the more likely a household will experience food insecurity (Coates *et al.*, 2007). According to the HFIAS indicator guide, the continuous score should be classified into four categories: food secure, mildly food insecure, moderately food insecure, and severely food insecure (Knueppel *et al.*, 2010).

Yi* is not observed, and we can only determine whether the household belongs to the category "0," "1," "2," or "3." So, what did the following actual placement in the discrete category reveal?

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots, \beta m Xm + \varepsilon$ ……..(1)

$Y_i = 0$ if $\mu 1 < yi^* \leq \mu 0$ - severely food insecure: percentage HFIAS score 75.5 – 100;

$Y_i = 1$ if $\mu 2 < yi^* \leq \mu 1$ - moderately food insecure: percentage HFIAS score 50.5 - 75.4;

$Y_i = 2$ if $\mu 3 < yi^* \leq \mu 2$ - mildly food insecure: percentage HFIAS score 25.5 - 50.4; and

$Y_i = 3$ if $0\ yi^* \leq \mu 3$ - Food secure: percentage HFIAS score 0 - 25.4.

Where Y is the dependent variable, β0 is the intercept, and β1, β2, β3… βn, are the slopes of the parameters of the model in use; Xi is the vectors of exogenous variables. ε = Error term.

Description of variables

Food security status is a dependent variable in this study. The study's vegetable production is thought to have contributed to food security, better food consumption, and livelihood well-being. The explanatory variables in the regression model are hypothesized to have an effect on vegetable producers' food security status. Table 1 presents the summary of study variables.

Table 1: Summary of study variables and their descriptions

Independent Variable	Description
Households Size	Number of members of the household (Continuous)
Gender of the house	Dummy; 1 if head is male 0 if female
Employment Status	Dummy; 1 if yes, 0 if otherwise
Marital status	1= married, 2= single, 3= divorce
Age of the house	1=21-30, 2=31-40, 3=41-50, 4= >50
Educational status	0= unable to read and writing,1= non-formal education, 2= primary, 3= secondary, 4= diploma, 5= bachelors, 6= post graduate and above
Farming experience	1= 5 years, 2= 10 years, 3= 15 years,4=> 15 years
Housing/shelter status	1= own house, 2= private rented house, 3= Wereda rented house

RESULTS AND DISCUSSIONS

Socio-Economic Profile of Vegetable Producers

Demographic factors such as age, sex and family size and socioeconomic attributes like marital status and educational status are important factors in vegetables production and marketing. The majority of vegetable production respondent households (59.3%) were male, according to Table 2. This finding is consistent with the findings of Banchamlak and Akalu (2022), who found that male farmers are taking the lead in vegetable production and marketing. Male dominance appears to be more prevalent in this industry as a result.

In vegetable production, age was an important factor. According to the study, an overwhelming majority of the respondents belong to the age group 21-50 accounting for 81.0% of all working-age respondents (Table 2). Younger generations, according to Godfrey *et al.* (2012), are less likely to participate in urban agriculture due to a negative attitude, perception, and belief about farming, as well as a lack of knowledge. Farming was seen as time-consuming and exhausting by the youth.

According to Table 2, 19.0% of respondents were over the age of 50. Table 2 also revealed that most vegetable producers (67.8%) were married. The findings support those of Baba *et al.*, (2010); Pedzisai *et al.*, (2014) and Filmon and Mitke, (2022), who discovered that married farmers were more likely to engage in vegetable farming to support their families.

Table 2: Households' demographic characteristics

Item	categories	Frequency	Percent
sex	male	227	59.3
	female	156	40.7
	21-30	86	22.3
age	31-40	133	34.5
	41-50	93	24.2
	> 51	73	19.0
	married	261	67.8
marital status	single	82	21.3
	divorce	42	10.9

Table 3 shows that 30.9% of respondents were unable to read and write and had no formal education. Slightly more than half of the respondents (56.2%) have completed primary and secondary education. Urban vegetable producers that have attended higher education (diploma, degree and postgraduate) comprise 12.9 % of the respondents. Masuku and Xaba (2013) emphasized the importance of education in farming, claiming that it allows farmers to adopt change and innovation faster than the uneducated. According to Table 3, 55.0% of respondents had a 4-6 member family, while 34.4% had a 1-3 member family. To save money on labor, household size can be a significant source of family labor in farming. Similar findings were reported by Uuld *et al.* (2021); and Filmon and Mitke, (2022).

Table 3: Households socioeconomic characteristics

Item	categories	Frequency	Percent
	civil servant	19	4.9
	work for private	78	20.2
	vegetable farm	247	64.0
employment	home maker	22	5.7
	student	1	0.3
	retired	15	3.9
	union on VP	4	1.0
	unable to read and writing	57	14.7
	non formal education	63	16.2
	primary	144	37.1
Educational status	secondary	74	19.1
	diploma	27	7.0
	bachelors	17	4.4
	postgraduate and above	6	1.5
	up to 5 years	272	73.9
Farming experience	up to 10 years	44	12.0
	up to 15 years	13	3.5
	>15 years	39	10.6
	own house	234	61.3
Housing status	private rented house	138	36.1

	kebele rented house	10	2.6
Family size	1-3 family	133	34.4
	4-6 family	213	55.0
	7-9 family	38	9.8
	> 9 family	3	8.0

According to Table 3, the primary occupation of 64.0% of households is vegetable production. However, urban vegetable production is also practiced by individuals who are not primarily farmers, as 20.2% work in the private sector. The survey results show that 73.9% of participants have five or fewer years of experience in vegetable production, indicating that vegetable farming capacity has increased in the last five years. 61.3% of urban vegetable producers in the study area live in their own homes. Private house ownership, which provides participants with permanent and additional farming space, is strongly linked to urban vegetable farming practices.

Types of vegetables produced

Figure 2 show that the majority of respondents grow one or more vegetable products, such as kale, chard, and lettuce. According to Selamawit *et al.* (2021), onions, carrots, potatoes, and peppers are also dominant in the study area.

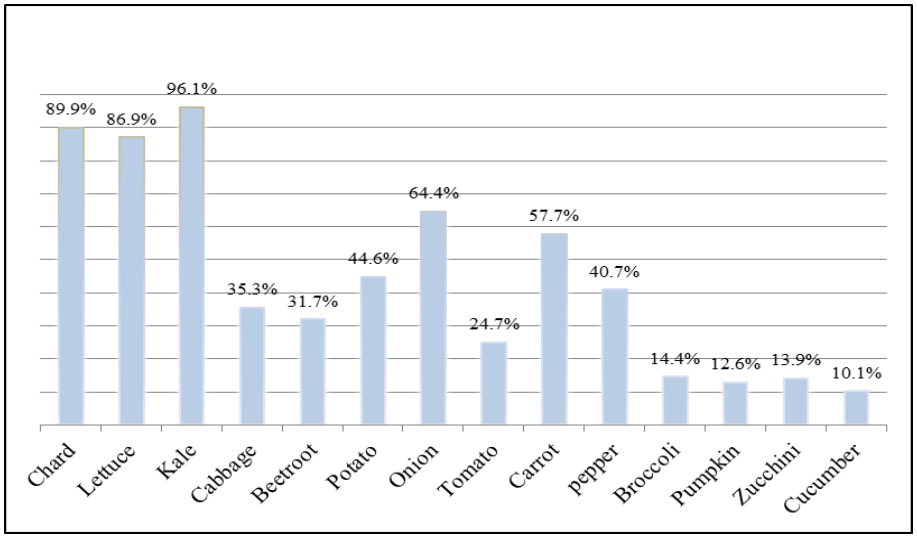

Fig. 2 Types of vegetables produced by respondents

Producers' food insecurity status

Table 4 lists nine important variables that can be measured with a binary response. The nine variables assess food access, ranging from "simple concern about food scarcity" to the "experience of spending the day and night without food." without consuming any food. The responses to these nine questions are aggregated together to form the dependent variable. According to Table 4, 63.9% of respondents reported being concerned about food shortages in the previous four weeks, and 71.1% reported being unable to eat their preferred food: 70.1% reported eating a limited variety of food; 19.1% reported being unable to eat the preferred variety of food due to a lack of adequate resources;

and 66.0% reported that their household members ate less food. 60.1% did not consume the recommended number of meals per day, which agreed with Adimasu *et al.,* (2019).

Table 4: The Household Food Insecurity Access Scale questions and household responses

Frequency	Percent
In the past four weeks, did you worry that your household would not have enough food?	
Yes/248	63.9
In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	
Yes/276	71.1
In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?	
Yes/272	70.1
In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	
Yes/74	19.1
In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	
Yes/256	66.0
In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?	
Yes/233	60.1

Table 5: Types and average number of foods consumed by the study households over the last seven days

Food types and consumption (percent)			If yes, the average frequency of foods consumed per week	average food consumed (percent)
Cereals	yes	100	4.5	16.7
	no	-		
Roots and tubers	yes	100	4.0	25.0
	no	-		
Vegetables	yes	100	4	14.3
	no	-		
Fruits	yes	92.8	4	13.3
	no	7.2		
Meat, poultry	yes	62.6	2.5	15.7
	no	37.4		
Eggs	yes	63.7	2.5	15.9
	no	36.3		
Fish and seafood	yes	30.9	2.5	7.7
	no	69.1		
Pulses, legumes, nuts	yes	81.7	4.5	13.6
	no	18.3		
Milk and milk products	yes	69.6	3.5	11.6
	no	30.4		
Oil/fats	yes	94.6	5	18.9
	no	5.4		
Sugar/honey/sweets	yes	95.4	5	19.1
	no	4.6		
Spices, salt, tea, coffee, alcoholic drink or local drinks	yes	94.3	5	18.9
	no	5.7		

Table 5 shows the types and average number of foods consumed by study households over the last seven days: cereals, roots and tubers, and vegetables consumed daily, with (4.2) the average frequency of foods consumed per week. According to the findings of Household Food Insecurity Access Prevalence, 14.9% of the respondents have attained food security while most of the sampled families (85.1%) tend to be food insecure (Table 6).

Table 6: Household food security and Household Food Consumption status summary

Food insecurity status	N	Percent
food secure	58	14.9
mildly food insecure	54	13.9
moderately food insecure	258	66.5
severely food insecure	18	4.6
Food consumption states		
poor	29	7.5
borderline	103	26.5
acceptable	256	66.0

As a result, minor food insecurity affected 13.9% of households, followed by a moderate food gap (66.5%). 4.6% of the sample's respondents experienced extreme food insecurity. This result is consistent with studies by Firehiwot and Degefa, (2015). On the other hand (Table 6), the summary shows that 7.5%, 26.5%, and 66.0%, are poor, borderline, and have acceptable household food consumption status, respectively. According to the CSA (2002) and Pauleit *et al.*, (2019), 70% of vegetable production in Addis Ababa is consumed by households, contributing to a balanced diet and reducing food insecurity.

Vegetable production's contribution to food security

Vegetable production is now widely recognized as a mechanism for community household resilience. Table 7 shows that 99.2% of respondents agreed that vegetable production activities provide fresh food for their household, and 98.5% agreed that it is a source of healthy food. According to 87.9% of respondents, the product reduces household expenses, 84.5% contributes to food security, 83.5% provides low-cost food, and 81.1% makes it easily accessible. Urban vegetable production is important for generating income for 81.2% of households. These findings corroborate those of FAO (2007), Walters and Midden (2018), Martin and Wagner (2018), and FAO (2022).

Table 7: Benefits of vegetable production

Items	Frequency	Percent
income creation	315	81.2
contribution to food security	328	84.5
reduce household expense	341	87.9
providing fresh food	385	99.2
gives healthy food	382	98.5
provides low cost food	324	83.5
easily available	315	81.1

Table 8: Cross-tabulation of employment and households' food security status

	Household food insecurity access scale score				Total
employment status	food secure	mildly food insecure	moderately food insecure	severely food insecure	
civil servant	2	4	12	1	19
work for private agency	6	22	50	0	78
urban vegetable farm	37	22	175	13	247
home maker	4	1	15	2	22
student	1	0	0	0	1
retired	5	4	4	2	15
Working as a union on UA	1	1	2	0	4
Total	56	54	258	18	386

According to Table 8, 66.0% of the total food-secured respondents were employed as urban vegetable farmers. This demonstrates that the sector has enabled respondents to achieve food security faster than others. However, this sector was home to 72.2% of severely food insecure households.

Determinants of households' food security status

At the conventional level of significance (P = 0.05), four explanatory variables (Table 9) were found to be statistically significant in influencing food security, while the remaining three explanatory variables were statistically insignificant in explaining the food security of households in the study area. As a result, shelter, gender, employment, and marital status all had a positive and significant impact on household food security.

Table 9: Multinomial regression estimates for determinants of food security status

Independent Variables		B	Std. E.	Wald	df	Sig.	Exp (B)	95% C. I. for Exp (B) Lower	Upper
mildly food insecure	Intercept	2.975	1.622	3.366	1	.067			
	gender	.541	.492	1.207	1	.272	1.717	.654	4.507
	age	-.142	.215	.437	1	.509	.867	.569	1.323
	academic	.133	.152	.772	1	.380	1.143	.849	1.539
	marital status	-.553	.357	2.406	1	.121	.575	.286	1.157
	employment	-.281	.194	2.090	1	.148	.755	.516	1.105
	shelter	-1.196	.515	5.383	1	.020	.302	.110	.831
	family size	-.365	.346	1.118	1	.290	.694	.353	1.366
moderately food insecure	Intercept	2.118	1.186	3.190	1	.074			
	gender	.903	.376	5.757	1	.016	2.467	1.180	5.159
	age	-.025	.165	.023	1	.880	.975	.705	1.349
	academic	-.148	.117	1.581	1	.209	.863	.685	1.086
	marital status	-.316	.248	1.619	1	.203	.729	.448	1.186
	employment	-.366	.141	6.768	1	.009	.693	.526	.914
	shelter	.277	.325	.724	1	.395	1.319	.697	2.495
	family size	-.126	.257	.239	1	.625	.882	.533	1.460
severely food insecure	Intercept	2.846	2.233	1.624	1	.202			
	gender	.639	.625	1.046	1	.306	1.895	.557	6.451
	age	-.538	.318	2.862	1	.091	.584	.313	1.089
	academic	-.214	.220	.943	1	.332	.807	.524	1.243
	marital status	-1.501	.650	5.326	1	.021	.223	.062	.797
	employment	.121	.236	.261	1	.609	1.128	.710	1.792
	shelter	-.503	.590	.725	1	.394	.605	.190	1.924
	family size	-.459	.497	.855	1	.355	.632	.239	1.672

a. The reference category is: food secure.

(Table 9) provides information comparing each food insecurity status to the reference category "food secure." The regeneration coefficient, in particular, indicates which predictors significantly discriminate between respondents in the mild food insecurity category and those in the "food security" category; between respondents in the moderate food insecurity category and those in the "food security" category; and between respondents in the "severe" food insecurity category and those in the "food security" category.

The first set of coefficients (Table 9) compares the food-secure and mildly food-insecure categories. Shelter status was significant a predictor in this category (b = -1.196, S.E. =.515, p =.020) in the model, as respondents' shelter differentiation on this variable indicated that respondents who own houses were more likely to be moderately food insecure. The odds ratio of 0.302 indicates that for every unit increase (in this case, a change in housing status), the odds of a respondent being moderately food insecure changed by a factor of 0.302 (In other words, the odds were decreasing).

The second set of coefficients (Table 9), gender status of the respondents on this variable, respondents' gender status was more likely to indicate a moderate food insecurity status. The odds ratio of 2.463 indicates that (in this case, differentiation of gender status), the odds of respondents being moderately food insecure increased by a factor of 2.463

(in other words, the odds were decreasing). According to the employment status of the respondents on this variable, respondents' employment status was more likely to indicate a moderate food insecurity status. The odds ratio of 0.693 indicates that for every unit increase (in this case, differentiation of employment status), the odds of respondents being moderately food insecure increased by a factor of 0.693 (in other words, the odds were decreasing).

The third set of coefficients represents (Table 9) a comparison between the food-secure and severely food-insecure categories. Only "marital status" was a significant predictor (b = -1.501, S.E. = 0.650, p =.021) in the model, as the respondents' marital status differentiation on this variable indicated the probability of being severely food insecure. The odds ratio of 0.223 indicates that (in this case, the marital status changed), the odds of a respondent having a severely food insecure status changed by a factor of 0.223 (in other words, the odds were decreasing).

Table 10: Sex of the respondents and household food insecurity access Cross tabulation

		Household food insecurity access scale score				
	sex of the respondents	food secure	mildly food insecure	moderately food insecure	severely food insecure	Total
male	Count	44	34	138	11	227
	Expected Count	34.4	30.8	151.1	10.7	227.0
	% within sex of the respondents	19.4	15.0	60.8	4.8	100.0
	% within HFIAS	75.9	65.4	54.1	61.1	59.3
	Adjusted Residual	2.8	1.0	-2.9	.2	
female	Count	14	18	117	7	156
	Expected Count	23.6	21.2	103.9	7.3	156.0
	% within sex of the respondents	9.0	11.5	75.0	4.5	100.0
	% within HFIAS	24.1	34.6	45.9	38.9	40.7
	Adjusted Residual	-2.8	-1.0	2.9	-.2	

Male respondents in the study area were more food secure than females, accounting for 15.1% of all food-secure households. Males made up 19.4% of total food-secure households, with a 2.8 adjusted residual, which was higher than expected, while females made up 9.0%, with a -2.8 adjusted residual, which was lower than expected (Table 10). According to the findings presented above, males made up 80.6% of food-insecure households, while females made up 91.0 percent. Previous research by Tefera *et al.,(*2011); Ayenew *et al.,* (2020) and Girma *et al.,* (2021), found that female-headed households were more likely to be food insecure than male-headed households. Despite being a signatory country to improving food security by implementing SDGs, particularly goals 2 and 5, the prevalence of food insecurity among female-headed households in Ethiopia increased during the SDGs period compared to the MDGs period.

Table 11: Household family size and household food insecurity access scale score contingency tables

		Household food insecurity access scale score				
household family size		food secure	mildly food insecure	moderately food insecure	severely food insecure	Total
1-3	Count	17	18	91	7	133
	Expected Count	19.9	18.2	88.7	6.2	133.0
	% within household family size	12.8	13.5	68.4	5.3	100.0
	% within HFIAS	29.3	34.0	35.3	38.9	34.4
	Adjusted Residual	-.9	-.1	.5	.4	
4-6	Count	33	31	139	10	213
	Expected Count	31.9	29.2	142.0	9.9	213.0
	% within household family size	15.5	14.6	65.3	4.7	100.0
	% within HFIAS	56.9	58.5	53.9	55.6	55.0
	Adjusted Residual	.3	.5	-.7	.0	
7-9	Count	7	3	27	1	38
	Expected Count	5.7	5.2	25.3	1.8	38.0
	% within household family size	18.4	7.9	71.1	2.6	100.0
	% within HFIAS	12.1	5.7	10.5	5.6	9.8
	Adjusted Residual	.6	-1.1	.6	-.6	
> 10	Count	1	1	1	0	3
	Expected Count	.4	.4	2.0	.1	3.0
	% within household family size	33.3	33.3	33.3	0.0	100.0
	% within HFIAS	1.7	1.9	0.4	0.0	0.8
	Adjusted Residual	.9	1.0	-1.2	-.4	

Sisay and Efta (2020), agree that family size influences the likelihood of poverty. This implies that a large family size results in a higher dependence ratio and fewer available resources per individual; however, our findings contradict. In vegetable production, larger family sizes allow for more households labor forces. Table 11 shows that respondents with ten or more household were more food secure (33.3%) and none were severely food insecure when compared to small family-size respondents in the study area.

Qualitative analysis

Focus group discussions, key informant interviews, and personal observations were used in this study. Details about them are as follows: Six urban farmers who grow vegetables participated in a focus group discussion (FGD). According to them, urban agriculture particularly vegetable production is widely practiced as a means of obtaining food security and generating income for low- and middle-income households. The main driving forces in the sector, according to respondents in the focus group, are the availability of land, manpower, a suitable environment, farmer motivation, and government initiatives. Aside from what the farmers mentioned in terms of production, the most exciting aspects for

most producers were making food available to households, earning extra income, and, most importantly, the ease of entry into the sector without large financial investments.

Government initiatives and a readily available labor force also contribute to increased production strength. "Market availability is one of our advantages in the production line, in addition to the good opportunities mentioned in the group discussion," says the household head. Furthermore, the farming area near their home enabled them to find food nearby, which saved them money and time. According to respondents, the most difficult aspects of production are a lack of government policies in the system, a scarcity of inputs, and poor extension services. In the discussions, land scarcity, water sources, and theft were all mentioned as potential future threats.

A key informant also supported the opinion of urban vegetable production impact on food security by stating the following: *"The main opportunity to engage in vegetable production is an unavailable market and the availability of fresh food. Vegetable production that is imported from another part of the region stays at least a week before reaching the consumer's hands, which allows the product to be contaminated and increases the chance of the consumer being sick.*

CONCLUSION AND RECOMMENDATIONS

The main goal of this paper was to determine the contribution of urban vegetable farming to food security in Addis Ababa, Ethiopia by using multiple regression analysis. Our study used survey data obtained from 388 vegetable households in the main growing areas of Addis Ababa, Ethiopia and qualitative information. As a result, in the last five years, vegetable cultivation has increased dramatically, and it has emerged as a source of food, income, and employment in the study area. This change is attributed to its high level of acceptance and adoption by the farmers. The cultivation of vegetables is done by all social groups, but for the majority of households, vegetable production is a primary occupation.

According to the findings, increased production improved household food security and consumption status by providing fresh and healthy food, lowering household expenses, providing low-cost food, and allowing households to generate income. In the multiple regression models, explanatory variables gender, marital status, employment, and shelter index, were significant variables that positively affected household food security status. Age, academic background, and family size were insignificant and negative variables. According to the logistic regression analysis, gender differentiation on this variable indicated that females were more likely to be food insecure.

City want to provide residents with sustainable, local, and fresh food, which is a difficult task that is dependent on a number of factors, including available land parcels for growing produce, farm size, revenue generation potential, postharvest handling, and distribution methods.

Therefore, in order to develop an effective and sustainable Addis Ababa city and vegetable production system, the government should encourage producers while minimizing vegetable cultivation problems. Strengthening the capacity of female-headed households should be prioritized. Further, food insecurity among city dwellers must be addressed through development intervention strategies, which should include long-term policy and training to help mitigate the challenges as well as research gaps.

Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability statement

Data will be made available on request.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

ACKNOWLEDGMENTS

The authors would like to acknowledge the people of Nifas Silk Lafto Sub-city for their hospitality and kind response to the enquiries regarding information about the study.

REFERENCES

AACA (2020). *Map of Nifas Silk Lafto sub city, Addis Ababa, Ethiopia.* Addis Ababa City Administration.

AAFUADC (2021). *Addis Ababa Farmers and Urban Agriculture Development Commission.* Addis Ababa, Ethiopia

Abo-El-Wafa, H., Kumelachew,Y., & Pauleitc, S. (2017). *Exploring the future of rural urban connections in sub-Saharan Africa: modelling urban expansion and its impact on food production in the Addis Ababa region.* Geografisk Tidsskrift-Danish Journal of Geography. ***117*(2**). DOI: 10.1080/00167223.2017.1350926

Abraham, A. (2012). *The Roles of Stakeholders Participation in Sustainable Urban Agriculture and Land Use System in Urban and Peri-Urban Areas of Addis Ababa, Ethiopia* (unpublished master's thesis). Norwegian University of Life Sciences, Norway.

Addis Ababa city Administration. (2017). *Addis Ababa City Structure Plan (2017-2027).* Addis Ababa, Ethiopia: Addis Ababa city Administration.

Adimasu, A. M., Senbetie, T. L., & Yoseph, H. H. (2019). *Assessment of food insecurity and its determinants in the rural households in Damot Gale Woreda, Wolaita zone, southern. Ethiopia.* Agriculture & food security, ***8(1)*.** doi.org/10.1186/s40066-019-0254-0

Alemu, T. (2015). *Land expropriation and compensation payment in Ethiopia: review.* Journal of Economics and Sustainable Development, ***6*(13).** ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)

Arku, G., P. Mkandawire, N. Aguda & V. Kuuire. (2012). *Africa's quest for food security: what is the role of urban agriculture?* African Capacity Building Foundation, Occasional papers, no.19, Harare. http://elibrary.acbfpact.org/

Ashebir, D., Pasquini, M., & Bihon, W. (2007). *Urban agriculture in Mekelle, Tigray state, Ethiopia: Principal characteristics, opportunities and constraints for further research and development.* The International Journal of Urban Policy and Planning, ***24*(3).** DOI:10.1016/j.cities.2007.01.008

Assefa, T. (2016). *Constraints and opportunities in peri-urban and urban agriculture system in Addis Ababa, Ethiopia.* African Journal of Rural Development, ***1*(**1). DOI:10.22004/ag.econ.263633

Ayenew, N., Dube, J., Habtamu, T., Getenet, D., Temesgen, G., Henok, M., Zeleke, A., Tesfahun, T., Fasil, W., & Yilkal, N. (2020). *The impact of being of the female gender for household head on the prevalence of food insecurity in Ethiopia: a systematic review and meta-analysis.* Public Health Reviews, ***41*(15).** doi.org/10.1186/s40985-020-00131-8

Baba, H.S., Zargar, A.B., Ganaie, A.S., Yousuf, S., & Sehr, H. (2010). *Gender participation in vegetable cultivation in Kashmir valley.* Journal of Extension Education, ***10*(2)**, pp.66-69

Banchamlak, H., & Akalu, T. (2022). *Vegetable market supply by small holder farmers in Ethiopia.* Cogent Social Sciences, ***8*(1)**, DOI: 10.1080/23311886.2022.2057058

Bapolisi, W.A., Ferrari, G., Ghislain, Bisimwa, G., & Merten, S. (2021). *Gendered determinants of food insecurity in ongoing regional conflicts, North and South Kivu, the Democratic Republic of Congo.* Agriculture & Food Security, ***10*(13).** https://doi.org/10.1186/s40066-021-00285-x

Birhane, T., Solomon, S., Seifu, H., & Mohindra, K.S. (2014). *Urban food insecurity in the context of high food prices: a community based cross sectional study in Addis Ababa, Ethiopia.* BMC Public Health, ***14*(680).** doi.org/10.1186/1471-2458-14-680

Coates, J., Swindale, A., & Bilinsky, P. (2007). *Household Food Insecurity Access Scale (HFIAS) for ,Measurement of Household Food Access*: Indicator Guide , Version (3), FANTA III, USAID.

CSA. (2002). *Agricultural Sample Enumeration - Area and production of crops and crop utilization 2001-2002.* Addis Ababa: Ethiopian Central Statistics Agency.

Dejen, G. (2020). *Wastewater-irrigated urban vegetable farming in Ethiopia: A review on their potential contamination and health effects.* Cogent Food & Agriculture, ***6*(1).** doi.org/10.1080/23311932.2020.1772629

Deshu, M., Alemnew, B., & Seyoum, L. (2021). *Assessing pollution profiles along Little Akaki River receiving municipal and industrial wastewaters, Central Ethiopia: implications for environmental and public health safety.* Heliyon, ***7*(7).** doi.org/10.1016/j.heliyon.2021.e07526

Fantahun, N. (2010). *Survey on the Status of Solid Waste and Its Management in Nifas-Silk Lafto Sub-City, Addis Ababa* (Unpublished master's thesis). Addis Ababa University, Addis Ababa, Ethiopia.

FAO (1996). *1996 Rome Declaration on World Food Security and World Food Summit Plan of Action.* Report of the World Food Summit: FAO, Rome.

FAO (2001). *Sub-Regional Expert Consultation on the Use of Low Cost and Simple Technologies for Crop Diversification by Small-Scale Farmers in Urban and Peri-Urban Areas of Southern Africa, Household Food Security and Nut.* FAO, Rome

FAO (2007). *Profitability and sustainability of urban and peri-urban agriculture* (Agricultural Management, Marketing and Finance Occasional Paper). FAO, Rome.

FAO (2022). *The state of food security and nutrition in the world.* Rome, FAO.

FAO, Rikolto and RUAF (2022). *Urban and peri-urban agriculture sourcebook – From production to food systems.* FAO and Rikolto, Rome.

Filmon, H., & Mitke, A. (2022). *Impact of program-based sustainable urban agricultural intervention on women empowerment in Addis Ababa: Evidence from women empowerment in agriculture index analysis.* African Journal of Agricultural Research, ***18*(5),** pp. 308-321, DOI: 10.5897/AJAR2022.16001

Firehiwot, M. & Degefa, T. (2015). *The Contribution of Urban Agriculture to Food Security of Individual Urban Farmers in Yeka Sub City, Addis Ababa.* Ethiopian Journal of Development Research, ***37*(1)**. Addis Ababa, Ethiopia.

Garnett, T. (1996). *Growing Food in Cities.*The National Food Alliance and the SAFE, UK.

GHI (2021). *Global Hunger Index.* European NGOs of Concern Worldwide and Welthungerhilfe.

Girma, G. G., Hiroshi, I., Yuichiro, A., Dil, B. R., Hisako, N., & Takaaki, W. (2021). *What Explains Gender Gaps in Household Food Security? Evidence from Maize Farm Households in Southern Ethiopia.* Springer, **155(1)**, PP. 281-314. DOI: 10.1007/s11205-020-02600-8

Godfrey, C., Emmanuel, Z., Chipo, C., Vincenta, M., & Musara, P.J. (2012). *An Assessment on Factors Affecting Urban Vegetable Production in Harare, Zimbabwe.* Global Advanced Research Journals, ***1*(8)**. pp 210-215

Gunilla, A. O. E., Kerselaers, E., Kristensen, S.L., Primdahl, J., Rogge,E., Wästfelt, A. (2016). *Peri-Urban Food Production and Its Relation to Urban Resilience.* MDPI- sustainability, ***8*(12).** https://doi.org/10.3390/su8121340

Hayuningtyas, M. (2017). *"Urban Agriculture Development: A Strategy to Support Food Security"* in 2nd International Conference on Sustainable Agriculture and Food Security: A Comprehensive Approach, KnE Life Sciences, pages 701–713. DOI 10.18502/kls.v2i6.1092

Knueppel, D., Demment, M.W., & Kaiser, L. (2010). *Validation of household food insecurity access scale in rural Tanzania.* Public Health Nutr, ***13*(3).** DOI: 10.1017/S1368980009991121

Korth, M., Stewart, R., Langer, L., Madinga, N., Da Silva, N.R., Zaranyika H., Carina van Rooyen Cv., & Wet T-de. (2014). *What are the impacts of urban agriculture programs on food security in low and middle-income countries: a systematic review?* Environ Evid, **3(21).** doi.org/10.1186/2047-2382-3-21

Martin, W and Wagner, L. (2018). *How to grow a city: Cultivating an urban agriculture action plan through concept mapping.* Agric & Food Secur, ***7*(33)**. doi.org/10.1186/s40066-018-0186-0

Masuku, B.M., & Xaba, B. (2013). *Factors affecting the Productivity and Profitability of Vegetables Production in Swaziland.* Journal of Agricultural Studies, ***1*(2)**. DOI: https://doi.org/10.5296/jas.v1i2.3748

Mcdougall, R., Rader, R., & Kristiansen, P. (2020). *Urban agriculture could provide 15% of food supply to Sydney, Australia, under expanded land use scenarios.* Land Use Policy, Elsevier, vol.***94*(C).** DOI: 10.1016/j.landusepol.2020.104554

Messay, M. T. (2020). Crisis and Fragility: Economic Impact of COVID-19 and Policy Responses. KIEP: Visiting Scholars' Opinion Paper, 357-367.

Miccoli, S., Fabrizio, F. F., & Murro, R. (2016). *Feeding the Cities Through Urban Agriculture The Community Esteem Value.* Agriculture and Agricultural Science Procedia, *8.* pp= 128-134. doi.org/10.1016/j.aaspro.2016.02.017

Morgan, K. (2015). Nourishing the city: *The rise of the urban food question in the Global North.* SAGE journals, ***52*(8)** doi.org/10.1177/0042098014534902

Mougeot, L. (2000). *Urban Agriculture: Definition, Presence, Potentials and Risks, and Policy Challenges.* International Development Research Centre, Cities Feeding People Series, Report 31

MUDHo. (2015). *Ethiopian Ministry of Urban Development and Housing*. Retrieved October 24, 2022, from http://mwud.gov.et.

Pauleit, S., Pribadi, D.O., & El-Wafa, H.A. (2019). *"Peri-urban agriculture:* lessons learnt from Jakarta and Addis Ababa", Field Actions Science Reports. Special Issue 20, online since 24 September 2019, http://journals.openedition.org/factsreports/5624

Pedzisai, E., Kowe, P., Matarira, H.C., Anyway, K.A., & Rutsvara, R. (2014). *Enhancing Food Security and Economic Welfare Through Urban Agriculture in Zimbabwe.* Journal of Food Security ***2*(3)**: pp=79-86.

Selamawit, K., Gashawbeza, A., & Mohammed, Y. (2021). *Vegetable Crops Research in Ethiopia:* Achievements and Future Prospects. (Conference: Agricultural Research for Ethiopian Renaissance_ Challenges, Opportunities and Directions). Ethiopia Instituite of Agricultural research, Addis Ababa, Ethiopia.

Senait, N., Li-Liu, & Kumelachew, Y. (2021). *Towards improving food security in urban and peri urban areas in Ethiopia through map analysis for planning.* Urban Forestry & Urban Greening, ***58* (126967).** doi.org/10.1016/j.ufug.2020.126967

Sisay, D., & Efta, H. Z. (2020). *Analysis of poverty, income inequality and their effects on food insecurity in southern Ethiopia.* Agriculture & Food Security, ***9*(16)**. doi.org/10.1186/s40066-020-00269-3

Tauer, L. (1995). *"Age and Farmer Productivity,"* Review of Agricultural Economics, Agricultural and Applied Economics Association, vol. ***17*(1),** pages 63-69.

Tefera, B., Hadley, C., Lindstrom, D., Abebe, G., Kifle, W.M., Yehenew, G., Carl-Lachat C., Kolsteren, P. (2011). *Gender Differences in Food Insecurity and Morbidity among Adolescents in Southwest Ethiopia.* Pediatrics, ***127*(2)**:e398-405. DOI: 10.1542/peds.2010-0944.

Tesfay, G. K. (2014). *Smallholder Farmers' Adaptation Strategies to Climate Change in Ethiopia: Evidence from Adwa Woreda of Tigray Region* (Unpublished master's thesis). Mekelle University, Mekelle, Ethiopia. oai:opendocs.ids.ac.uk:123456789/4507

Teshager, A. S. (2020). *Household level food insecurity assessment: Evidence from panel data.* Scientific African, ***7*(e00262)**. doi.org/10.1016/j.sciaf.2019.e00262

Tewodros, F. (2007). *Livelihood Dependence on Urban Agriculture in Addis Ababa, Ethiopia.* MSc Thesis, Norwegian University of Life Sciences, Norway

UN Department of Economic and Social Affairs. (2018). *The 2018 Revision of the World Urbanization Prospects.* Population Division of the United Nations Department of Economic and Social Affairs (UN DESA), New York, U.S.

UNDP. (1996). *Economic Growth and Human Development.* United Nations Development Programme, New York.

Uuld, A., Magda, R., & Bilan, Y. (2021). *"An Analysis of Technical Efficiency of Vegetables' Household Production in Mongolia"*, AGRIS on-line Papers in Economics and Informatics, ***13*(3),** pp. 101-111. ISSN 1804-1930. DOI 10.7160/aol.2021.130310.

Van-Veenhuizen, R. (2006). *Cities Farming for the Future: Urban Agriculture for Green and Productive Cities.* IDRC International Development Research Centre, Ottawa. http://hdl.handle.net/10625/31770

Walters, A.S and Midden, S.K. (2018). *Sustainability of Urban Agriculture: Vegetable Production on Green Roofs.* MDPI- *agriculture*, ***8*(11)**. doi.org/10.3390/agriculture8110168

Winiewska-Paluszak, J., & Grzegorz, P. G. (2021). T*he Urban and Peri-Urban Farms (UPFs) Relational Model: The Case of Greater Poland Voivodeship, Poland.* MDPI- agriculture, ***11*(5)**. doi.org/10.3390/agriculture11050421

Yalew, A. (2020). U*rban Agriculture in Ethiopia: An overview.* Regional Economic Development Research, ***1*(2),** pp. 85–92. doi.org/10.37256/redr.122020607

Yamane, T. (1967). *Statistics: An Introductory Analysis.* New York: 2nd Ed. Harper and Row.

Yared, G., Heyaw, T., Pauleit, S., Mengistie, K. (2019). *Urban green infrastructure planning in Ethiopia: The case of emerging towns of Oromia special zone surrounding Finfinne.* Journal of Urban Management, ***8*(1)**, pp.75-88. doi.org/10.1016/j.jum.2018.09.004

Yeselamfire, H. (2021). *Factors Influencing Performance of Micro and Small Scale Industries in Addis Ababa: A case of Nifas Silk Lafto Sub-city, Addis Ababa, Ethiopia.* Unpublished master's thesis, Addis Ababa University, Addis Ababa, Ethiopia

ABOUT THE AUTHORS:

Habtamu Serbessa - senior consultant at Technical Vocational Training and Technology Development Bureau, Addis Ababa, Ethiopia. PhD Candidate at Addis Ababa University, Addis Ababa, Ethiopia.

Teferee Makonnen (PhD) - Associate professor at College of Social Sciences, Addis Ababa University, Addis Ababa, Ethiopia.

Meskerem Abi (PhD) - Assistant Professor at College of Development Studies, Addis Ababa University, Addis Ababa, Ethiopia.