SCHOOL OF GRADUATE STUDIES

DETERMINANTS OF HOUSEHOLD PARTICIPATION IN URBAN AGRICULTURE: THE CASE OF GURAGE ZONE, ETHIOPIA

MSc THESIS

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ADVISORS' APPROVAL SHEET

This is to certify that the thesis entitled **"*Determinants of Household Participation in Urban Agriculture: The Case of Gurage Zone, Ethiopia*"** submitted in partial fulfillment of the requirements for the degree of Master's with specialization in Development Economics, the Graduate Program of the Department/School of Business and Economics, and has been carried out by AlemuLemma undermy/our supervision. Therefore I recommend that the student has fulfilled the requirements and hence hereby can submit the thesis to the department.

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We, the undersigned, members of the Board of Examiners of the final open defense by Alemu Lemma have read and evaluated her thesis entitled **"*Determinants of Household Participation in Urban Agriculture: The Case of Gurage Zone, Ethiopia*"**, and examined the candidate. This is, therefore, to certify that the thesis has been accepted in partial fulfillment of the requirements for the degree of Masters in Development Economics

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DECLARATION

I, Alemu Lemma, hereby declare that this MSc thesis entitled **"*Determinants of Household Participation in Urban Agriculture: The Case of Gurage Zone, Ethiopia*"** is my original work and has not been presented for a degree in any other university, and all sources of material used for this thesis have been duly acknowledged.

Name: **Alemu Lemma**

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Date: _____

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ABBREVIATION AND ACRONYMS

ATT	Average Treatment Effect on the Treated
CIA	Conditional Independence Assumption
CM	Caliper Matching
CSC	Common Support Condition
FAO	Food and Agricultural Organizations
IFPRI	International Food Policy Research Institution
KBM	Kernel-based Matching
NNM	Nearest Neighbor Matching
PSM	Propensity Score Matching
RM	Radius Matching
RUAF	Resource Centres on Urban Agriculture and food security
SDG	Sustainable Development Goal
SME	Small and Medium Enterprise
SNNPRS	Sothern Nations and Nationalities Peoples Representative State
TFP	Total Factor Production
UA	Urban Agriculture
UNDP	United Nations Development Program
UPA	Urban and Pre urban Agriculture

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ABSTRACT

Urban agriculture plays a very important role in improving household income and decreasing poverty. Despite its significant role in fulfilling the basic demand of low-income families, household's participation were very low. Therefore, this study was conducted to identify factors that determine household's participation in urban agriculture and assess the impact of participation on household income in Gurage zone. The study utilized both primary and secondary data sources, and a multi-stage sampling technique was employed to gather information from 204 households using a structured questionnaire. The logistic regression model was employed to analyze the determinants of participation in urban agriculture and propensity score matching was used to analyze the impact of participation on household income. The results of the study show that, 25.76% of the households were practicing in urban agriculture. Household's decision to participate in urban agriculture was influenced by household sex, education level, income from other sources, access to credit, access to water, access to improved inputs and access to extension services. The impact analysis results of this study show that urban agriculture has a positive significant impact on household total income. The average treatment effect on the treated was ETB 6803 and it was significant at 1% significance level. In conclusion, this study suggest that urban agriculture practice should be encouraged by governmental and non-governmental organizations through provision of credit and promotion of alternative water sources to increase urban agriculture participation in the study area.

Keywords: Impact, Income, logistic, Participation, Propensity score matching, Urban agriculture

CHAPTER ONE

INTRODUCTION

1.1. Back ground of the study

By 2050, the world population will reach 9.6 billion, and the majority are likely to live in urban areas of less developed regions. Africans are anticipated to have the most considerable urban population growth by approximately 824 million by 2030 (FAOSTAT, 2019). Likewise, the urbanisation trend is already evident in sub-Saharan Africa, where the urban population is projected to double between 2010 and 2030 (Chari, F.; Ngcamu, 2022). This will be very likely for Ethiopia too is going to be part of the process. With this increase in the number of people living in urban areas, the level of urban poverty is also going to increase significantly (Matheme et al., 2020).

Urban agriculture (UA) is proposed as a solution to the social and economic challenges presented by cities by providing urban households with food and income using environmentally friendly food production techniques (Sangwan and Tasciotti, 2023). Urban agriculture has a great role to play in achieving household food security. It is an important source of alternative income for many households (Ofordu et al., 2023). Urban agriculture (UA) is defined as the growing of crops and the raising of (small) livestock in areas within the urban boundaries of cities and towns with the purpose of either personal consumption or selling the crops in urban markets. UA is practiced in several locations, e.g., home gardens, vacant lots, roadsides, green areas and balconies, but also in privately or institutionally owned land (Poulsen et al., 2015).

The divergence between the ever-increasing urban populations and the availability of employment opportunity in industrial or manufacturing sectors, and in the lack of formal jobs in many African cities; urban agriculture considerably served as an important source of employment for the urban poor and urban agriculture created vital employment opportunity for urban people (Arku et al., 2012). There is now a general recognition of the importance of UA in most countries of the world and in the African continent in particular (Salome, 2015).

The government in Ethiopia has implemented various agricultural policies such as market liberalization, structural adjustment, agricultural-led industrialization, sustainable development and poverty reduction program, participatory and accelerated sustainable development to eradicate poverty and successive growth and transformation plans I and II to raise productivity in agriculture between 1991 and 2016. Since 1991, the government abolished all subsidies and price support measures to agriculture. All these policy interventions have been implemented to increase agricultural productivity and production which in turn reduce poverty and food insecurity (Shikur et al., 2020). Ethiopia is one of the developing countries that have set the implementation of urban agriculture for the city/ town dwellers to escape from urban poverty (Dereje, 2011).

According to Abraham (2017), urban agriculture is used as means of survival strategies exhibited by households in Ethiopia. Households mainly those with low income in the urban areas react to the extreme threat from poverty by moving out urban farming on any vacant space available. Urban agriculture is also practiced because of lack of income and being without a job of the urban centres. Besides, urban agriculture has also been considered as a contributor to improved nutritional levels among the urban poor in Ethiopia.

However, Getahun (2012) has identified many Ethiopian towns characterized by factors as the insufficient source of income, lack of asset/skill, poor health status, poor educational level and backward attitude of people towards work. These factors in one or another way have a direct or indirect effect on the life standard of the people. For example, lack of income results in the reduction of expenditure pattern, poor health leads to being unproductive, absence from work, less energetic, lack of education results in a lack of skill, helplessness and so on. Similarly, in Gurage zone, the number of urban poor is increasing at an unprecedented level and despite the potential benefits that UA can generate the participation of urban peoples on urban agriculture is small (Gurage zone Agriculture Development Office, 2022).

According to Komakech et al. (2013) the balance between UA intended for individuals' own consumption and for income generation varies and may depend on several variables, including the gender of the farmer, wealth of the households, area of residence and size of the allotment. Therefore, this study was mainly concerned with finding out the factors that determine the household's participationin on urban agriculture in the study area.

1.2. Statement of the problem

Strengthening urban agriculture can serve as a significant approach in improving the urban household income. On the other hand, urban agriculture serves as availability of fresh and healthy foods, which may consequently boost the nutrition of diverse groups of the urban population. The benefits of urban agriculture are numerous and relate to alleviation and/or reduction in poverty, local economic development, improvement in food security, environmental and waste management, community adaptation to climate change and social and community development (Naomi, 2016).

Urban agriculture is being practiced in all the major urban areas of central part of Ethiopia, particularly in Addis Ababa and the neighbouring towns. However, many of the major cities have incorporated UA as part of their SME programs. Very few towns of Ethiopia developed urban horticultural, poultry and dairy the town. However, some fundamental questions regarding this intervention remain unanswered. Renewed interest in the topic did not necessarily converge with new knowledge about UA (Daniel and Getaneh, 2016).

Urban home gardening, as unlike to other larger forms of agricultural production in the city or to home gardening in rural areas is a particularly undocumented phenomenon and its impacts remain well understudied. Urban agriculture is a direct action against hunger, food insecurity, unemployment and low level of income which contributes to household's wellbeing in general. However, in many towns of Ethiopia urban agriculture is not well take into account when urbanization and planning (Dereje, 2011). Promoting urban agriculture participation in town can have contribution to address the sensitive food scarcity problems, creating employment opportunities and lack of enough income of urban communities of Ethiopia.

Even though the knowledge of the economic consequence of urban agricultural activities is relevant for designing policies that aim at improving household income/welfare, policy makers of town and government in Ethiopia have deliberately neglected this huge sector and have failed to acknowledge it and direct attention to it rather than urban agriculture practice gradually moved out of town.

Urban agriculture in Gurage zone is labour intensive farming practice done only on small areas such as vacant plots, outdoors, gardens, parks, riversides, containers and road stripes. It is

resource- poor, subsistence and urban poor growing vegetables and raising animals within and/or around town boundaries in uncoordinated manner. The outputs are mostly meant for subsistence purposes, making the sector unable to play a significant role in poverty alleviation, urban greening and employment opportunity; that is why studying urban agriculture is necessary in Gurage zone.

There have been some previous related studies on urban agriculture by some researchers in Ethiopia: Contribution of UA to improving food security (Dereje, 2011), the importance of farmer cooperatives and sustainability (Dawit, 2010), employment generation through urban agriculture (Daniel and Getaneh, 2016), assessment of UA contribution to urban household (Belete, 2015), food security contribution of UA (Endale, 2011), food security attainment role of urban agriculture (Mesay, 2010). Their finding in general showed that UA helps to generate employment opportunities and food security for urban inhabitants.

However, they were not assessed factors influence households participation in urban agricultural practice and its impact on households' income in the study area. Different factors such as land size, credit, education etc will affect the participation of urban household in urban agriculture. This may reduce the role of urban agriculture in deferent perspective. Particularly the main and the common determinants of urban agricultural have not yet studied by any researcher in the study area. Therefore, this study aims to fill the research gap by identifying and evaluating the main determinants of urban agriculture in Gurage zone.

1.3. Objective of the study

1.3.1. General objective

The main objective of this study is to identify the determinants of urban household's participation inurban agriculture in Gurage zone

1.3.2. Specific objectives

The specific objectives of this study are:

- To access the perceptions of households towards urban agriculture in the study area
- To identify the main determinants that affect urban agriculture participation in the study area

- To investigate the impact of urban agriculture on household income in the study area

1.4. Research Question

- What are the perceptions of households towards urban agriculture in the study area?
- What are the main factors that affect urban agriculture participation in the study area?
- Does participation in urban agriculture have an impact on household's income in the study area?

1.5. Significance of the study

The result of this study will provide pertinent information and knowledge base to urban households/individuals, farmers and associations who want to invest in urban agriculture. On the other hand, the results of this study will also expect to have important role to fill the knowledge gap in the study area. Furthermore, it can be used as input for policy makers and urban planners to consider urban agriculture as an option for livelihood. The study will also help as evidence and literature for those researchers who have the interest to conduct a study related to this topic in the area at the future.

1.6. Scope and Limitation of the study

This study focused on the investigation of the determinants of participation in urban agriculture and its impact on household income in selected town of Gurage zone by using cross-sectional data collected from 204 sample households. The study was limited to the study area and selected sample mainly due to time and financial shortage.

1.7. Organization of the study

The remaining part of this thesis is organized as follows. The second chapter contains a detailed literature review on the relevant topics of the study. The third chapter deals with a description of the study area and an explanation of the research methodology employed in the study. The fourth chapter presents the results and discussions, including a presentation on respondent characteristics, analyzing the factors affecting participation of households in urban agriculture in the study areas, identifying the impact of urban agriculture on income of households. Finally, the fifth chapter concludes the finding of the study and provides recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1. Theoretical Literature Review

2.1.1. Concepts of Urban Agriculture

Urban agriculture can be expressed as growing of plants and the raising of animals for food and other uses within urban and pre-urban areas, and related activities such as production and delivery of inputs and the processing and marketing of products (Dezeeuw, 2010).

Defining urban agriculture is difficult because of the varying contexts in which it takes place, the resources involved and the people undertaking it. Against such as environment, different scholars have defined UA differently. For instance, "Urban agriculture is an industry located within /intra-urban or on the fringe /peri-urban of a town, a city or a metropolis, which grows and raises, processes and distributes a diversity of food and non-food products, re-using largely human and material resources, products and services found in and around that urban area, and in turn supplying human and material resources, products and services largely to that urban area" (Guo, 2012).

A large variety of urban farming systems exist internationally, with varying characteristics depending on local socio-economic, geographic and political conditions. Urban agriculture thus can include a wide variety of economic activities refer to the differentiation of the production, processing and marketing phases, planting, keeping cattle, garden vegetable in Urban interventions. Each phase requires a different set of skills and results in different profit and income margins for urban farmers. Urban agriculture is remained one under-appreciated avenue to get better urban food security (Marcel et al., 2013).

Urban Agriculture comprehends production, processing, and distribution activities within, around cities and towns, whose core motivation is personal consumption and/or income generation. Also, urban agriculture competes in order to get scarce urban resources of land, water, energy, and labour that are in demand for other urban activities. Urban Agriculture is located within or on the fringe of a city or peri-urban and comprises of a diversity of production

systems, ranging from subsistence production and processing at the household level to fully commercialized agriculture (Veenhuizen, 2010).

Studies on urban agriculture have provided little theoretical frame work for which and assessing the factors that determine an urban household's decision to engage in urban agricultural activities. Nugent (2010) models on urban household's decision to partake in urban farming as a reflection of household's attempt to maximize its wellbeing amongst employment options including leisure subject to a set of constraints.

2.1.2. Overview of Global and African urban agriculture

Research has shown that the majority of the urban farmers are women. 42% and 40% of their populations in some American countries and in some Africa cities is engaged in urban or peri-urban agriculture respectively. Urban dwellers may engage themselves in growing crops and more habitually raise limited animals to produce their own food. The urban poor households are also benefited by urban agriculture to fulfil their needs (Shumate, 2012).

Urban food production is well established in cities of developing world. Social and economic issues such as poverty and unemployment which are prevalent in developing countries have lead people to adopt survival tactics to fight against to poverty and vulnerability. Even in well established, highly developed cities that are Taipei, Taiwan, urban agricultural activities can be readily observed, particularly on the city's edge (Niekerk, 2015).

During the last 15 years, FAO has gained considerable experience in a wide range of countries in several continents in the application of urban and peri-urban technologies. This paper was compiled to capitalize on the lessons learned and to illustrate how UPA has become a key component of the SPFS, targeting improved food security and diet diversification of the urban poor (FAO, 2011).

Around 200 million city dwellers generate food for the urban market, which is 15–20 percent of entire global food production. In West Africa, almost 20 million households (20 percent of the urban population) put into practice urban agriculture and they contribute 60–100 percent of the fresh vegetable market in those cities. The merits of urban and peri-urban agriculture are a lot of contributing to the food supply chain. Since the most of the sales are near the production centres the cost of transportation is low. Producers can towards fulfilling market demands.

2.1.3. Importance of Urban Agriculture

Urban agriculture has the indispensable potential to tackle some of the key challenges that cities in developing countries faced from achieving sustainability such as urban poverty, food insecurity, unemployment and environmental problems of the cities (Naomi, 2016).

In recognition of the Sustainable Development Goals (SDGs), urban agriculture can assist in potentially decreasing hunger and poverty creating sustainable food production patterns and promoting the integration of environmental values in development. In terms of decreasing poverty and hunger, urban agriculture provides a mechanism for improving urban food security and providing entrepreneurship opportunities for low-income individuals. In creating sustainable food patterns, urban agriculture is projected to reduce climate change-related greenhouse gas emissions through reducing food production and distribution inputs. Furthermore, by incorporating waste management, nutrient recycling and energy recycling urban agriculture utilize environmentally sustainable practices in meeting the necessities of urban regions (Deezeeuw, 2010).

Over the years urban agriculture is gradually gaining recognition by urban authorities and civil society establishments due to its capability of strengthening the pliability of the urban food structure, in addition to promoting easy accessibility of most urban residents to healthier diet and creating job opportunities and revenue. Thus, strengthening urban agriculture may serve as a significant approach in improving easy availability of fresh and healthy foods which may consequently boost the nutrition of diverse groups of the urban population. The benefits of urban agriculture are numerous and relate to alleviation and/or reduction in poverty, local economic development, improvement in food security, environmental and waste management, community adaptation to climate change and social and community development (Naomi, 2016).

Food security has been recognized as a major purpose of practicing UA. Initiative UA contribute to urban food self-sufficiency by helping to provide all citizens with increased access to nutritious foods and reduce their food expenses which results in food security. When a household produce food for their own consumption, the saving expenses on foodstuffs can be thought as fungible income. Urban agriculture is therefore playing important role in generating source of food. Secondly, if there are more products than household needed, they tend to sell the surpluses

on market, which comes to another complementing source of household income (Komakech et al., 2013; Nkrumah, 2018)

2.1.4. The Economic Impacts of Urban Agriculture

Urban agriculture creates employment opportunities for 800 million urban dwellers in the world and decreases the high rate of urban unemployment, and contributed to local economic development by creating significant employment for the urban residents and enhanced the living standards of the urban resident. It is one of the particularly vital sources of employment for people who may not successfully compete for formal sector jobs, for people with low skill and for vulnerable urban people. It is estimated that 40 percent of urban dwellers in Africa are vigorously engaged in urban agriculture in one way or other related sectors (Arkuet al., 2012).

Urban food production, processing, and marketing encourage local economic development by creating income and employment. Chance for many poor urban households and urban agriculture policies is part of a local economic development policy that focuses on income generation and employment creation for a whole range of producers from home-based to community-based. Next to growing crops or rearing animals, urban agriculture provides other employment opportunities, for example: agricultural input production and delivery activities; the collection of urban organic wastes and the production of compost or animal feed from collected organic wastes, sale of agricultural inputs and the development of related micro-enterprises: productions and sale of processed products for instance meals, jams, and other food products (MoustierandDanso, 2006).

Urban horticultural products are contributing to the growing domestic and international food demand, urban agriculture expanding market access for urban poor in lagging regions of the world and serving residents in lagging regions to escape poverty through the production of staple crops (Albert, 2012).

2.1.5. Urban Agriculture in Ethiopia

In line with the increment of the urban population, urban centres face economic shocks and food insecurity. Kedir (2013) showed that in urban areas 26% people are challenged by chronic poverty and 23% of households experienced transitory poverty.

According to Sabine Gundel (2006), over the last decade, there has been a growing recognition of the meaning of urban and peri-urban agriculture (UPA) for poor people's livelihoods. Although a great deal attention has been given by governments and donors to urban job creation and employment sources, health and infrastructure, IFPRI's Global Vision 2020 emphasizes that efforts to improve urban livelihoods must go further than a focus on urban jobs. Urban and rural livelihoods are frequently intertwined through goods, services, and people.

Currently to motivate urban agriculture, the Addis Ababa City Municipality has started new campaign to promote the urban dwellers to start producing of urban agricultural products in their surroundings, in their garden and in riverside's individually and organized. Though, the practice was there with unorganized manner by different households, following the city's campaign, a lot of households has started the farming mainly in producing vegetables for household consumption within limited land. In addition, organized people mainly under the Safety Net Program have started investments by taking land from their local administrations which currently is showing significant progress (The Ethiopian Herald December 14/2021)

2.1.6. Urban Agriculture Policy in Ethiopia

Dawit (2010) conducted his research in Addis Ababa on urban agriculture 'the importance of farmer cooperative' in which he revealed that the urban agriculture policy in Ethiopia was not supportive of urban agriculture progress so far. The planner should give much attention to the urban agriculture benefits. The lack of proper attention from policy-makers, urban planners, and local authorities, stemmed from the shortage of information that substantiates urban agriculture's importance in the city sustainability is also causing a problem for urban farming in the city. Add to this the lack of reliable data on the extent of urban areas being used for farming has also affected developing sustainable policies to manage urban farming in the city. Although urban agriculture is gradually being recognized as playing an important role in increasing level of income in particular and poverty alleviation in general in urban areas, it is still not being integrated into agricultural policies and the urban planning of cities.

Lee (1997) and Egziabher (1994) stated that the livelihoods of many urban citizens in Ethiopia (e.g. Addis Ababa: economic capital and which accounts for over thirty percent of the total urban population) is heavily dependent on urban farming, but urban policy makers fail to give due attention to urban agriculture during urban planning policy reforms. But according to (Edwards,

2010) as is the case in Ethiopia, urban agriculture can be characterized in to three farming systems on the basis of location. These are the peri-urban, household or homestead gardening, and vacant-space cultivation. The peri-urban cultivation takes place on lands just outside the built up areas of the city. Vacant-space cultivation is done in open spaces usually in residential areas, beside water ways (natural and man-made such as drainage channels), and road sides Urban agriculture today is increasing all over the world including Ethiopia. Its focus is on poverty alleviation. Urban agriculture from the sustainable development perspective is considered in to four major aspects; food security, the contribution of urban agriculture to the cultivating household, the environmental benefits of the practice and associated social and psychological benefits (Berhanu and Akola, 2016).

2.1.7. Urban agriculture at household level

Urban households face choices in how to allocate their labour and their expenditures in order to maximize their welfare within a constraint of limited resources. A simple economic model predicts behaviour that would bring the most income into the family. This means family members jointly choose how to allocate their work time to the most remunerative income-generating activities over a given time horizon. However, urban farmers are simultaneously suppliers of labour to agriculture, and producers and consumers of food. This makes the maximization problem more complex. In order to understand household behaviour with respect to urban agriculture, the existence of other factors that affect income expectations must be brought into the analysis (Rachel, 2010).

2.2. Empirical Studies

Daniel and Getaneh (2016), they studied factors that affect employment generation through urban agriculture in Ethiopia, Oromia Region, Bishoftu area by using multiple linear regression model and their study revealed that perception of a better credit, access to inputs, access to land, land ownership, educational status, better farm income, engagement in poultry and dairy farms are significantly affected employment contribution of urban agriculture. Furthermore, its role to urban farmers/households', urban agriculture has played a massive role in supplying; fresh products to the city dwellers, raw materials to agro-processing industries and market to their products.

Naomi (2016) conducted his research on urban agriculture and household welfare: an analysis of Ghana's recent experience by using logit regression model for analysis of determinants of household decision to participation in urban agriculture and propensity score matching techniques to evaluate the impact of urban agriculture on household welfare, he come up with an urban household's decision to participate in agricultural activities is influenced by factors such as education, age, gender and employment status of the household head and household characteristics such as household size and access to agricultural land while the PSM analysis showed that there is no significant impact of urban agriculture on household welfare.

Rebati (2013) in his research conducted on impact of Agricultural Productivity Changes on Poverty Reduction in Developing Countries by employing a stochastic frontier analysis to estimate TFP change for countries with different income levels. His result showed that Agricultural growth is essential for poverty reduction in developing countries. And agricultural total factor productivity is important factor determining agricultural growth. However, a country's performance differs when a regional frontier moves than when the global frontier shifts. Although agriculture is generally perceived as only a rural activity, it can also be an element in urban livelihoods, used as a source of food and employment for poor households and for whole cities. The extent of urban agriculture is broadly varied depending on land availability and legal restrictions. The study reveals that as much as 40 percent of the population in African cities and up to 50 percent in Latin American cities are engaged in urban or peri-urban agriculture. In the 1980s urban and peri-urban agriculture in China's largest cities met greater than 90 percent of vegetable demand and greater than half of meat and poultry demand.

Jongwe (2013) studied the linkage between urban agriculture and urban household food security in Gweru City, Zimbabwe by applying logit regression model; he showed as household size, household head age and educational status are significant factors that affect participation in urban agriculture.

Simon peter (2008) Assessed the contribution of urban agriculture to household poverty reduction: the case of Morogoro municipality in Tanzania using a gross margin (GM) analysis and his result revealed in comparison with other sources of household income, urban agriculture was not contributing greatly to poverty reduction and income distribution because of the constraints such as poor weather condition, lack of capital which made them unable to meet costs

of inputs thereby hindering expansion of farm enterprises. Other constraints included pests and diseases, poor seed germination, theft of crops especially green maize, high transport costs, high inputs costs, lack of inputs, labour shortage, low soil fertility and lack of irrigation water facing farmers. If these constraints are addressed, urban agriculture has a great potential in poverty reduction and income distribution.

The study carried out in five East African cities: Addis Ababa; Dar es Salaam; Kampala; Kisumu and Nairobi revealed that urban livestock keeping, the one segment of urban agriculture, benefits the poor and provides a means of diversifying livelihood activities that are accessible to vulnerable groups such as female-headed households, children, retired people, the sick and widows, on top of this, providing a source of locally produced food projects for people living near the livestock keepers. Besides, this study also showed that Livestock is kept as social safety nets, retirement policies, deposits for funerals, sources of food and income. Urban livestock keeping is of great importance to those in need of a social security strategy (Richards & Godfrey, 2003).

According to Mesay (2010), he studied food security achievement role of urban agriculture in Adama city, Ethiopia by applying multiple linear regression models and his research suggested that the amount of commercial fertilizer applied per unit hectare, number of oxen (availability of traction power), dung input and sex of household head are the major determinants of food availability.

Most of the urban studies which are done in developing countries mainly concentrate on UA and employment opportunities and food security for urban inhabitants. However, they were not assessed factors influence households participation in urban agricultural practice and its impact on households' income. Therefore, this study aims to fill the research gap by identifying and evaluating the main determinants of urban agriculture in Gurage zone.

2.3. Conceptual framework of the study

Based on the literature review, conceptual framework outlines various factors which can be taken in to consideration in this study, with an emphasis on the determinants of urban agriculture and its impact on income.

Demographiccharacteristicss such as age, sex, marital status, household size and education level are important factors in urban agriculture participation. On the other hand, another factors like land size, access to water, access to credit, access to extension service, access to improved inputs, market distance and household income from other source can strongly affect urban agriculture participation.

Urban agriculture provides to households own consumption, or households may sell agricultural products and they can earn income.

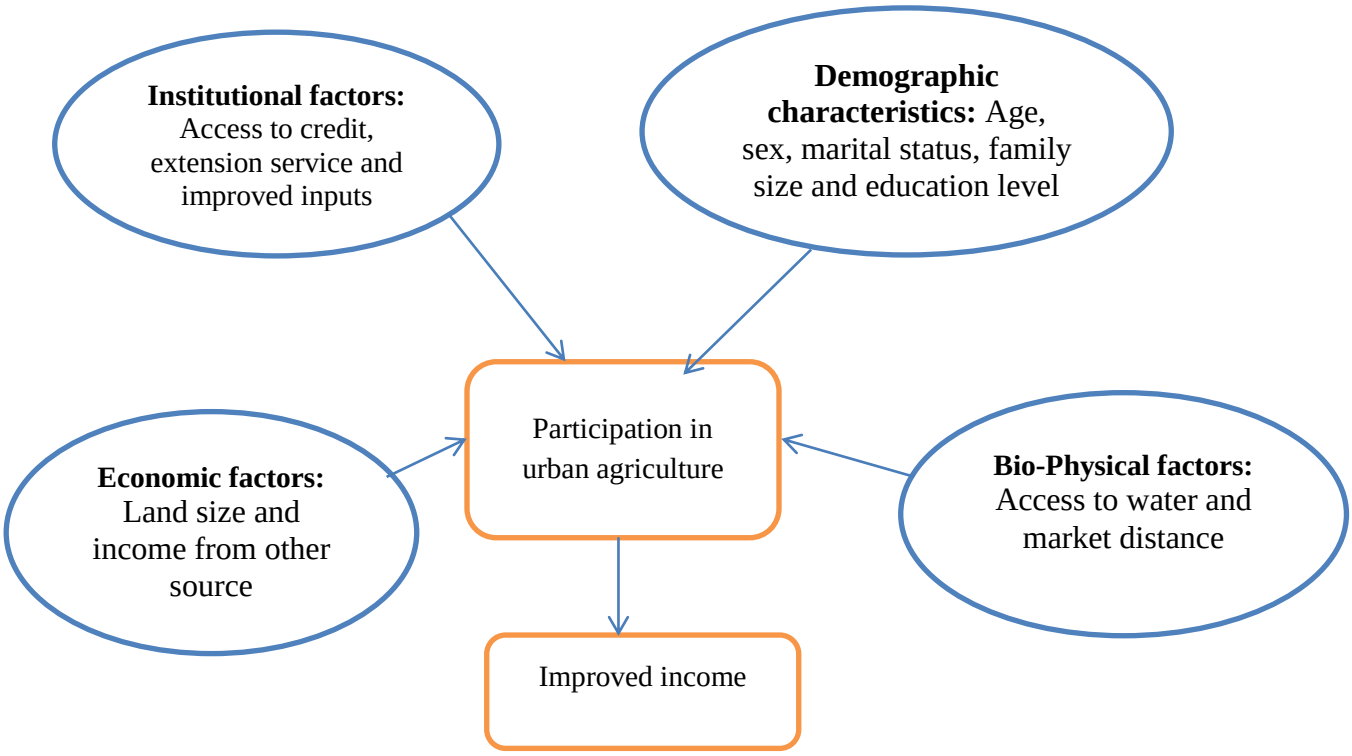

Figure 1: Conceptual framework of the study

Source: own construction based on reviewed literature, (2023)

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Description of the Study Area

Gurage zone is one of a zone in SNNPR and it is organized with 16 weredas and 8 city administrations. It is approximately 155 km far from Addis Abeba via Wolkite road and 135 km through Butajira road. Gurage zone has a latitude and longitude of 8017, N 37047, E/8.2830N 37.7830E with an elevation of between 1910 and 1935 meters above sea level. Also the main administration city known as Wolkite is 125 km away from Jimma and 110 km from Zeway according to Gurage zone finance and economic development office of 2019/20.The population number of the zone is estimated 1,889,195.Of which 971,988 are women, 917,236 are male 293,696 are urban population and 1,595,498 are rural total population. The economy of the towns in Gurage zone is the same to the other towns of Ethiopia that is trade. According to the agricultural sector, Gurage zone towns' urban agriculture is based on chat farming, horticulture, other urban agriculture such as cattle fattening, poultry, milk and milk process and other type of business(Gurage zone administration office, 2022).

Source: researchgate.net

Figure 2.Description of the study area

3.2. Data Type, source and collection Methods

The research strategy that was employed in this study combines both qualitative and quantitative data sources. Qualitative method is used to capture data relevant to urban household's attitude, willingness and constraint they face to participate in urban Agriculture. Since the aim of the study is to identify the main determinants of urban agriculture participation obtaining data particularly on urban agriculture contribution separately and assessing all urban Ethiopia is tricky at country level. On the other hand, household's participation in urban agriculture may not continue over some years. Household may change his/her participation in urban agriculture due to some factors. So cross sectional data which will be collected at one time period will be collected from sample respondents of cause study area. The Primary data, both qualitative and quantitative data on institution, socio-economic and demographic factors and other basic information were collected from sample households using structured and semi structured questionnaire and interview. Focused group discussion and key informant data collection tools also used. Secondary data were collected from relevant literatures, reports of Agricultural development offices of Gurage zone, government report, and other publications. The interest of the respondents in survey work was given top priority. Therefore, in order to gain their trust, the respondents were carefully informed about the objectives of the survey and the direct and indirect benefits to them.

3.3. Sampling Technique and Procedure

Gurage zone is selected purposively because of urban agriculture activities such as chat farming, fattening cattle, poultry, milk and milk processing, farming within urban and peri- urban are practiced. From the urban towns 4 towns (Wolkite, Emdebir, Butajira and Buei) were selected randomly. Lastly, 204 sample respondents were selected using simple random sampling technique.

The sample size for this study was determined using the formula given by Yamane (1967) in drawing an adequate sample size from a given population at 7% level of precision.

$$.\boldsymbol{n} = \frac{\boldsymbol{N}}{\mathbf{1}+\boldsymbol{e}^{\mathbf{2}}\ (\mathbf{N})}$$

Where n= the sample size

N= the total urban household heads

e= the level of perception

$$\boldsymbol{n} = \frac{203{,}137}{\mathbf{1}+(\mathbf{0.07})^{\mathbf{2}}\ (203{,}137)} = 204$$

Hence 204 sample respondent were selected from the total population of 203,137 household heads which found in four towns (Wolkite, Emdebir, Butajira and Buei) of Gurage zone. The researcher used proportional random sampling in each town to get the total sample respondents.

Table 3.1: Distribution of sample size

Name of town	No. of Population	Participants in UA	Non-participants in UA	Sampling from Participants(A)	Sampling from Non-participants(B)	Total sample (A+B)
Wolkite	80,168	6,500	73,668	20	61	81
Emdebir	30,089	4,000	26,089	7	23	30
Butajira	70,600	7,500	63,100	18	53	71
Buei	22,280	3,500	18,780	6	16	22
Total	203,137	21,500	181,637	51	153	204

Source: Gurage zone administration & communication office, population of town, 2022

3.4. Methods of Data Analysis

The study employs both descriptive and econometric analysis techniques for this study. Descriptive statistics such as mean, standard deviation, percentages and frequencies were used to summarize household characteristics that influence household participation in urban agriculture. Furthermore, Chi-square and *t*-test were also employed to test the difference between urban agriculture participants and non-participants across categorical and continuous variables.

The logistic regression model was applied to determine the relationship between household socio-economic characteristics and the decision to participate in urban agriculture. The propensity score matching methods was applied to estimate the effect of urban agriculture on household income. SPSS version 22 and STATA version 14 was used to compute these statistics.

3.4.1. Econometric Model Specification

3.4.1.1. Specification of Logistic Regression Model

One of the objectives of this study is to identify the main factors that affect urban agriculture participation in Gurage zone.Since participation in urban agriculture is a binary dependent variable with the option of either participation or non-participation, the binomial regression model was adopted as the most appropriate tool to identify determinants of household participation in urban agriculture. For binary dependent variables, the models that are used to estimate the probability of participation against non-participation households are logit or probit models. However, the choice between the two is not as problematic as they provide the same result (Fadare et al., 2014). Therefore, due to its simplicity, the logit model was used to to investigate the relationship between binary or ordinal response probability and explanatory variables. In this study, the probability of the household participation in urban agriculture was modeled as a function of household socio-economic characteristics. Factors that influence participation in urban agriculture were used as independent variables for the logit model.

In estimating the logit model, the dependent variable is participation in urban agriculture, which takes a value of 1 if the household participated in urban agriculture and 0 otherwise. The logistic regression model was used to determine how each independent variable affects household probability of participation in urban agriculture and the direction of relationship between the dependent and independent variables. Thus, mathematically the logit model is formulated as follows:

$$P_i = \frac{e^{zi}}{1+e^{zi}} \text{----------} \quad (1)$$

Where, Pi is the probability of participation in urban agriculture

$$Z_i = \beta o + \sum \beta i x i + ui \text{----------} \quad (2)$$

Where, i= 1, 2, 3 …… n, βo = intercept, βi =regression coefficients to be estimated

u_i = a disturbance term, and xi =is vector of various factors affecting household participation in urban agriculture

The probability that a household belongs to the urban agricultures:

$1 - p = \frac{1}{1+e^{zi}}$p=1/ 1+e^zi---------- (3)

Then the odds ratio can be written as

$\frac{Pi}{1-p}=\frac{1+e^{zi}}{1+e^{-zi}} = e^{zi}$---------- (4)

Taking natural logarithm, then Z_i:

$Z_i = \beta o + \sum_j^n = 1^{\beta jxji+\varepsilon i}$---------- (5)

3.4.1.2. Specification of Propensity Score Matching model

For this study, the intervention was participation in urban agriculture. However, estimating the effect of treatment on outcomes is a major challenge because of the following three expected biases: the selection of observables resulting from sampling bias, the selection of a comparison group in the presence of externalities, and the selection of unobservable resulting from differences between the treated and the control groups in the distribution of their unobserved characteristics (Wooldridge, 2010).

According to Mendola (2007) both OLS and IV procedures impose linear functional form, and finding instruments are very difficult in impact analysis procedure. In addition to this, unlike an observed control variable, an instrumental variable is assumed not to have any direct effect on the outcome. Instead, the instrumental variable is thought to influence only the selection into the treatment condition which results in over estimation or underestimation of impact under consideration. In simple regression or logistic models, the coefficients on the control variables would be the same for participants and non-participants. Due to this limitation, the PSM method developed by Rosenbaum and Rubin in (1983) is generally adopted in various literatures to examine the effect of treatment on outcomes. Because of its non-parametric approach to the balance of covariates between the treated and the control groups, the PSM method improves the ability of regression to produce reliable causal estimates (Conniffe et al., 2000). Thus, by considering these advantages PSM was used for this study to estimate the impacts of participation in urban agriculture on income.

Despite many advantages, PSM cannot handle the problem of unobserved characteristics, and therefore depends on the quality of the observational data (Li, 2013). This study attempted to minimize this limitation by collecting quality data, the inclusion of the most relevant variables, and the use of recommended matching techniques.

According to Caliendo and Kopeinig (2008), the implementation of PSM involves six steps. These are: estimation of propensity score, choosing a matching algorithm, checking for common support region, matching quality test, impact estimation, and sensitivity analysis.

Estimating the propensity score

According to Kousar et al., (2019), the propensity score is defined P (X_i) as the conditional probability of receiving a treatment given pre-treatment characteristics:

$$P(X_i) = \text{prob}(D_i = 1/ X_i) = E(D_i/ X_i) \quad \ldots\ldots 6$$

Where Di = (0, 1) is the dummy for participation, and X represents the vector of household characteristics. The conditional distribution of X, given the propensity score p(X), is similar in both groups of participants and non-participants. PSM constructs a statistical comparison group that is based on a model of the probability of participating in the treatment (T) conditional on observed characteristics (X), or the propensity score: P(X) = Pr (T = 1/X). Since the propensity is unknown, the first task in matching is to estimate this propensity score.

Estimating propensity score involves the identification of the probability of participation in urban agriculture. When estimating the propensity score, two choices have to be made. The first one concerns the model to be used for estimating the probability of participation in urban agriculture, and the second one is about the variables to be included in that model (Caliendo and Kopeinig, 2005). For binary dependent variables, the models that are used to estimate the probability of participation against non-participation households are logit or probit models. However, the choice between the two is not as problematic as they provide the same result (Fadare et al., 2014). Therefore, due to its simplicity, the logit model was used to determine the propensity score of the sample households.

Matching theory in the propensity score generated through the logit model should include predictor variables that influence the selection procedure or participation and the outcome of

interest (Bergstra et al., 2019). Based on this suggestion, 11 independent variables that simultaneously affect households' decision to participate in urban agriculture and the outcome variables were included in this study.

The common support region determination

According to Rosenbaum and Rubin (1983), the validity of the outputs of the PSM method depends on two basic assumptions: the Conditional Independence Assumption (CIA) and the Common Support Condition (CSC). The CIA argues that treatment needs to meet the criterion of being exogenous, meaning that any systematic difference in outcomes between treatment and control groups with the same values for characteristics X can be attributed to treatment. The CSC means that there is sufficient overlap in the treated and untreated units' characteristics to find appropriate matches.

The common support region is the area that contains the minimum and maximum propensity scores of treatment and control group households, respectively. It is a region where the propensity score of the participant and non-participants overlap. Then, outcomes of participating and non-participating households with similar propensity scores are compared to obtain the program effect. Households for which no match is found are dropped because no basis exists for comparison. This is done by cutting off those observations whose propensity scores are smaller than the minimum and greater than the maximum of participants and non-participant groups, respectively (Caliendo and Kopeinig, 2005).

Choosing matching algorism

The matching aims to find the closest comparison group from a sample of participants to non-participants. Thus, after the estimation of the propensity scores, seeking an appropriate matching estimator is the major task. There are four common matching algorisms that are widely used, including nearest neighbor matching (NNM), kernel-based matching (KBM), radius matching (RM), and caliper matching (CM) algorism (Caliendo and Kopeinig, 2008). Among them, a matching estimator that bears low pseudo R^2, results in large matched samples and insignificant explanatory variables after matching should be chosen among them (Dehejia and Wahba, 2002).

Testing matching quality

The matching quality of the best matching algorism should be tested for its quality using different parameters. The basic idea is to compare the situation before and after matching and check if there are any differences after conditioning on the propensity score. Standard bias, t-test, joint significance, pseudo-R^2, and stratification test are the mechanism that different kinds of the literature suggested to test this situation. Based on this, matching is considered a good match when there is no statistically significant difference in the mean of covariates of both groups, significant mean bias reduction, and low pseudo-R^2 (Caliendo and Kopeinig, 2005).

Impact estimation

Following matching quality tests, impact estimation needs to be conducted using the average treatment effect on the treated (ATT). It is the mean outcome difference between intervention participants and non-participants matched by PSM.

ATT are defined as the average effect for sampled households with a given value of the explanatory variables. Hence, the ATT for the individual can be defined as the difference between the expected outcome variable (income). For this study it is estimated by taking the mean difference between participants and non-participant that are matched through the propensity scores (Caliendo and Kopeinig, 2005).

ATT will be estimated as follows:

$$ATT = E\,(Y_{1i} - Y_{2i} / D_i = 1)$$

$$ATT = E\,[E\,(Y_{1i} - Y_{2i} / D_i = 1, P(x))]$$

$$ATT = E\,[E\,(Y_{1i} / Di = 1, P(x)) - E(Y_{2i} / Di = 0, P(x))] \qquad (8)$$

Where

Y_{1i} is the expected outcome variable (income) if the household *i* participates in urban agriculture;
Y_{2i} is the expected outcome variable (income) of household *i* not-participates in urban agriculture;
X represents the vector of household characteristics.

Sensitivity analysis

An assumption of the matching method is based on CIA, which states that the researchers should observe all variables that are at the same time influencing the participation decision and outcome variables (income). The estimation of participation effects with matching estimators is based on the confoundedness or selection of observables assumption. However, if there are unobserved variables that affect the assignment into treatment and the outcome variable simultaneously, a hidden bias might arise which invalidates the CIA and it results in biased estimates of ATTs. Since estimates are not robust against hidden biases, it is important to test the robustness of results to depart from the identifying assumption. However, it is impossible to estimate the magnitude of selection bias with non-experimental data. To address such a problem, in this study, sensitivity analysis was applied accordingly (Rosenbaum, 2002).

The propensity score matching approach is used to estimate the impact of urban agriculture on household income since the method takes into account the systematic differences in socio-economic characteristics between the urban agriculture practicing and non-practicing households by matching from both groups with similar characteristics (Mupeta et al., 2020).

3.5. Definition of Variables used for the Study

3.5.1 Dependent and Outcome variables

Dependent variable

Participation in urban agriculture is dependent variables taking value of 1 if the farmer participated and 0 if not participated in urban agriculture. The main intension here is to identify the factors determining the participation of households in urban agriculture

Outcome variable:

The outcome variable in this study is total annual income of household. It is continuous variable by which is measured in birr. It is expected that participation in urban agriculture increase income of the participants households. Therefore, it is expected that participation in urban agriculture would improve income of the households.

3.5.2. Explanatory Variables

This section highlights and discusses some factors from literature that are hypothesized to have an influence on a household's decision to participate in urban agricultureand income of the household.Therefore, the most common factors influence on a household's decision to participate in urban agriculture are defined and hypothesized below.

Age of household head: It is continues variables measured in years. Older people tend to participate in UA because of family responsibility (Guo, 2012). Therefore, this variable was hypothesized as influencing the household's decision to participate in urban agriculture positively.

Sex of household head: It can be identified as (dummy variable) takes value 1 for male and 0 otherwise. Jongwe (2013) suggested that the sex of household head is positively related to participation in urban agriculture. Male headed households are expected to be related positively to participation in urban agriculture whereas female headed households are negatively related to participation in urban agriculture sex is expected to correlate with urban agriculture participation positively.

Household Size: it is continues variables. It is expected that the household size is positively related to UA participation (Niekerk, 2015).

Education levels of Household heads: It is Categorical variables. According to (Jangwe, 2013) educational level is negatively related to UA participation. It is expected that there is directly or indirectly relationship of education and UA participation.

Marital Status: It is a categorical variable as married, single, divorced, or widowed.This variable was hypothesized as being married the respondent the more probability of participating in UA practice.

Income from other source: It is the income of household other than urban agriculture and it is continues variable measures in birr. If household head gets a better income from other activities then there is less probability to be participating in urban agriculture (Belete, 2015). Income from other source is expected to have negative relation with urban agriculture participation

Land size owned by household head: land size is a plot of land used to different UA activities by household. It is continues variable measures in hectares. Households that have easy access to land are more likely to participate in urban agricultural activities and vice-versa. In addition, land can be used as collateral by farmers to obtain agricultural loans from banks (Niekerk, 2015). Land size is expected to have positive relation with participation in UA.

Access to water: It is dummy variable that takes value 1 for access to enough water used for UA, 0 otherwise. Based on the previous literature it is expected to have positive relation with UA participation.

Access to extension service: it is dummy variable which takes 1 is if household gets extension service, 0 otherwise. It is expected that to have positive relation to urban agriculture.

Access to improved inputs: it is dummy variable which take 1 is household is access to improved inputs, 0 otherwise. Inputs are not readily available in cities because the markets and sale channels are not either developed and organized or are oriented toward rural farmers (Dereje, 2011). So it is expected that it is positively relate to UA participation.

Access to credit service: It is a dummy variable and it takes 1 if there is access to credit, otherwise 0. In this study, it is expected that, if there is access to credit to household head, he or she can easily buy very important inputs which are used to participant in urban agriculture. Therefore AC is expected that to have positive relation with urban agriculture.

Market Distance: It is continuous variable measured in kilometers. Based on the previous literature it is expected to have negative relation with UA participation.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

This chapter presents the major findings of the study obtained from the survey data and secondary data. Both descriptive statistics and econometric models were used to analyze the primary data. Under descriptive statistics means, standard deviations, and percentages are used to describe household and farm characteristics that affect household decision to participate in urban agriculture. The second part deals with perception of household' towards the effects of urban agriculture using a 5 point Likert scale. Within the chapter, an empirical analysis of the determinants of household participation in urban agriculture is done and presented using the logistic regression model. Lastly, the propensity score matching method is applied to estimate the impacts of urban agriculture on household total income in the study area are presented.

4.1 Descriptive statistics

Response rate refers to the total number of respondents who participated in the study and completely answered the questioner. Out of the total 204 selected samples in the survey 6 were incomplete and therefore excluded. The remaining 198 questionnaires which is 97% were used for analysis. Therefore, it is enough to analyze the data.

Table 4.1 below presents a summary of socio-economic characteristics of the sampled households for this study. As it can be observed from Table 4.1, the mean and standard deviation values of the variables are computed for the entire sample and for the groups, participants and non-participants. After estimating the mean values, the significance of mean difference test (t-statistic) was undertaken by two-group mean comparison test for the continuous variables. The distribution of the categorical variables for participants and non-participants is given on Table 4.2. The proportions of the respondents falling into these categories are given and the difference of the proportion across participants and non-participants was tested by using chi-square test.

Table 4.1: Summary statistics and mean difference test of continuous variables

Variables	UA Participant (N=51)		UN Non-Participant (N=147)		Total (N=198)		t-values
	Mean	S.D	Mean	S.D	Mean	S.D	
Age	50.98	14.05	51.07	11.65	51.05	12.28	-0.044
Family size	6.92	2.23	6.62	1.85	6.70	1.95	0.953
Land size	0.09	0.13	0.07	0.07	0.08	0.09	1.386
Market distance	1.92	1.24	2.37	1.33	2.25	1.32	-2.111**
Income from other source	10199.68	10863.23	17560.7	11446.23	15664.7	11724.52	-4.008***
Total annual income	24253.89	12588.47	17560.7	11446.23	19284.7	12080.12	3.506***

Source: Owen survey result, 2023, ***, ** and* Indicates statistically significant at 1%, 5% and 10% probability level respectively.

Out of the 198 households that were included in this study sample, only 25.76% (51) of the households were practicing in urban agriculture and the remaining 74.24% (147) of the respondents did not practice in urban agriculture.

As depicted in Table 4.1, the mean age of the household head was 51.05 years. The mean age of the sampled respondents of participant and non-participants was 50.98 and 51.07 years respectively. The t-test result indicates that, there was no significant difference between participant and non-participants in terms of household head age.

The result of the study indicated that in the study area the mean family size was around 7 persons per household, the average family size of participant and non-participants was around 7 persons respectively. The t-test shows that, there is no statistically mean family size difference among participant and non-participants.

The mean land size of the sample respondent is 0.08 hectare. The mean land size for participant household is 0.09 and the corresponding figure for non-participant household is 0.07 hectare. When we compare the average land size between participants and non-participants of urban agriculture it has slight difference. The t-test result indicates that, there was no significant difference between participant and non-participants in terms of land size.

In terms of distance to the market, the mean distance travelled to attain the center of the market is about 1.92 kilometers for participant while it was 2.37 kilometers for non-participants. As t-test (-2.111) value indicated that there was a statistically significant mean distance difference in kilometers at 5% significance level. The result indicates that the market distance for the non-participants is higher as compared to that of participants. This showed that as households far from the market they tend to be fewer participants in urban agriculture activities in the study area.

The mean annual income from other sources of the sampled household head was found to be 15664.71 birr per year. The mean other income of participants is 10199.68 birr per year and the corresponding figure for non- participants is 17560.75 birr per year. From the statistical analysis paired t test (-4.008) performed, it is found out that there is significant difference between the mean other income of participants and non-participants at 1% significance level. When compared to non-participant households, participating households had less mean of other income. This showed that households who have higher income from other source tend to be fewer participants in urban agriculture activities in the study area.

The analysis shows that the mean annual income of the urban farming household participants was 24253.89 birr per year, whereas, those of non-farming household participants was 17560.75 birr per year. From the statistical analysis paired t test performed, it is found out that there is significant difference between the mean income of participants and non-participants of urban agriculture at 1% significance level.

As can be seen in table 4.2, the majority of the sampled households were male-headed 169 (85.4%) while only 29 (14.6%) were female-headed. Furthermore, majority 42 (82.4%) of the urban farming respondents were male headed while 9 (17.6%) were female headed households. Whereas most 127 (86.4%) of the non-urban farming households are male headed and 20 (13.6%) are female headed households. The chi-square test result on this variable shows that there was no significant difference between participants and non-participants.

Majority 176 (88.9%) of the sample respondents were married and the remaining samples reported as they were 7 (3.5%) single, 9 (4.5%) divorced, and 6 (3.0%) widowed. This finding suggests that most of the urban farmers in the study area are married. Compared to non-

participants (91.2%), participants were less likely to be married (82.4%). Among the unmarried respondents, the participants households tended to have a higher proportion of divorced heads (9.8%) than non-participants households (4.5%). This suggests that divorced were more likely to resort to urban agriculture.

Table 4.2: Summary statistics and mean difference test of categorical covariates

Variables	Category	UA Participant (N=51)		UN Non- Participant (N=147)		Total (N=198)		χ^2
		N	%	N	%	N	%	
Sex	Male	42	82.4%	127	86.4%	169	85.4%	0.495
	Female	9	17.6%	20	13.6%	29	14.6%	
Marital Status	Married	42	82.4%	134	91.2%	176	88.9%	4.718
	Divorced	5	9.8%	4	2.7%	9	4.5%	
	Widow	2	3.9%	4	2.7%	6	3.0%	
	Single	2	3.9%	5	3.4%	7	3.5%	
Educational	Primary	12	23.5%	29	19.7%	41	20.7%	2.865
status	Secondary	24	47.1%	56	38.1%	80	40.4%	
	Diploma	5	9.8%	24	16.3%	29	14.6%	
	Degree	7	13.7%	24	16.3%	31	15.7%	
	Illiterate	3	5.9%	14	9.5%	17	8.6%	
Access to	Yes	35	68.6%	19	12.9%	54	27.3%	59.23***
improved variety	No	16	31.4%	128	87.1%	144	72.7%	
Access to credit	Yes	32	62.7%	36	24.5%	68	34.3%	24.57***
	No	19	37.3%	111	75.5%	130	65.7%	
Access to	Yes	30	58.8%	28	19.0%	58	29.3%	28.92***
extension service	No	21	41.2%	119	81.0%	140	70.7%	
Access to water	Yes	31	60.8%	42	28.6%	73	36.9%	16.88***
	No	20	39.2%	105	71.4%	125	63.1%	

Source: Owen survey result, 2023, ***, ** and* Indicates statistically significant at 1%, 5% and 10% probability level respectively.

Concerning the educational status of the respondents, 8.6% were illiterates, 20.7% of respondent attained primary school, 40.4% of respondent attained secondary and preparatory school, 14.6% respondents were diploma/TVET holders and 15.7% of the respondents were first degree

holders or above. The results in Table 4.2 reveal that, more than (75%) of the participant household heads had below secondary and preparatory school education. That is, 5.9% are illiterates, those with primary education are 23.5%; those with secondary and preparatory school education level are 47.1% of the household heads. While (55%) of non-participants household heads are below secondary and preparatory education level. non-participants household heads were more likely to be more learned (32.6% had reached diploma/TVET education and above) than participants household heads (23.5% had reached diploma/TVET education and above). This suggests that most of the household heads that had below secondary and preparatory school education are participating on urban agriculture.

Table 4.2 above, showed that from the sample households 34.3% have access to credit service while 65.7% had no access to credit service. This suggests that majority of the households in the study area do not have access to credit services. Comparing by participation in urban agriculture, 62.7% participants have access to credit service while only 24.5% of non-participant samples have access to credit service. On other hands, 37.3% of participant sample household and 75.5% of non-participant sample households had no access to credit service. The chi-square test ($\chi 2$= 24.57) showed that, there was statistically significant difference in credit access between participant and non-participant at 1% significance level. Thus, this shows that there is a relatively high difference between participants and non-participants in terms of credit access.

Among the sampled households 27.3% have access to improved agricultural inputs variety while majority 72.7% had no access to improved agricultural inputs variety. The result of the survey revealed that about 68.6% of urban agriculture participant sample respondents have access and user of improved agricultural inputs variety, while only 12.9% non-participants have access to improved input. When we compare participant with non- participant household, the majority of the participant household have access to improved agricultural inputs variety. The chi-square test ($\chi 2$= 59.23) showed that, there was statistically significant difference in improved agricultural inputs variety between participant and non-participant at 1% significance level.

According to the survey, majority about 72.73 % of the sampled household had no access to extension service. When we compare participant with non- participant, the majority of the participant which is (70.7%) households had access to get support from extension agents while 19.0% of non-participant had access to extension service. The chi-square test ($\chi 2$= 59.23)

showed that, there was statistically significant difference in access to extension service between participant and non-participant at 1 % significance level. This suggests that, there is a limited extension service provision for urban farmers in the case study area.

The result also shows, majority about 63.1% of the sample households did not have accessibility of water where as 36.9% of sample households had water access. When we compare to participants with non- participant households, about 60.8% of participants and 28.6% of non-participants had water access in their local area. This shows that the majority of the participant households had water access which help to participate in urban agriculture. The chi-square test ($\chi 2$= 16.88) showed that, there was statistically significant difference in access to water between participant and non-participant at 1 % significance level.

4.2. Households' perception toward benefits of urban agriculture

Respondents were asked about whether they heard about urban agriculture or not. As to the data acquired from respondents in Table 4.3, most of them 87% were cognizant of urban agriculture while the remaining 12% of the respondent revealed that they did not recognize urban agriculture at all. Therefore, majority of the respondents were informed about urban agriculture.

Table 4.3 respondents' information about urban agriculture

Variables	Response	Frequency	Percent
Have you ever heard about urban agriculture	Yes	173	87.38
	No	25	12.62
	Total	198	100.00

Source: own survey, 2023

To understand the respondents' perception towards urban agriculture benefit, respondents were asked to give their extent of agreement to the statements with regard to urban agriculture benefit and its environmental impacts in a five-point Likert scale. The data collected from the questionnaires were analyzed with descriptive statistics of mean score, standard deviation, and percentage. All variables that are evaluated based on a 5-pointLikert scale hence, the indicators where by 1-point as 'strongly disagree', 2-point as 'Disagree', 3-point as 'Neutral', 4-point as 'Agree', and 5-point as 'Strongly Agree'.

According to Zaidaton and Bagheri (2009) the mean score below 3.39 was considered as low, the mean score from 3.40 up to 3.79 was considered as moderate and mean score above 3.8 was considered as high as illustrated by comparison bases of mean of score of five point Likert scale instrument. Therefore, detail of the analysis is presented as follows:

Table 4.4 Respondents' perception towards urban agriculture's benefit

Items	Agreement level					N	Mean	S.D
	SD N (%)	DA N (%)	N N (%)	A N (%)	SA N (%)			
UA create income	4(2.0)	24(12.1)	33(16.7)	99(50)	38(19.2)	198	3.72	0.976
UA reduce household food expenditure	3(1.5)	18(9.1)	24(12.1)	133(67.2)	20(10.1)	198	3.75	0.815
UA contribute to food security	12(6.1)	18(9.1)	60(30.3)	91(46)	17(8.6)	198	3.41	0.982
UA is important to gain fresh and nutritious food in order to uplift the family nutrition	6(3)	14(7.1)	81(40.9)	88(44.4)	9(4.5)	198	3.40	0.811
UA create a permanent and temporary job for the household members and others	9(4.5)	6(3)	60 (30.3)	97(49)	26(13.1)	198	3.63	0.912
UA solve waste water and organic waste problems in to a productive resource	12(6.1)	25(12.6)	79 (39.9)	75(37.9)	7(3.5)	198	3.20	0.923
UA helps to keep the environment cleaner and greener	9(4.5)	39(19.7)	57 (28.8)	78(39.4)	15(7.6)	198	3.25	1.007
Aggregate **mean**							3.48	0.419

Source: own survey, 2023

In table 4.4 item 1 the respondents were asked about urban agriculture is important as a method of income generation activity, the result of the study showed a mean score of 3.72 with standard deviation 0.976, which lies between the range of 3.39-3.79 and felt moderate category. This implies that most (69.2%) of respondents were agreed & strongly agreed on the statement. This indicated that their perception towards urban agriculture is important as a method of income generation activity was good.

In the above table 4.4 on the second item the respondents were asked whether urban agriculture reduce household food expenditure, the result of the study showed a mean score of 3.75 with

standard deviation 0.815, which lies between range of 3.39-3.79 and felt moderate category. This implies that most (77.3%) of respondents were agreed & strongly agreed on the statement. This indicated that their perception towards urban agriculture reduce household food expenditure was good.

Similarly, regarding to item 3 of the same table, the respondents were asked whether urban agriculture contribute to food security, the result of the study indicated that the mean score of 3.41 with standard deviation of 0.982, which lies between range of 3.39-3.79 and felt moderate category. This implies that most (54.6%) of respondents were agreed & strongly agreed on the statement. This indicated that their perception towards urban agriculture contribute to food security was good.

As depicted in item 4 of the same table respondents were asked that whether urban agriculture is important to gain fresh and nutritious food in order to uplift the family nutrition. The result of mean score showed 3.4 with standard deviation of 0.811, which lies between range of 3.39-3.79 and felt moderate category. This implies that most (53.9%) of respondents were agreed & strongly agreed on the statement. This indicated that their perception towards urban agriculture is important to gain fresh and nutritious food in order to uplift the family nutrition was good.

Similarly, respondents were asked whether urban agriculture create permanent and temporary job for the household member and for others. The result of mean score was 3.63 with standard deviation 0.912, which lies between range of 3.39-3.79 and felt moderate category. This implies that most (62.1%) of respondents were agreed & strongly agreed on the statement. This indicated that their perception towards urban agriculture create permanent and temporary job for the household member and for others was good.

Also in the above table, on the six items the respondents were asked whether urban agriculture solve waste water and organic waste problems in to a productive resource. The result of the study indicated that the mean score of 3.2 with standard deviation of 0.923, which is below 3.39 and felt low category. Additionally from the respondents' majority (39.9% and12.6%) of them were neutral and disagreed on the statement. This indicated that their perception towards urban agriculture Solve waste water and organic waste problems in to a productive resource was poor.

Finally, on the seventh items the respondents were asked whether urban agriculture helps to keep the environment cleaner and greener. The result of the study indicated that the mean score of 3.25 with standard deviation of 1.007, which is below 3.39 and felt low category. Additionally from the respondents' majority (53%) of them were neutral and disagreed on the statement. This indicated that their perception towards urban agriculture helps to keep the environment cleaner and greener was poor.

The aggregate mean of all perception towards urban agriculture's benefit items indicate 3.48 with standard deviation 0.419, which lies between the range of 3.39-3.79 and it felt moderate category. Generally we can conclude that respondent's perception towards urban agriculture's benefit was good. But majority of the respondents were not aware about practicing urban agriculture as a good strategy to cope with environmental problem. This implies that respondent's perception towards urban agriculture's benefit in terms of environmental impact was poor.

4.3. Types and Purposes of Urban Agricultural Production

4.3.1. Types of Urban Agricultural Production

Participant Households in the study area engaged in a variety of urban agricultural. As shown in table 4.5, the types of urban agriculture practiced by the sample households is categorized into three major types including vegetable production, livestock production and poultry production. Finding results reveal that the majority 22 (43.14%) of the sample respondents has been practicing livestock production, 13 (25.5%) of the respondents are vegetable growers; 13 (25.5%) of the respondents are participating in poultry production and 31 (60.78%) practicing mixed farming of vegetable production, livestock production and poultry production.

Similarly the result of key informant interview and FGD shows that the types of urban agricultural activities practiced in study area are vegetable and crop production, livestock production and poultry production.

4.5: Types of urban agriculture practiced by sample households

Types of UA		Freq.	Percent
livestock production	Cow for milk Oxen for fatting Sheep and goats	22	43.14
Vegetable production	Tomato Cabbage Carrot beetroot Onion	13	25.5
Poultry production	Chicken for egg Chicken for meat	16	31.37
Mixed		31	60.78
Total		51	100.00

Source: own survey, 2023

4.3.2. Purposes of Urban Agricultural Production

Sample households requested during the survey that for what purpose they participate in urban agriculture. As shown in Table 4.6 majority of the respondents 30 (58.82%) were practicing urban agriculture for both home consumption and for sale, about 13 (25.49 %) of respondents were practicing urban agriculture for only commercial and the least number of the respondent is about 8 (15.68%) were engaging in urban agriculture for only home consumption.

Table 4.6: Purposes of the respondent engaging urban agriculture

Purpose of production	Freq.	Percent
Home consumption	8	15.68
For sale	13	25.49
Both	30	58.82
Total	51	100.00

Source: own survey, 2023

This also supported by FGD. The participants on the FGD also said that urban agriculture plays a critical role in serving as a source of food for the households, generating income and creating job opportunities.

4.4. Econometric Analysis

In this section econometric estimation results is presented and discussed. In this study, one of the objectives was to identify the determinants of urban agriculture participation and its impact on household income. As noted earlier to identify factors affecting urban household participation in urban agricultural activities logistic regression model was employed and propensity score matching estimation technique was employed for accounting the impact of urban agriculture on household income

4.4.1. Determinants of household participation in urban agriculture

In this study, logistic regression model was employed to determine the degree of influence and the direction of the relationship between household socio-economic characteristics and the household decision to participate in urban agriculture. Before estimating the econometric model, the data have been tested for Multicollinearity, and Hetroscedasticity problems.

The Variance Inflation Factor (VIF) and contingency coefficient were used to test the multicollinearity problem among continuous and dummy/ categorical variables respectively. For the continuous variables the VIF greater than ten reveals strong correlation and measures inflation in variance in due to Multicollinearity and the value of contingency coefficient is a chi-square based measure of association where a value above 0.8 shows the existence of strong Multicollinearity problem (Greene, 2003). Based on the results (appendix II), the mean VIF value was 1.01 and for each explanatory variable, the VIF ranged between 1.00 and 1.02. This implies that, the data had no serious problem of Multicollinearity. The contingency coefficient is between 0.0025 and 0.25. Similarly, the contingency coefficient (CC) results showed absence of strong association between different hypothesized discrete explanatory variables.

The Breusch-Pagan test was employed to check existence of hetroscedasticity problem. The test results (appendix III), indicates the absence of hetroscedasticity.

The goodness fit of the model for the logistic regression model, an intuitively appealing way to summarize the result of the fitted logistic model is via a classification table. This cross-

classification is the result of cross-classification of the outcome variable 'y" with a dichotomous variable whose values are derived from the estimated logistic probabilities. With regard to the predictive efficiency of the models out of 198 sample household include in the model, 178 (90%) were correctly predicted. The sensitivity and specificity indicate that 75% of a participant of urban agriculture and 95% of non-participant of urban agriculture households were correctly predicted in their categories respectively (appendix IV).

The result of logistic regression, given on Table 4.7, reveals that out of the twelve explanatory variables, seven explanatory variables were found significantly determined the participation decision of the households. The possible explanations of the significant variables are as follows:

Table 4.7: logistic model estimates for factors affecting participation in urban agriculture

Explanatory variable	Coefficient	Std. Err	P-value	Marginal effects	Odd
Age of household head	0.007	0.021	0.756	0.0007	1.007
Sex of household head	-1.48	0.733	0.044	-0.233	0.228
Marital Status	0.272	0.487	0.576	0.029	1.313
Family size	0.098	0.140	0.486	0.010	1.102
Educational level	0.434	0.255	0.089	0.047	1.543
Income from other source	-0.001	0.000	0.001	-0.001	1.000
land size	1.114	3.689	0.763	0.122	3.046
Distance to market	-.249	0.198	0.209	-0.027	0.780
Access to improved variety	2.845	0.542	0.000	0.470	17.208
Access to credit	1.445	0.517	0.005	0.190	4.243
Access to extension service	1.498	0.527	0.005	0.208	4.471
Access to water	1.125	0.509	0.027	0.139	3.081
Constant	-3.336	1.859	0.073		0.036
Number of observation	198				
LR Ch^2 (12)	111.36				
Prob> ch^2	0.000				
Pseudo R^2	0.4929				
Log likelihood	-57.278957				

Source: own survey data (2023)

Sex of household head: This variable was found be significant at 5% significance level and positively related to household participation decision in urban agricultural practice. The marginal effect of this variable shows that, those household with female household head have a 23.3% greater chance of participating in urban agricultural than the household with male head, other things remain constant. This finding is in line with Onyango (2010), who reported that the percentage of women participating in urban agriculture was significantly higher than men. Furthermore it is supported by the report of FAO (2012), claims that women are more involved in urban agriculture than males.

Education level of household heads: the study result showed that education is positively related to household participation in urban agriculture activities. This variable is significant at 10% significance level. The marginal effects of the regression revealed that, increasing in one year of schooling of household head approximately increased the probability of household's participation in urban agriculture by 4.7%. This result shows more educated household are more participant in urban agriculture in the study area. This is due to the fact that education of the household can raise their information acquisition capacity and adjustment or resource allocation abilities of household rational expectation for decision making. This is similar to earlier study result of Mupeta (2020) who reported that tertiary education has a positive influence on urban agriculture participation and that most urban agriculture participants have attained post-high school level of education. Furthermore with the study by Alemayehu et al., (2017) and Thomas (2013) who justified that highly educated household could be practiced urban agriculture more likely.

Income from other sources: Income from other sources represents the amount of income earned from other activities rather than urban agriculture within the year. This variable was found be significant at 1% significance level and negatively related to household participation decision in urban agricultural practice. The marginal effect of this variable shows that, when the household income from other sources increases by one birr; being the other determinants are constant the probabilities of urban household participation in urban agriculture decreases by 0.1%. This result is in line with the findings by Handalo and Abafita (2020), and Ejeta (2019) who conclude that the probabilities of urban households to be participating in urban agriculture decreases as the urban households obtain more unit of other income.

Access to credit: The logit model analysis revealed that access to credit has a significant positive association with participation in urban agriculture at a probability level of 1%. The marginal effect shows that, households that have access to credit service has 19% higher probability of participation in urban agriculture than that of households without credit access other things remain constant. Urban households who have the opportunity of accessing credit would build their capacity to produce more through purchasing of agricultural inputs. This result is consistent with a study by Ejeta (2019) and Tafese (2014) who reported that accessing farm credit positively related with probability of participation in urban agriculture.

Access to improved inputs: As expected access to improved inputs influence urban agricultural practice significant and positively at 1% level of significance. The marginal effects of this variable shows that household who had access to improved agriculture input are 47% more likely to participate in urban agriculture as compared to that of households without improved agricultural input access keeping all other variables remain constant. This is in line with Handalo and Abafita, (2020).

Access to extension services: as expected access to extension services is positively related to participation in urban agriculture practice. This variable is significant at 5% probability level. The marginal effects showed that, household heads who had access to extension services are 20.8% more likely to participate in urban agriculture as compared to household heads that had not access t0 extension services. This is in line with Guta and Irge (2022), and Mulgeta (2013) those concluded that extension service/contact improves urban agricultural practices.

Access to water: Access to water was one of the variables hypothesized as determinant of household's participation decision in urban agricultural practice. This variable was also found significantly and positively influencing the participation decision of the households in urban agricultural practice as at 5% level of significance. The marginal effects of this variable shows that, household heads who had access to water are 13.9% more likely to participate in urban agriculture as compared to household heads that did not have access to water keeping all other variables remain constant. This survey result is in line with the finding of Handalo and Abafita (2020), and Ejeta (2019), they concluded that access to water positively related with probability of participation in urban agriculture.

4.4.2. Impact of urban agriculture on household income

This subsection is concerned with the impact evaluation of participation in urban agriculture on household income. The impact evaluation in this particular case of study was conducted by the use of propensity score matching method. Propensity score matching method was chosen because it gives more consistent and realistic estimates than Instrumental variables and Heckman's methods (Woodridge, 2005). In this study, the variable urban agriculture participation was considered to be the treatment and total household income was the outcome variable. The treated group was households that participate in urban agriculture and the control group was households that did not participate in urban agriculture. Propensity score matching consists of five phases: estimating the propensity scores, matching the propensity scores, choice of matching algorism, testing of the matching quality and estimation of the ATT.

4.4.1.1 Estimation of Propensity Score

In this study, the propensity scores are constructed using the logit regression, because it is the most common model for propensity score estimation. In order for the propensity scores to correctly estimate the probability of participation, the characteristics included in the propensity score estimation have been well-considered and were exhaustive. However, it is very important that characteristics which may have been affected by the treatment are not included and for this reason the income from other sources of the household that is affected by the treatment is excluded from the covariates included in the estimation of propensity score. Table 4.8, shows the value of the covariates related with the estimation of propensity scores for the individual observations, which is the probability of assigning the observation to participate in urban agriculture.

As shown in the lower part of Table 4.8, the model sufficiently fitted the data at less than one significant level LR Ch^2 (11) = 94.40; Prob> chi^2= 0.000). The pseudo-R^2 value is = 0.4178 which is fairly low and it indicates that there is not much significant difference in characteristics between urban agriculture participants and non-participants. This model diagnostic result suggests that the data fitted well in the estimated mode.

Table 4.8: Logit model coefficients in estimation of propensity score

Explanatory variable	Coefficient	Std. Err	Z-value	P>z
Age of household head	0.002	0.019	0.091	0.927
Sex of household head	-1.388	0.648	-2.140	0.032
Marital Status	0.454	0.451	1.005	0.315
Family size	0.107	0.130	0.824	0.410
Educational level	-0.076	0.201	-0.380	0.704
land size	1.293	3.301	0.392	0.695
Distance to market	-0.166	0.191	-0.867	0.386
Access to improved variety	2.546	0.477	5.335	0.000
Access to credit	1.363	0.482	2.827	0.005
Access to extension service	1.550	0.486	3.192	0.001
Access to irrigation	1.062	0.466	2.277	0.023
Constant	-3.720	1.668	-2.231	0.026
Number of observation	198			
LR Ch^2 (11)	94.40			
Prob> ch^2	0.000			
Pseudo R^2	0.4178			
Log likelihood	-65.760239			

Source: own survey data (2023)

4.4.1.2. Matching the propensity scores and selecting the Region of Common Support

The underlying principle of the propensity score matching method is to match sample units in the treated group with sample units in the control group based on similar propensity score (Lance et al., 2014). In this case, urban agriculture participants were matched with non-participants with similar values propensity scores. Matching is done within the region of common support which is defined by the propensity scores of the treated sample units and the control sample units. The region of common support refers to the area of overlap of the propensity score of the treated sample units and the control sample units. All values that do not fall within the region of common support are discarded (Caliendo&Kopeinig, 2008).

The common support region (overlap condition) for the estimated propensity score is constructed based on the summary statistics of the participants and non-participants. Therefore, the common

support region was determined by taking the maximum of the minimums and minimum of the maximums for the two group's propensity scores. Based on this technique as Table 4.9 indicates, the estimated propensity scores vary between 0.013903 - 0.9979327 for the participant with a mean score of 0.6223415and the score varies between 0.010284-0.8597668 for the non-participants household with a mean score of 0.1310244. The common support region would then lie between 0.013903 - 0.8597668. This means that households whose propensity score is less than the minimum (0.013903) and larger than the maximum (0. 8597668) are not considered for matching purposes. This is because no matches can be made to estimate the ATT parameter when there is no overlap between the treatment and non-treatment groups. As a result of the overlap condition, 19 observations (6 from non-participants and 13 participants) were found to be out of the common support and hence they were excluded from the observations.

Table 4.9: Distribution of estimated propensity scores

Categories	Obs	Mean	Std. Dev.	Min	Max
Total households	198	0.2575758	0.3008722	0.010284	0.9979327
Participants	51	0.6223415	0.3172823	0.013903	0.9979327
Non-participants	147	0.1310244	0.1583271	0.010284	0.8597668

Source: Own survey data (2023).

4.4.1.3. Choice of matching algorism

There are a number of matching algorithms which can be employed in undertaking the impact evaluation to get the effect of the treatment. The most common matching algorithms used in PSM include: nearest neighbor matching, radius matching and kernel matching. These matching methods use different means of matching the beneficiaries to the control group to determine the average effect of certain program participation or intervention. The challenge in employments of propensity score matching is the absence of definite techniques of choosing the appropriate algorithm for matching from the algorithm techniques mentioned in the literature (Singh, 2014).

According to Dehja and Wehba (2012), the final choice of a matching estimator was guided by different criteria such as equal means test referred to as the balancing test, pseudo-R^2 and matched sample size. Matching algorism which balances all explanatory variables of groups (resulting in insignificant mean differences between formal market participants and informal

market participants), bears low pseudo R^2 value, and results in a large matched sample size was chosen as being the best estimator of the data.

Accordingly, alternative matching estimators (nearest neighbor, radius, caliper, and kernel matching) were evaluated via matching the participant and non-participant households in common support region. Based on the above mentioned criterion as shown in Table 4.10, Kernel matching with 0.5 distances from the propensity score value of the individual observation fit the entire three criterions. In this matching at Kernel matching with 0.5 distances, 11 variables were insignificant in mean difference, relatively have low pseudo-R^2 (0.119), and comparatively have large matches sample size (179). Therefore, the estimation result of this study is based on Kernel matching algorithm with 0.5 distances from propensity score of the individual household.

Table 4.10: Performance criteria of matching algorisms

Matching Algorism	Performance criteria		
	Balancing test*	Pseudo R^2	Matched sample size
Nearest Neighbor			
1 Neighbor	8	0.187	179
2 Neighbor	9	0.200	179
3 Neighbor	9	0.201	179
4 Neighbor	10	0.140	179
5 Neighbor	9	0.132	179
Radius			
0.01	7	0.348	179
0.1	7	0.348	179
0.25	7	0.348	179
0.5	7	0.348	179
Caliper			
0.01	10	0.089	119
0.1	8	0.187	179
0.25	9	0.187	179
0.5	9	0.187	179
Kernel			
0.01	11	0.111	119
0.1	10	0.133	179
0.25	10	0.125	179
0.5	11	0.119	179

Source: Own survey result (2023)

4.4.1.4. Testing of the matching quality

After selecting the best performing matching algorism which satisfies the prior identified performance criteria, the balance of propensity score and explanatory variables was checked by the selected matching algorism (Kernel matching with 0.5 distances in this case). Table 4.11 shows that the standard bias difference between identified explanatory variables before matching was in the range of -0.7 % - 88.7% in absolute value. But after matching, the remaining standardized error differences between explanatory variables lay between 1.5% - 18.9% in absolute value. It is clear that the main intention of estimating propensity score is not to get a precise prediction of selection into treatment. Rather, to balance the distributions of relevant variables in both groups (Caliendo and Kopeinig, 2008). Therefore, the selected matching algorism, Kernel matching with 0.5 distances, has created a covariate balance between participant and non-participant households which is important to conduct impact analysis.

Table 4.11: Propensity score and covariate balancing

Covariate		**Mean**		**% reduction**		
	Sample	**Treated**	**Control**	**% bias**	**/bias/**	**P value**
pscore	Unmatched	0..62234	0.13102	196.0		0.000
	Matched	0.51463	0.35314	64.4	67.1	0.014
Age of household head	Unmatched	50.98	51.068	-0.7		0.965
	Matched	50.632	51.602	-7.5	-106.8	0.742
Sexof household head	Unmatched	0.82353	0.86395	-11.1		0.484
	Matched	0.84211	0.86636	-6.6	40.0	0.768
Marital Status	Unmatched	2.1373	2.0476	29.6		0.216
	Matched	2.1579	2.0174	18.9	-56.7	0.197
Family size	Unmatched	6.9216	6.619	14.8		0.342
	Matched	6.6579	6.8129	-7.6	48.7	0.724
Educational level	Unmatched	3.0196	3.102	-7.3		0.660
	Matched	3.0263	3.0631	-3.3	55.4	0.886
Land size	Unmatched	0.0949	0.07439	19.7		0.167
	Matched	0.07816	0.07663	1.5	92.6	0.925
Distance to market	Unmatched	1.9216	2.3694	-34.8		0.036
	Matched	2.0579	2.1488	-7.1	79.7	0.748
Access to improved	Unmatched	0.68627	0.12925	36.5		0.000

variety	Matched	0.57895	0.43357	5.6	73.9	0.210
Access to credit	Unmatched	0.62745	0.2449	83.0		0.000
	Matched	0.52632	0.48096	9.8	88.1	0.697
Access to extension service	Unmatched	0.58824	0.19048	88.7		0.000
	Matched	0.44737	0.28108	17.1	58.2	0.136
Access to water	Unmatched	0.60784	0.28571	68.0		0.000
	Matched	0.52632	0.49789	6.0	91.2	0.807

Source: own survey result, 2023

As indicated in Table 4.12, the value of pseudo-R^2 was very low. This low pseudo-R^2 value and the insignificant likelihood ratio test indicate that the participant households and non- participant households had the same distribution in the covariates after matching. Hence, based on partial and joint test of covariate and propensity score balance, there is no significant mean difference between adopters and non-adopters. Therefore it is trustworthy to estimate treatment effects based on the available data and the chosen matching algorithm (Kernel matching with 0.5 distances in this case).

Table 4.12: Chi-square test for the joint significance of variables

Sample	**Pseudo R^2**	**LR ch2**	**P > chi2**	**Mean bias**	**Med Bias**
Unmatched	0.452	102.14	0.000	56.6	27.3
Matched	0.119	12.58	0.400	18.0	7.5

Source: own survey result, 2021

4.4.1.5. Estimation of average treatment effect on the treated

The purpose of these all process was, to see whether the participant households have significant difference in household income compared to non-participant households or not. The ATT was used to calculate the average effect of urban agriculture on household total income. ATT was estimated using Kernel matching with 0.5 distances.

As Table 4.13 indicates that after matching, the ATT of urban agriculture on household total income is about ETB 6803 and the mean difference in the average effect of the treatment on the treated between the matched treatment and control groups was found to be statically significant at a 1% significance level. This showed that, urban agricultural practices brought statically

positive significant impact on household's total income at 1% significance level. This implies that household's participation in urban agriculture increased the expected household income on average by ETB 6803for participant households. From this, it can be concluded that participating urban agricultural has brought a positive impact and improved the household's annual income in the study area. The result of this study is consistent with Handalo and Abafita (2020), (Mupeta, 2020) and Tafese (2014), who found that participation in urban agricultural brought statically positive significant impact on household's income. Therefore, urban agricultural practice in the study area should be encouraged and the problems hindering urban agricultural practice should be attempted to be solved by government and any other stakeholders.

Table 4.13: Impact of participation in urban agricultural on household income

Algorithm	**Outcome variable**	**Participant**	**Non participant**	**Difference(ATT)**	**t-test**
Kernel 0.5	Annual income	24128.225	17325.0618	6803.16316	2.56 ***

Source: own survey result, 2023

After estimating the treatment effect, sensitivity analysis, Rosenbaum bound estimation was conducted between the gammas values of 1 and 2, by adding 0.25 on 1 and continuing up to 2, to test whether the treatment effect on the treated is sensitive to the hidden bias (unobservable). The result shows that the inference for the effect of participants in urban agricultural is not changing though the participants and non-participant households have been allowed to differ in their odds of being treated up to 200% ($\gamma 2$) in terms of unobserved covariates. That means for all outcome variables estimated, at various levels of the critical value of γ, the p- critical values are significant which further indicates that the study has considered important covariates that affected both participation and outcome variables. Thus, it can be concluded that the impact estimates (ATT) of this study are insensitive to unobserved selection bias and are a pure effect of participants in urban agricultural.

Table 4.14: Result of sensitivity analysis using Rosenbaum bounding approach

Outcome variables	$e^{\gamma}=1$	$e^{\gamma}=1.25$	$e^{\gamma}=1.5$	$e^{\gamma}=1.75$	$e^{\gamma}=2$
Annual income	0.00209	0.011264	0.033887	0.072981	0.127501

Source: own survey result, 2023

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1. Conclusion

This study was initiated with investigating the determinants of household's participation in urban agriculture and its impact on household's income in Gurage zone of Ethiopia. In addition to the above issues it has also identified household's perception towards urban agriculture benefit.

The results of the study show that, 25.76% % of the total sample respondents were found to be participant urban agricultural activities. The main urban agriculture activities practiced in the study area were vegetable production, livestock production and poultry production.

The aggregate mean of perception towards urban agriculture's benefit items indicate 3.48 with standard deviation 0.419, which lies between the range of 3.39-3.79 and it felt moderate category. Generally we can conclude that respondent's perception towards urban agriculture's benefit was good. But majority of the respondents were not aware about practicing urban agriculture as a good strategy to cope with environmental problem. This implies that respondent's perception towards urban agriculture's benefit in terms of environmental impact was poor.

Results also show that household decision to participate in urban agriculture is influenced by the household's socio-economic characteristics. Out of the twelve explanatory variables, household sex, education level, income from other sources, access to credit, access to water, access to improved inputs and access to extension services show a significant influence on the household's decision to participate in urban agriculture. Female headed households are more inclined to engage in urban farming than the male household heads. Results indicate that household heads with higher level of education are more capable of participating in urban agriculture than lower levels of education. It can also be concluded from the results that households that have access to credit, water, improved inputs and extension service has higher probability of participation in urban agriculture than that of households without access. Households that are in informal and formal businesses as their main source of earning a livelihood are less likely to participate in urban agriculture. On the other hand those households with high income from other sources were

found less participant as compared to those farmers that have land closer to irrigation water source and found nearer to the market. This shows income from other sources was negatively related to household participation decision in urban agricultural.

The impact analysis results of this study show that Urban Agriculture has a positive significant effect on household income. Participant households had higher incomes compared to non-participants with similar socio-economic characteristics due to participation in urban agricultural. The average treatment effect on the treated was ETB 6803 and it was significant at 1% significance level. Therefore, the urban agriculture practice should be encouraged in the study area.

5.2. Recommendations

Based on the findings, the following recommendations are forwarded so as to be considered in the future intervention strategies which are aimed at the promotion of urban agriculture participation.

- This study shows that participating in urban agriculture has a significant positive impact on income of households. However, only 25% of the households were participating in urban agriculture in the study area. Therefore, Governmental organization, NGOs and other civil society organizations need to recognize the potential economic benefits of urban agriculture and increase their efforts in encouraging people in urban areas to engage in urban agriculture.

- The results of the study indicates access of extension service improve urban agriculture participation. Extension service is important for obtaining technical support to participate in urban agriculture and on how to use them practically for increasing production. Hence, the government shall facilitate availability of extension service in urban area there by enhanced urban agriculture participation.

- Access to improved inputs has a positive influence on urban agriculture participation. Therefore, it is highly recommended to improve the input access and supply system so that households receive the right type of production inputs, quantity and quality needed at the right time. Moreover, the institution should create and coordinate input-output linkages within the urban areas.

- Access to credit has also positive impact on urban agriculture participation. So the government body, micro finance institutions, multipurpose cooperatives, government development agencies and NGOs should give due attention on provision of credit.

- Access to water has positive impact on urban agriculture participation. Therefore, concerned bodies should give attention in introduction of various sources of water such as ground water development and water harvesting should be considered and encouraged to minimize problem of water shortage.

- Furthermore, as education was one of the important factors for determining farmers to participate in urban agriculture. Hence, the administrative bodies should promote education and households should be educated by a means that fits with their living condition, such as adult education or in the form of short training and workshop.

- Finally, further studies should focus on undertaking the impacts of participating in urban agriculture on household's food insecurity in the study area.

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APPENDIX

Appendix I: **Survey Questionnaire**

WOLKITE UNIVERSITY

Department of Economics

MSC in Developmental Economics

ENGLISH VERSION QUESTIONER

Informed Consent Form

This questioner/interview schedule is developed for the thesis entitled "The Determinants of Urban Agriculture participation in Gurage Zone, Ethiopia" by AlemuLema for partial fulfillment for the awarded of MSc. in Developmental Economics. Dear respondent, you have been selected to help me in responding to this questionnaire; because I feel personally you will give me the necessary information. I kindly request your cooperation to respond to the following questions and feel free to respond to all items. The information collected will not be in any way transferred to a third party and only be used for academic purpose. I appreciate your cooperation and thank you in advance.

General Information

Date of interview: _____ Questionnaire no._____

Name of Interviewer: _____

Name of town: _____Signature: _____

Part I. Socio-economic characteristics of the respondent

1. Sex of Household head:- 1 Male 2 Female

2. Age of Household head:- _____years

3. Marital Status of Household head:- 1.Single 2.Married 3.Divorced 4.Widow

4. Total number of family in the household: _____

6. Educational Level: - 1 Illiterate 2 Primary (1 to grade 8) 3 Secondary (grade 9 to 12) 4 Diploma OR TVET 5 Degree and above

7. How much is the average total income of your household per year?.....

8. What is your total monthly expenditure?

A) For consumption……birr

B) For health treatment----------birr

C) For school----------birr

D) If any other, ----------birr

Part II: Respondents Perception towards Urban Agriculture

Now we will start asking you some questions about the attitude you have about urban agriculture. Please take time to answer the following questions in the below table.

1. Do you know/ access information about urban agriculture? 1) Yes 0) No

Please Indicate your level of agreement to the statement below relating to the benefits of Urban Agriculture as per the following scale. 1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree and 5 = strongly agree.

No	List of Perceptional measurements	**1**	**2**	**3**	**4**	**5**
		SD	**D**	**N**	**A**	**SA**
1	UA Create income					
2	UA reduce household food expenditure					
3	UA Contribute to food security					
4	UA is important to gain fresh and nutritious food in order to uplift the family nutrition					
5	UA create a permanent and temporary job for the household members and others					
6	UA Solve waste water and organic waste problems in to a productive resource					
7	UA helps to keep the environment cleaner, greener and cooler					

Part III: Urban Agriculture related characteristics

1. Do you participate in urban agricultural activities? 1 yes 2 no
2. If yes, how long have you been in farm experience? 1) Less than 5 2) 6 to 10 years 3) 11 – 20 years 4) Over 20 years?
3. For what purpose do you use your urban agriculture products? 1. HH food supply/own consumption 2 Market sale 3 Both 1 and 2 4 leisure 5 If any other, ----------
4. What are the major types of urban agriculture practicing in your farmland by you and your household members? 1) livestock production, 2) vegetable and crop production, 3) Fruit trees 4) poultry production, 5) bee-keeping, and 6) mixed of all.
5. If you are rear livestock, would you tell us the specific types? 1) Cows for milk production 2) Oxen for fatting 3) Sheep and goats 4) Mixed of all
6. If you are producing vegetation, on which crop you are engaging and more benefiting? Specify it. 1). Cabbages, 2). tomato 3. Onion 4. the beetroot, 5). potato, 6). Carrot
7. If you are engaging in crop production, would you tell us a specific type? 1). wheat, 2). barley, 3). teff 4). mixed of all
8. Where do you grow crops and rear animals? 1) In backyards 2) In open space 3) In urban fringe areas 4) Roadside/others
9. Do you have your own land? 1 yes 2 no
10. If yes, how many hectares do you have? ----------hectares
11. Do you apply improved seed, improved cows or Poultry? 1) yes 2) No
12. If not get access to improved inputs, why? 1) Shortage of finance 2) No need 3) High price 4) Not available 5) If any other,----------
13. Do you have the access to credit service for the production of your Urban Agriculture? 1 yes 2 no
14. If you have the access to credit, what are the sources? 1) Banks 2) Relatives/Friends 3) Micro finances 4) If any other, ----------
15. Do you get extension service from the concerning Government organ? 1 yes 2 no
16. . If yes, how often the extension agent contacted you 1per month _____
17. Do you have access to water for Urban Agriculture Production? 1 yes 2 no
18. Who did you contribute labor for your Urban Agriculture? 1) Family labour 2) Hired labour

19. How many kilometers far from you the market for purchasing inputs and selling your products?---------- Kilometers
20. How much money does your household earn in average every year from urban agriculture? (Write '0' if no sell)(Estimation)

How is the yield you gained from the UA activity?

If dairy, milk yield per cow per day and for how long _____

If vegetable, yield per Ha per one season and for how long (No. of seasons) _____

If poultry, egg yield per hen per year and for how many chicken totally _____

If fattening how much weight gained per one bull _____

Checklists for Focus Group Discussion

1. What are the kinds of urban agriculture activities implemented in your area?
2. Why are people engaged in urban agriculture in your area?
3. Who are engaged in urban agriculture?
4. What are the major benefits obtained from practice of urban agriculture by those beneficiaries engaged in the sector?
5. How is the significance and contribution of urban agriculture for food security at household and community level? Discuss the issues separately and thoroughly.
6. What are the challenges faced by the urban agriculture practitioners in the process of production, processing, and marketing of the products?
7. What do you think about the solutions for those challenges faced by the urban agriculture practitioners

Checklist of Key Informant Interviews

1. What is urban agriculture means to you? What are the major types of UA activities practiced in the area and by whom?
2. Who are engaged in urban agriculture in the town?
3. Why people are engaged in urban agriculture?
4. What are the roles and contributions of urban agriculture at household and community level?
5. What kind of government support is rendered to the urban agriculture practitioners and what would be its future perspective?
6. What are the challenges and opportunities for urban agriculture in the town?
7. What are the challenges faced by the government offices that are working with urban agriculture? Discuss the roles of all stakeholders thoroughly.
8. What will be the future fate of urban agriculture versus the challenges faced by the sector nowadays

Appendix II Multicollinearity test

```
. vif
```

Variable	VIF	1/VIF
VAR00001	1.02	0.979021
Land_size	1.02	0.981720
DNM	1.01	0.986985
Family	1.00	0.995722
Mean VIF	1.01	

```
. corr  Sex Marital_Status Educ  improved_seed credit extension_service  irrigation
(obs=198)
```

	Sex	Marita~s	Educ	improv~d	credit	exten~ce	irriga~n
Sex	1.0000						
Marital_St~s	-0.0949	1.0000					
Educ	0.0665	-0.0608	1.0000				
improved_s~d	0.0292	0.0302	0.0261	1.0000			
credit	0.1492	0.0525	-0.0695	0.2497	1.0000		
extension~ce	0.0155	-0.0025	0.0804	0.2537	0.1655	1.0000	
irrigation	0.0501	0.1141	-0.0903	0.1667	0.1528	0.1522	1.0000

Appendix III Hetroscedasticity test

```
. estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of Age

         chi2(1)      =     1.33
         Prob > chi2  =   0.2484
```

AppendixIV, The goodness fit test

```
. estat classification

Logistic model for Participation
```

Classified	True D	True ~D	Total
+	38	6	44
-	13	141	154
Total	51	147	198

```
Classified + if predicted Pr(D) >= .5
True D defined as Participation != 0
```

Sensitivity	Pr(+| D)	74.51%
Specificity	Pr(-|~D)	95.92%
Positive predictive value	Pr(D| +)	86.36%
Negative predictive value	Pr(~D| -)	91.56%
False + rate for true ~D	Pr(+|~D)	4.08%
False - rate for true D	Pr(-| D)	25.49%
False + rate for classified +	Pr(~D| +)	13.64%
False - rate for classified -	Pr(D| -)	8.44%
Correctly classified		90.40%