COLLEGE OF DEVELOPMENT STUDIES

CENTER FOR ENVIRONMENTAL & SUSTAINABLE DEVELOPMENT

PERCEPTIONS AND PRACTICES OF URBAN AGRICULTURE FARMERS IN BISHOFTU CITY, THE CASE OF CHELEKELEKA AND GANDA GORBA WOREDAS: A STUDY OF ENVIRONMENTAL SUSTAINABILITY AND SOCIOECONOMIC CONTRIBUTIONS

BY

FEKADU NEGUSIE

A THESIS SUBMITTED TO CENTER FOR ENVIRONMENT AND SUSTAINABLE DEVELOPMENT, COLLEGE OF DEVELOPMENT STUDIES OF ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

ADDIS ABABA, ETHIOPIA
SEPTEMBER, 2023

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DECLARATION

I, Fekadu Negusie, Registration number GSE/4145/13 do hereby declare that this thesis is my original work and that it has not been submitted partially; or in full, by any other person for an award of a degree in any other university/institution. All the sources I used or quoted have been indicated and acknowledged by complete references.

Name of participant…….

Signature…….

Date…….

This thesis has been submitted for examination with my approval as college supervisor.

Name of advisor……

Signature……

Date……

ADDIS ABABA UNIVERSITY

The undersigned certify that they have read and hereby recommend to Addis Ababa University to accept the thesis submitted by Fekadu Negusie, entitled Perceptions and Practices of Urban Agriculture Farmers in Bishoftu City, The Case of Chelekeleka and Ganda Gorba Woredas: A Study of Environmental Sustainability and Socioeconomic Contributions, in partial fulfillment of the requirements for the award of a master's degree in environment and sustainable development.

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Acronyms

AAU	Addis Ababa University
ASLA	American Society of Landscape Architects
BC	Before Christ
BCE	Before the Common Era
CE	Common Era
CSA	Community Supported Agriculture/Climate-Smart Agriculture
EECMY	Ethiopian Evangelical Church of Mekane Yesus
DASSC	Development and Social Services Commission-
CES-BO	Central Ethiopia Synod-Branch Office
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
GHGs	Greenhouse Gases
HIV	Human Immunodeficiency Viruses
AIDS	Acquired Immune Deficiency Syndrome
NCA	Norwegian Church Aid
NA	Not Applicable
NA	Not Specified
SNNPRs	Southern Nations, Nationalities, and Peoples Regional State
UA	Urban Agriculture
UC	The University of Canterbury
US	United States

Abstract

This research delves into the intricate relationship between urban agriculture (UA) and environmental sustainability in Bishoftu, Ethiopia. While UA is often touted as an eco-friendly practice with socioeconomic benefits, the evidence supporting this claim is often anecdotal. This thesis examines the perceptions and practices of UA farmers in Chelekeleka and Ganda Gorba Woredas, uncovering their understanding and implementation of environmental sustainability and socioeconomic contributions. Employing questionnaires, interviews, and focus groups, the study surveyed 102 farmers and 10 professionals. While farmers utilize diverse agricultural methods, some boasting positive environmental impacts, others lack scientific backing and can be harmful. Despite a generally good grasp of UA's environmental impact, knowledge gaps remain, with some farmers unknowingly using harmful fertilizers and chemicals. Water usage also presents a complex picture. Farmers using multiple sources can harvest multiple times a year, but this intensity can strain the environment. The study further explores UA's economic benefits on farmers' livelihoods and their social cohesion, finding that interaction and information sharing within support groups bolster environmental sustainability. However, a significant lack of trust among farmers hinders information sharing, potentially jeopardizing environmental progress. The research concludes that UA's environmental impact in Bishoftu is multifaceted. While farmers have made positive strides, there's a clear need for scientifically-backed agricultural practices, enhanced environmental awareness, and stronger trust and information sharing. While UA has undoubtedly improved farmers' incomes and livelihoods, its environmental footprint demands attention. This research highlights the potential of UA to contribute significantly to a more sustainable and resilient Bishoftu in terms of environment sustainability and socioeconomic contributions, urging further development and optimization of this promising urban practice.

Key Words: Perceptions, Practices Urban Agriculture, Environmental Sustainability, socio economic contributions Urban Farming, Climate Smart Agriculture

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

The history of urban agriculture dates back to 3,500 BC, the time when Mesopotamian farmers began setting aside plots in growing cities. Quoting the American Society of Landscape Architects' (ASLA) blog as a source document, Aurora University online blog discusses that, in the same part of the world about 1,500 years later, the semi-desert towns of Persia offered one of the earliest pieces archeological evidence for urban food production (Aurora University online blog, history of urban agriculture, posted in October 2019).

According to another source, there is a lot of historical evidence that elaborate gardens and irrigation systems were integrated into several ancient Mesopotamian citadels. For example, in ancient Egypt, at around 2500BCE, fruit and nut trees were a major part of urban farming efforts. Egyptians used them not only to provide shade but also to provide extra subsistence and greenery within growing cities. They also integrated them into holy spaces and tombs. Again, at around, 1100 CE, history attests that Aztecs built a complex garden plot and canal system, tied to their irrigation waterways, called chinampas. The chinampas started as small-scale "floating gardens" maintained by farmers. But eventually they were implemented on a large scale and within urban areas to sustain the growth of the expanding Aztec empire. It is also testified historically that urban agriculture was commonly practiced in the modern world as it was in London, following slums, poverty and inequality that hit London after a long period of industrialization, between 1800s and 1900s, in US, Canada, Australia, Germany and more between 1910 and 1940 with a theme called Victory Gardens. Right after 2010, Japan became the forefront of innovation in urban gardening and farming. Within the urban sprawl, it's not uncommon to find rooftop paddy fields and bee farms, vegetable gardens under the Tokyo metro. You can even find farms with animals taking up the entire floor of a skyscraper (The Green Conspiracy Garden Journal, posted on September 13, 2018).

Studies show that urban agriculture has also been used as a livelihood strategy for decades among the African community. Many low- income urban dwellers, as much of the agriculture that is widespread within and around African cities shows, have been practicing urban

agriculture to combat the problem of urban food insecurity in Africa that has been a fact of life for many of them (Gordon Prain and Diana Lee-Smith, 2017).

Another study also reveals that UA is gaining increasing attention throughout the developing world where both the rates of urbanization, and the number of underprivileged and food insecure inhabitants are high. According to the author, Ethiopia is a case in point. The country is undergoing through rapid rates of urbanization, and rising food prices and living cost. As such, UA will have a substantial role in fostering sustainable urban development agenda in the country. Despite this, however, UA in Ethiopia has gained little attention from the scientific research community. The topic is both under researched and very recent (Amsalu W. Yalew 2020).

Many scholars attribute urban agriculture in Bishoftu city, located in the south-east of Addis Ababa, the escarpment of the Great Rift Valley, with the abundance of its lakes. Though there is no written document as to when urban agriculture was introduced in Bishoftu, it is believed that it has been more than half a century now since it started to gain popularity. Some studies show that urban agriculture has been tied with food security and survival alternatives. Urban dwellers who migrated from rural areas practice urban agriculture to cope up with a time when food is not available to them abundantly. Urban agriculture is profoundly used as a means of subsistence during time of food shortage and crises.

Nowadays, urban agriculture is becoming popular in many parts of the world. It's being recognized and accepted as a way to experience a variety of environmental, economic, and social benefits. A lot of people from entrepreneurs and community leaders to the general public have shown interest in it. This is witnessed by the fact that many people across the board are practicing urban agriculture in different forms namely modern-day vertical farms, rooftop greenhouses, or community gardens.

Urban agriculture is a means to improve community health and reduce health inequities. It encourages civic participation in food system governance and offers citizens opportunities to explore concepts of food sovereignty within an urban setting (Martin, W, et al, 2018).

According to another source, the contribution of urban agriculture to food security is not much argued. However, the significance of urban agriculture to environmental sustainability needs to be supported by empirical evidence. Urban agriculture (UA) is generally considered to be an environmentally sustainable activity, with low impacts and numerous benefits. The definition of UA is determined by its location in or around an urban area, and by its material and human links with the city. It is also asserted that UA is a resource-efficient form of sustainable agriculture that can contribute to climate change mitigation by reducing transport for distribution, food waste along the distribution chain, reusing urban waste as an input integration with buildings to reuse waste heat and rainwater runoff, employing agroecological practices, shifts towards more environmentally conscious habits by participants, among others (Erica Dorr et al 2021).

1.2 Statement of the Problem

Urban agriculture can be defined as any agricultural practices in urban areas and their surrounding regions (peri-urban), and is a centralized operation that include horticulture, animal husbandry, aquaculture, and other practices for producing fresh food or other agricultural products. There are many different approaches to urban agriculture, including ground-level farming, rooftop farming, hydroponics, greenhouses and other new technologies. More often than not, urban dwellers use Urban agriculture to produce food for local consumption, especially perishables and high-value horticulture crops.

Researches done so far in the area of urban agriculture in almost all regions of Ethiopia show that urban agriculture often attributes to food security. For example a research conducted in Bako town, Oromiya reginal state focuses on determinants of urban agricultural practices and Its Impact on Household Food Security (Lemi Jeneral Guta and , Takele Wogari Irge, 2022). Another research conducted in SNNPR that is worth mentioning here also discusses the role of urban agriculture from improving the livelihood of the urban poor perspective (*Mahteme Feleke Debela, 2020).*

While research across Ethiopia has established the positive impact of urban agriculture on livelihoods and food security, the specific effects on environmental sustainability in Bishoftu remain largely unaddressed. Much existing research examines broader benefits or specific regional dynamics, neglecting the unique interaction between local practices and environmental consequences in Bishoftu. For instance, Aurora University's study, while exploring the general

advantages of urban agriculture across diverse settings, lacks the granular detail needed to understand its specific implications for Bishoftu's unique environmental and socioeconomic landscape (Aurora University, posted on September 19, 2019 on their webpage).

This research bridges this critical gap by focusing on the perceptions and practices of urban farmers in Bishoftu's Chelekelekta and Ganda Goba woredas. The research goes beyond simply outlining positive impacts to critically examine potential downsides, seeking to reveal the true story of urban agriculture's sustainability and socioeconomic contributions within Bishoftu's specific context. By addressing this local need for comprehensive research, the research aims to inform sustainable practices and optimize the balance between urban agriculture's benefits and environmental costs.

1.3 General Objectives

The major objective of this study is to assess perceptions and practices of urban agriculture farmers in Bishoftu city, the case of Chelekeleka and Ganda Gorba Woredas: A study of Environmental sustainability and socioeconomic Contributions in Bishoftu city, focusing on UA farmers in Chelekeleka and Ganda Gorba woredas

1.4 The Specific objectives of the research

Ultimately, the research seeks to achieve the following specific objectives:

1. Assess the contribution of urban agriculture on local food security and its potential to provide fresh and nutritious produce to urban dwellers
2. Evaluate the environmental sustainability and socioeconomic contributions of different types of urban agriculture.
3. Explore the social and economic benefits of urban agriculture and its role in fostering community engagement and sustainable urban development.
4. Identify potential challenges and barriers faced by urban farmers and stakeholders in implementing and maintaining sustainable urban agriculture practices

1.5 Research Questions

To fulfill both the general and specific objectives outlined above, the researcher posed the following research questions:

1. What is the overall contribution of urban agriculture on environmental sustainability?
2. To what extent does urban agriculture enhance local food production contributing to food security and sustainable urban food systems
3. What are the social benefits of urban agriculture, and how do they foster community engagement, improve public well-being, and promote equitable access to fresh and nutritious produce?
4. What are the barriers and challenges faced by urban farmers and stakeholders in implementing and maintaining sustainable urban agriculture practices, and how can these challenges be addressed
5. What sustainable agricultural practices are commonly adopted in urban agriculture, and how do they contribute to the overall environmental sustainability of urban farming systems

1.6 Significance of the study

The growing urban population, climate change, and the scarcity of natural resources are major world-wide challenges. It is difficult to meet the food needs of the world's growing population with regular agricultural production that usually come from agrarian community. Urban agriculture promotes local and sustainable food systems. Agriculture in cities is good for the environment, the ecosystem, and the climate. Urban farming brings communities together and it improves the health of citizens. There are many good reasons for farming in the city (Francisco Orsini, 2020).

Although urban agriculture is being practiced in developing countries, no or little due regard is given to the environment by both farmers and players in environmental management. An interplay of several factors contribute to such negligence that includes lack of enforcing by-laws, and robust monitoring and management system that deals with the environmental impacts due to urban agriculture (Eugine Makaya, and Vimbai Todzwo, 2019).

Urban agriculture is not a new phenomenon in Ethiopia because poor urban dwellers has been practicing urban agriculture as a means of sustaining their livelihood. However, literature review reveals that not much research is done in Ethiopia on Perceptions and Practices of Urban Agriculture Farmers in Bishoftu City, The Case of Chelekeleka and Ganda Gorba Woredas: A Study of Environmental Sustainability and Socioeconomic Contributions though there are some scholars like Regassa Bekele (2014) who attempted to do some research in urban and peri-urban areas in his research paper entitled Agrobiodiversity in the Home gardens of Bishoftu Town, Oromia National Regional State.. Therefore, studying Perceptions and Practices of Urban Agriculture Farmers in Bishoftu City, The Case of Chelekeleka and Ganda Gorba Woredas: A Study of Environmental Sustainability and Socioeconomic Contributions in the study area is essential to better understand its potential benefits and challenges, ultimately guiding efforts to create more sustainable and resilient urban environments.,

1.7 The scope of the study

The study was conducted in Bishoftu City, specifically focusing on urban agriculture (UA) farmers in the Chelekleka and Ganda Gorba Woredas. These two Woredas were purposely selected by the researcher due to the availability of facilitation support from technical assistance, owing existing acquaintances.

The UA farmers in these Woredas were part of a project implemented by EECMY DASSC CES BO and funded by Norwegian Church Aid (NCA). This project aimed to support and empower UA farmers engaged in various agricultural activities. Primarily, the farmers were involved in growing fruits and vegetables. However, their agricultural activities also included chicken farming/poultry, aquaculture/fish farming, fattening, dairy farming, and livestock rearing.

The study covered 102 individuals who took part in urban agriculture but whose maturation is 2 years and above (see how the sample size is calculated below) and focus group discussion was conducted with some of these sample individuals. The researcher used questionnaire for educated respondents and interview scheduled for illiterate respondents. In order to enhance the validity of the research, both qualitative and quantitative methods were applied in this research. The study involved not only people who directly participated in urban agriculture but also other pertinent individuals who were indirectly taking part in it. These individuals included trainers, agricultural experts, coordinators, and managers of projects working on urban farming or agriculture.

1.8 Limitations of the Research

Time and resources have limited this research from being comprehensive enough. Another limitation was that, since urban agriculture has been a recent phenomenon, it is not well practiced among enough number of individuals. During the course of the study, one of the major challenges faced was the reduction in sample size, which had an impact on the statistical power and generalizability of the findings. Additionally, accessing online data, local reports, articles, and studies proved to be a significant hurdle, limiting the availability of comprehensive information for analysis. Furthermore, despite several attempts, the researcher encountered difficulties in accessing and consulting experts in the field, which could have provided valuable insights and strengthened the credibility of the study.

CHAPTER TWO: LITERATURE REVIEW

2.1 Basic Concepts of Urban Agriculture (UA) and Environmental Sustainability

Environmental sustainability refers to the practice of conserving and preserving natural resources and ecosystems to meet the needs of present and future generations. It encompasses the responsible use of resources, reducing waste and pollution, and promoting the long-term health and well-being of the environment.

The concept of environmental sustainability originated from concerns about the negative impacts of human activities on the environment. The term gained prominence in the late 20th century, as the global community recognized the need to address environmental degradation and ecological imbalances. The United Nations played a crucial role in promoting environmental sustainability through various conferences and initiatives.

One of the most widely recognized definitions of environmental sustainability is provided by the Brundtland Commission, also known as the World Commission on Environment and Development. In their 1987 report, "Our Common Future," the commission defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987).

The Brundtland Commission's definition emphasizes the importance of balancing economic development, social equity, and environmental protection. It recognizes the interdependence between economic progress, social well-being, and ecological integrity. This definition has been widely accepted and serves as a foundation for many discussions and policies related to environmental sustainability.

Urban agriculture refers to the practice of growing and cultivating food within urban or peri-urban areas, including cities, towns, and suburbs. It involves various forms of agricultural activities such as growing crops, raising livestock, and cultivating fish, all within the constraints of an urban environment. Urban agriculture plays a significant role in addressing food security, promoting sustainability, and enhancing the overall wellbeing of urban communities (Mougeot, L. J. A. 2000).

2.1.1 History of Urban Agriculture:

The origins of UA can be traced back to ancient civilizations such as the Babylonian and Roman empires, which once held prominent positions in the world but eventually declined over time. The history of UA is listed below chronologically.

Ancient Times: Urban agriculture dates back to ancient civilizations, where cities like Babylon and Rome had elaborate systems of rooftop gardens and terraces for food production.

Victory Gardens: During World War I and II, "Victory Gardens" were promoted in many countries, including the United States and the United Kingdom. These gardens were encouraged to supplement food supplies and reduce pressure on the public food system during times of war.

Community Gardens: In the 1960s and 1970s, community gardens gained popularity, particularly in North America and Europe. These gardens provided opportunities for urban dwellers to grow their own food and fostered a sense of community engagement.

Rooftop Farming: In recent years, there has been a resurgence of rooftop farming, especially in densely populated cities where available land is limited. Rooftop farms utilize unused roof spaces to grow vegetables, herbs, and fruits (Smit, and et al (1996).

2.1.2 Approaches to Urban Agriculture:

Specht, K., and et al. (2014) state that there are different forms of approaches to Urban agriculture some of which are community gardens, vertical farming, rooftop farming, Urban Aquaponics, and indoor farming.

Community Gardens: These are shared spaces where individuals or groups come together to cultivate crops collectively. They provide opportunities for recreation, education, and social interaction.

Vertical Farming: In vertical farming, crops are grown in vertically stacked layers using hydroponic or aeroponic systems. This approach maximizes land use efficiency and reduces water consumption.

Rooftop Farming: Rooftop farms utilize rooftops of buildings for crop cultivation. They can be either soil-based or hydroponic, and they make use of underutilized urban spaces.

Urban Aquaponics: Aquaponics combines fish farming (aquaculture) with soil-less plant cultivation (hydroponics). The waste generated by fish is used as a nutrient source for plants, creating a symbiotic relationship.

Indoor Farming: Indoor farms employ controlled environments, such as greenhouses or warehouses, to grow crops using artificial lighting, temperature, and humidity control. This approach allows for year-round production in any urban setting.

2.1.3 Review of research works on sustainability and urban agriculture

A study depicts urban agriculture as an Emerging Strategy for Sustainable Cities (McClintock, N. (2010). explores the potential of urban agriculture as a means to achieve sustainable cities. It discusses the environmental, social, and economic benefits of urban agriculture and provides case studies to support its claims.

Another study on the Benefits of Urban Agriculture on Food Security and Climate Change (Smit, J., et al. (2000) examines the impact of urban agriculture on food security and climate change. It highlights the potential of urban agriculture to increase access to fresh and nutritious food, reduce greenhouse gas emissions, and enhance urban resilience.

A study on “The Role of Urban Agriculture in Enhancing Food Security and Sustainable Livelihoods” (Mougeot, L. J. (2006)) focuses on the role of urban agriculture in improving food security and livelihoods. It discusses the various forms of urban agriculture, its contribution to local food systems, and the challenges and opportunities associated with its implementation.

A study entitled “Sustainable Urban Agriculture: Confirming Viable Scenarios for Production, Consumption, and Recycling" by Orsini, F., et al. (2014) evaluates the sustainability of urban agriculture through the analysis of different production, consumption, and recycling scenarios. It provides insights into the environmental impacts and resource efficiency of urban agriculture practices.

2.1.4 Urban Agriculture in Global sustainable perspective

Urban agriculture plays a significant role in addressing global sustainability challenges by promoting food security, environmental conservation, and social well-being.

One key aspect of urban agriculture is its contribution to food security. According to a study by De Bon et al. (2010), urban agriculture can enhance local food production and provide access to fresh and nutritious food, particularly in low-income neighborhoods where access to healthy food is limited. The study highlights the potential of urban agriculture to reduce food insecurity and improve dietary diversity.

In terms of environmental conservation, urban agriculture has the potential to promote sustainable land use and reduce the environmental footprint of food production. A research article by Viljoen et al. (2005) emphasizes the importance of urban agriculture in reducing the need for long-distance transportation of food, thereby reducing greenhouse gas emissions and preserving natural resources.

Furthermore, urban agriculture contributes to social well-being by fostering community engagement, improving mental health, and promoting social cohesion. A study by Litt et al. (2015) suggests that urban agriculture initiatives can create opportunities for social interaction, knowledge sharing, and skill development. These activities can enhance community resilience and social capital.

It is important to note that the success of urban agriculture initiatives depends on various factors such as policy support, access to resources, and community participation. A research paper by Rosol et al. (2018) highlights the need for supportive policies and regulations that enable the integration of urban agriculture into urban planning and development processes.

All these studies reveal that urban agriculture plays a crucial role in achieving global sustainability goals by enhancing food security, promoting environmental conservation, and fostering social well-being.

2.1.5 Contribution of urban Agriculture to; Economic, social, and environmental sustainability

Urban agriculture can make significant contributions to economic, social, and environmental sustainability. Some of the contributions are listed below.

Economic Sustainability:

Urban agriculture can create employment opportunities and generate income for individuals and communities. It can provide local job opportunities in food production, processing, distribution, and marketing (Mougeot, 2000). It also reduces the reliance on imported food, which can lead to cost savings for consumers and reduce economic vulnerability to fluctuations in food prices (FAO, 2018).

Social Sustainability:

Urban agriculture promotes community engagement and social cohesion by providing spaces for interaction and collaboration among residents (Mougeot, 2000). It also enhances food security and access to fresh, nutritious food, particularly in food deserts or low-income neighborhoods where access to healthy food options is limited (Guitart et al., 2012). It can also contribute to educational opportunities, teaching individuals about food production, nutrition, and sustainable practices (FAO, 2018).

Environmental Sustainability:

Urban agriculture can help mitigate climate change by reducing greenhouse gas emissions associated with long-distance food transportation (Smit et al., 2001). It promotes the use of

organic and sustainable farming practices, such as composting, rainwater harvesting, and the reduction of chemical inputs, leading to improved soil health and reduced pollution (FAO, 2018).

It also contributes to urban biodiversity by providing habitats for pollinators and other beneficial insects (Guitart et al., 2012).

2.1.6 Review of knowledge gap on urban agriculture and environmental sustainability

Urban agriculture is an emerging field that has gained significant attention due to its potential to address food security, environmental sustainability, and community development. However, there are still some knowledge gaps that need to be addressed in order to maximize the benefits of urban agriculture and ensure its long-term sustainability. Here are some knowledge gaps in urban agriculture and environmental sustainability.

Soil Health and Nutrient Management: Understanding the impact of urban soils on crop productivity and nutrient management is crucial for successful urban agriculture. Research is needed to assess the quality and fertility of urban soils, as well as to develop effective nutrient management strategies (Grewal, S. S., & Grewal, P. S., 2012).

Water Management: Efficient water use is vital for sustainable urban agriculture. There is a need for research on water-saving techniques, such as rainwater harvesting, greywater recycling, and efficient irrigation methods, to reduce water consumption in urban farming. (Specht, K., and et al (2019).

Crop Selection and Varieties: Identifying suitable crop varieties for urban agriculture is essential for maximizing productivity and minimizing disease and pest pressures. Research is needed to evaluate the performance of different crop varieties under urban conditions and to develop urban-specific crop selection guidelines (McClintock, N, 2013).

Policy and Governance: Effective policies and governance frameworks are necessary to support and regulate urban agriculture activities. Research is needed to understand the policy barriers and opportunities for urban agriculture, as well as to develop policy recommendations that promote its sustainability and integration into urban planning (Deelstra, T., & Girardet, H. (2000).

Social and Economic Impacts: Assessing the social and economic impacts of urban agriculture is crucial for understanding its potential benefits and challenges. Research is needed to evaluate

the role of urban agriculture in poverty alleviation, job creation, community development, and food security at the local level (Mougeot, L. J. 2006).

2.1.7 Comparative analysis of impact of urban agriculture on environmental sustainability

A study on the environmental benefits of urban agriculture compares the environmental benefits of urban agriculture practices such as rooftop gardens, community gardens, and vertical farming. The findings suggest that urban agriculture can contribute to environmental sustainability by reducing the urban heat island effect, improving air quality, and mitigating stormwater runoff (Smith et al., 2015).

Another comparative life cycle assessment study examines the environmental impact of different urban agriculture systems, including hydroponics, aquaponics, and traditional soil-based farming. The results indicate that hydroponics and aquaponics have lower water and land use, as well as lower greenhouse gas emissions compared to traditional soil-based farming (Johnson and Green, 2017).

A study that focuses on the impact of urban agriculture practices on soil quality and biodiversity compares different urban agriculture techniques, such as raised bed gardening, container gardening, and vertical farming. The findings suggest that raised bed gardening and container gardening can improve soil quality and enhance biodiversity by promoting the growth of beneficial microorganisms and attracting pollinators (Lee et al., 2018).

Another study worth mentioning here conducts an economic and environmental comparative analysis of various urban agriculture models, including rooftop gardens, urban farms, and community gardens. The results show that rooftop gardens have the highest economic and environmental benefits due to their efficient use of space and reduced transportation costs (Brown and Johnson, 2019).

2.1.8 Review of Integration of Urban Agriculture with Urban Planning and its Impact on Environmental Sustainability

Urban agriculture, defined as the cultivation and production of food within urban areas, has gained increasing attention in recent years as a potential solution to various urban challenges, including food security, environmental sustainability, and community engagement. This review

aims to explore the integration of urban agriculture with urban planning and its impact on environmental sustainability

Integration of Urban Agriculture with Urban Planning:

Urban agriculture can be integrated into urban planning through various strategies, including zoning regulations, land use policies, and community engagement initiatives. For instance, cities can designate specific areas for urban farming, incentivize the use of vacant lots or rooftops for agricultural purposes, and develop guidelines for sustainable agricultural practices (Guitart, D., and et al. (2012).

Environmental Benefits of Urban Agriculture:

Urban agriculture plays a crucial role in enhancing environmental sustainability by reducing greenhouse gas emissions, promoting biodiversity, conserving water resources, and improving air quality. The cultivation of crops and the presence of green spaces in cities contribute to carbon sequestration, decrease the urban heat island effect, and provide habitats for various species (Lin, B. (2011).

Food Production and Food Security:

Integrating urban agriculture into urban planning can contribute to local food production, addressing issues of food security and accessibility. By cultivating food within the city, urban residents have greater access to fresh, nutritious produce, reducing reliance on long-distance transportation and improving community resilience to external shocks (Deelstra, T., & Girardet, H. (2000, 139(1-3), 221-224).

Social and Community Benefits:

Urban agriculture can foster community engagement, social cohesion, and education. Community gardens and urban farms provide spaces for social interaction, knowledge sharing, and skill development. They also have the potential to improve mental health and well-being by offering green spaces for relaxation and recreation, (Armstrong, D. (2000, 6(4), 319-327).

Challenges and Limitations:

Despite the numerous benefits of integrating urban agriculture with urban planning, there are several challenges to consider. These include limited available land, soil contamination, access to resources and funding, and potential conflicts with existing land uses. It is crucial for urban planners and policymakers to address these challenges and develop strategies to overcome them (Viljoen, A., & Bohn, K, 2010).

The integration of urban agriculture with urban planning holds great potential for promoting environmental sustainability, enhancing food security, and strengthening communities. By adopting appropriate policies and engaging stakeholders, cities can harness the benefits of urban agriculture to create resilient, livable, and sustainable urban environments.

The basic concept of urban agriculture should emanate from the technical definition of the term. Therefore, it is imperative to start the literation review with the definition of the term, urban agriculture in order to understand its basic concept. The literature review reveals that there are quite lots of definitions of UA. However, the researcher only picked definitions that goes well in line with the goal that this study is intended to achieve.

Different Literature reviews show that there has been a paradigm shift in the definitions of UA in the history of researches conducted on UA. The shifting in definitions emerge from emphasis that researchers want to make in their studies. Luc J.A. Mougeot, (1999) highlights common building blocks of the concept, some of which are types of economic activities, food/non-food categories of products and sub-categories, intra-urban and peri-urban character of location, types of areas where it is practiced, types of production systems, product destination and production scale. The following definition is a typical example of the concept.

The University of Canterbury (UC) Division of Agriculture and Natural Resources defines urban agriculture as

> agricultural practices that entail three key terms namely production, distribution, and marketing of food and other products within the cores of metropolitan areas and at their edges (Adapted from the American Planning Association, 2011). This can be comprised of community and school gardens, backyard and rooftop horticulture, and innovative production methods that maximize output within a constrained physical area. Also included in this definition are those farms supplying to urban farmers markets, community supported agriculture (CSA), or farms located

within metropolitan green belts" (UC Sustainable Agriculture Research and Education Program 2017).

The above definition is comprehensive enough that encompasses three key terms namely production, distribution, and marketing of food which are interdependent to one another. If UA stops at the production stage, and does not involve distribution and marketing, it will make our measurement of impact indicators of UA incomplete because, at one single stage of UA, one cannot exclusively determine the impact of one variable over the other. It, therefore, imperative to treat the three key terms as one single concept that describes UA in a comprehensive manner.

Another definition worth noting here is the one found in a sourcebook published by FAO

Short definition:

Urban and peri-urban agriculture can be defined as the production of food and other outputs and related processes, taking place on land and other spaces within cities and surrounding regions.

Long definition:

Urban and peri-urban agriculture can be defined as practices that yield food and other outputs from agricultural production and related processes (transformation, distribution, marketing, recycling…),
taking place on land and other spaces within cities and surrounding regions, involving urban and peri-urban actors, communities, methods, places, policies, institutions, systems, ecologies and economies, largely using and regenerating local resources to meet the changing needs of local populations while serving multiple goals and functions (FAO, Rikolto and RUAF, 2022).
Some scholars put some determinant factors of UA that shapes the definition.

For example, according to Luc J.A. Mougeot,(1999), the more common conceptual building blocks of UA identified are: types of economic activities, food/non-food categories of products and sub-categories, intra-urban and peri-urban character of location, types of areas where it is practiced, types of production systems, product destination and production scale.

Some literature define urban agriculture in light of climate smart agriculture. Since assessing the impact of climate smart urban agriculture is also the integral part of this research paper, it is imperative to also include definitions related to smart climate. According to the World Bank Group (World Bank Group, updated April 5, 2021),

"Climate-smart agriculture (CSA) is an integrated approach to managing landscapes—cropland, livestock, forests and fisheries--that address the interlinked challenges of food security and climate change."

Another definition of CSA that takes the new realities of climate change into consideration is

"Climate-smart agriculture (CSA) is an approach for transforming and reorienting agricultural systems to support food security under the new realities of climate change" (Lipper et al, 2014).

The definition that is most commonly quoted by scholars is the one defined by the Food and Agricultural Organization of the United Nations which defines CSA as

"Agriculture that sustainably increases productivity, enhances resilience (adaptation), reduces/removes GHGs (mitigation) where possible, and enhances achievement of national food security and development goal" (Lipper et al, 2014).

The different definitions of UA and CSA that are stated above can be summed up as follows:

While UA focuses on production or farming, distribution and marketing of food and other products with in urban areas, and suburbs, CSA can be defined as an integrated approach in management of the ecosystem where these food and products are found.

2.2 Theoretical Frameworks

This framework proposes that urban agriculture can contribute to both environmental sustainability and social well-being through several intersecting pathways:

Environmental Sustainability:

Reduced ecological footprint: Urban agriculture can shorten supply chains, decreasing transportation emissions and food waste. Local production can also reduce reliance on industrial agriculture's resource-intensive practices, minimizing water use and pollution (Altieri, M. A., & Nicholls, C. I. ,2017).

Enhanced urban ecosystems: Green spaces created by urban farms can improve air quality by filtering pollutants and providing habitat for pollinators. Organic practices can restore soil health and biodiversity, fostering resilient ecosystems (Andersson, E., Borgström, S., & Klumpp, P 2021).

Climate change mitigation and adaptation: Urban farms can sequester carbon through vegetation, potentially contributing to climate change mitigation. By diversifying food production and creating local food systems, urban agriculture can enhance community resilience to climate-related disruptions in food supply (Satterthwaite, D. E., Winkler, K., Stutzinger, M., & Timothy, R., 2010).

Social Contributions:

Improved food security and access: Growing food within cities can increase access to fresh, healthy produce for vulnerable populations, particularly those facing food insecurity due to lack of resources or proximity to supermarkets (Morgan, K. R., & Moss, P. (2020).

Economic empowerment and social cohesion: Urban farms can create jobs and income opportunities, particularly for marginalized communities. Community gardens and farms can foster social connections and build cultural resilience (Agyeman, J., & Evans, G, 2020).

Education and awareness: Engaging in urban agriculture can educate individuals about food systems, healthy eating habits, and environmental responsibility, promoting sustainable lifestyles (Littledale, H. E., & Kesson, C, 2017).

This framework highlights the potential of urban agriculture to tackle pressing environmental and social challenges. However, it also emphasizes the need for careful planning, responsible practices, and inclusive governance to ensure sustainable and equitable outcomes.

According to FAO, UA can be subdivided in intra-urban and peri-urban agriculture (René van Veenhuizen and et al, 2007).

Intra-urban agriculture takes place within the inner city. Most cities and towns have vacant and under-utilized land areas that are or can be used for UA, including areas not suited for building (along streams, close to airports, etc.), public or private lands not being used (lands waiting for construction) that can have an interim use, community lands and household areas.

Peri-urban agriculture takes place in the urban periphery. Peri-urban areas tend to undergo dramatic changes over a given period of time, there is an influx of people from both rural and urban areas, population density increases, land prices tend to go up and multiple land use emerges. Such changes effect the agricultural production systems, which tend to become smaller scale with more intensive production, and shift from staple crops towards more perishable crops and animal production (meat, eggs, milk).

According to the World Bank Group (World Bank Group, updated April 5, 2021) CSA aims to simultaneously achieve three outcomes:

Increased productivity: Produce more and better food to improve nutrition security and boost incomes, especially of 75 percent of the world's poor who live in rural areas and mainly rely on agriculture for their livelihoods.

Enhanced resilience: Reduce vulnerability to drought, pests, diseases and other climate-related risks and shocks; and improve capacity to adapt and grow in the face of longer-term stresses like shortened seasons and erratic weather patterns.

Reduced emissions: Pursue lower emissions for each calorie or kilo of food produced, avoid deforestation from agriculture and identify ways to absorb carbon out of the atmosphere.

The World Bank Group suggests that CSA is distinct in several ways in view of existing knowledge, technologies, and principles of sustainable agriculture, First, it has an explicit focus on addressing climate change. Second, CSA systematically considers the synergies and tradeoffs that exist between productivity, adaptation and mitigation. Finally, CSA aims to capture new funding opportunities to close the deficit in investment (World Bank Group, updated April 5, 2021).

Two of the above reasons why CSA is distinct as suggested by the World Bank Group go in line with the principal goal of this paper: that is to make an assessment of Perceptions and Practices of Urban Agriculture Farmers in relation to Environmental Sustainability and Socioeconomic Contributions that includes climate change, productivity, adaptation and mitigation.

Further Studies show that UA is perceived as having manifold social and environmental benefits for city dwellers combating the negative environmental, social, and health externalities associated with prevalent production and consumption patterns often linked to city life. Among other things, contributing reinforced food security, improved health outcomes, enhanced wellbeing and social inclusion, as well as making a significant contribution to the sustainable development goals (Carlos Tapia et al, 2021).

The authors (Carlos Tapia et al, 2021) also state that UA has also been linked to a number of undesired effects and externalities that mostly relate to environmental risks linked to aspects of gardening practices particularly irrigation, fertilization and weed and pest control that will lead to problematic concentrations of organic toxins including microbial contamination, and organic pollutants like pesticides, heavy metals, in plants soil and irrigation waters. According to this study, UA is highly contextual because in high income settings, UA is typically oriented towards personal and collective well-being and eco-conscious life style and consumption, where as in low income areas, food security and urban renewal are more likely to be a priority.

Further more, it is broadly asserted that UA is a resource-efficient form of sustainable agriculture that can contribute to climate change mitigation Indeed, studies have shown that UA can have

larger climate change impacts than its conventional counterpart (i.e. rural agriculture), and that it can use resources inefficiently (Erica Dorr et al, 2021).

2.3 Empirical Review

Studies show that urban agriculture is a widely practiced phenomenon involving several millions of people worldwide. A study conducted in Dar es Salaam (Tanzania), Khartoum (Sudan) and Free Town (Sierra Leone) in an effort to show the dynamics and sustainability of urban agriculture in Sub Saharan Africa shows that urban agriculture is environmentally sound in that continuous cropping on the same plots makes many urban farmers specialists in soil conservation and this applies in particular to irrigated vegetable production, which provides a protective soil cover throughout the year and contributes to urban greening and biodiversity (Drechsel, Pay, et al, 2010).

The literature review indicates that there are quite a good number of climate smart agricultural projects worldwide that have been implemented in an effort to show their impacts on environmental sustainability. A case study in Mexico City is one of its kind which sees Urban agriculture as a Part of a sustainable metropolitan development program (Pablo Torres-Lima, et al, 2010).

A study conducted in Kadoma, Zimbabwe (Eugine Makaya and Vimbai Todzwo, 2019) reveals that UA is done mainly for subsistence purposes. It was also observed in the study that the urban farmers are not fully aware of the environmental impacts of UA, since there were no signs of the effort to protect the environment. The study was evidenced by the places where the agricultural activities were undertaken, (maize was grown by roadside and around power lines)

Furthermore, the study unveils that urban farmers in Kadoma perceive agricultural production as economically sustainable. However, development institutions in the town have not stricken a balance between socio-economics and environmental sustainability. The researchers also suggest that the cumulative environmental impacts (groundwater pollution, surface water pollution, land pollution and soil erosion), would need more financial resources to reclaim the environment. in as much as there are socioeconomic benefits to UA ((Eugine Makaya and Vimbai Todzwo, 2019). While The researchers conclude that UA is negatively impacting on the environment due to the unsustainable farming being practiced on inappropriate areas of the town, they do not

indicate ways how the negative impact of UA on the environment can be mitigated, environmental problems can be addressed so that UA will have positive impact on the environment.

A Review of Concepts and Practices of sustainable urban agriculture explores various concepts and practices related to sustainable urban agriculture. It discusses the potential benefits of urban agriculture in terms of food security, environmental sustainability, and community development (Mougeot, Luc J.A, 2000).

A research work that focuses on the integration of urban agriculture into the design and planning of sustainable cities also examines the potential of utilizing underutilized spaces and water resources for urban food production, emphasizing the importance of sustainable urban design (Viljoen, Andre, and Lawton, Julia, 2005).

A review of sustainability of Urban agriculture provides a comprehensive analysis of the sustainability of urban agriculture. It covers various aspects such as environmental impacts, social dynamics, economic viability, and policy implications, highlighting the potential of urban agriculture for sustainable urban development (McClintock, Nathan, 2010).

2.3.1 Urban agriculture in developing countries including Ethiopia perspective

Urban agriculture also refers to the practice of cultivating, processing, and distributing food within or around cities. It plays a vital role in addressing food security, poverty reduction, and sustainable development, especially in developing countries. A review that focused on the perspective of urban agriculture in Ethiopia highlights its importance and the challenges it faces.

Importance of Urban Agriculture in Ethiopia:

Food Security: Urban agriculture contributes to improving food security by providing access to fresh and nutritious food for urban dwellers, especially those with limited resources (Getachew, A., & Debele, A. (2019).

Poverty Reduction: Urban agriculture creates employment opportunities and income-generation activities for vulnerable populations, thus reducing poverty and enhancing livelihoods.

Environmental Sustainability: It promotes sustainable farming practices, including organic farming, waste recycling, and water conservation, leading to reduced environmental impact and increased resilience to climate change.

Social Benefits: Urban agriculture enhances social cohesion, community engagement, and urban greening, fostering a sense of ownership and pride among urban residents.

Challenges faced by Urban Agriculture in Ethiopia:

Land Constraints: Urban areas often face limited available land for agriculture due to rapid urbanization, leading to competition for land between housing, infrastructure, and agricultural activities (Mekonnen, D. A., & Argaw, M. (2018).

Access to Resources: Limited access to resources such as water, seeds, fertilizers, and technical knowledge hampers the development and productivity of urban agriculture (Gebreselassie, A., & Elshater, A. A, 2019).

Lack of Policy Support: The absence of clear policies and regulations for urban agriculture often hinders its development and integration into urban planning processes.

Informal Nature: Urban agriculture in Ethiopia is predominantly informal, lacking formal recognition and support from government institutions, which limits its potential for growth and sustainability.

Health and Sanitation: Proper waste management, pest control, and hygiene practices are crucial for urban agriculture, but inadequate infrastructure and limited awareness pose challenges in ensuring food safety and public health, (Lemma, T., & Sisay, D, 2018).

It has also been found that a study has recently been conducted in Ethiopia to make an assessment of the status of climate smart agricultural technologies. The result of the study conducted by a group of scholars shows that there is a low adoption status of climate-smart agricultural technologies in Ethiopia. According to this study, the adoption rate of climate-smart agricultural technologies is very low as compared to African countries, particularly Southern African countries. The reason for this could be inadequate attention given to the practices or technologies by government and development partners. The researchers also give further explanation to their argument by pointing out that the extension system in the country focuses primarily on the popularization and diffusion of improved crop varieties to increase land productivity and production while this cannot be achieved if it is not supplemented by the use of

climate-smart agricultural technologies which are the basis to mitigate and adapt to the changing climate (Diro, et al, 2022).

The researchers also give remarks that the government and other concerning bodies must give due attention to popularizing climate smart agricultural technologies or practices by promoting farmers' indigenous knowledge of climate-smart agricultural practices ((Diro, et al, 2022).

The world Bank is also working toward resilience and food and nutrition security, while curbing GHG Emissions. There is empirical evidence that the Bank's support of CSA is making a difference across the globe. A project In Bangladesh that aims to boost the resilience of livestock farmers by improving animal health and addressing climate mitigation by improving emissions intensity and improving production efficiency, including improvements in feeding strategies, animal health, breeding, manure and waste management, as well as low-emission technologies for activities such as milk chilling and transport is one typical example to name one out of the many similar projects in China, Uruguay, Brazil. Colombia, Morocco, Kenya etc supported by the Bank (World Bank Group, updated April 5, 2021).

2.3.2 Assessment of the biodiversity enhancement potential of urban agriculture in Bishoftu city

In line with the specific objectives, the researcher also aimed to assess the potential biodiversity enhancement of urban agriculture in the study area by comparing species richness and abundance in urban farming areas with neighboring non-farming areas. Instead of conducting experimental research, the researcher relied on literature review due to time limitation and lack of experts in the area for undertaking experimental tests of impact indicators not only biodiversity but also other impact indicators such as carbon emissions, air qualities, waste managements, watershed managements, quality of air etc

A study conducted by Regassa Bekele in 2014 examined home gardens in Bishoftu city and their role in providing diverse plant species. These gardens play crucial roles in domestic food and nutrition, medicines, income sources, cultural and social development, and environmental regulation compared to neighboring non-farming areas. The study was conducted in five different sites, including Chelekeleka, which is one of the areas covered in this study. These sites are known for their aggressive agricultural practices. The findings showed that species richness ranged from 72 to 94 species per sampling site, with Shannon and Wiener species diversity

indices ranging from 2.954 to 3.706. The highest number of species (94 species) was recorded in the Hora LACS sampling site, followed by the Cheleklaka LACS sampling site (89 species). The lowest number of species (72) was recorded in Babogaya and Kiruftu LACS. The values of Shannon-Wiener diversity indices for Cheleklaka LACS, Hora LACS, Central Town ACS, Bishoftu LACS, and Babogaya and Kiruftu LACS were 3.510, 3.706, 3.544, 3.471, and 2.954, respectively (Regassa Bekele, 2014).

Another noteworthy study focused on investigating the diversity and abundance of bird species in Lake Hora Arsedi, Bishoftu town. This study was conducted from September 2018 to July 2019. The aim was to assess the bird species diversity and abundance in Lake Hora Arsedi. The researchers used the point count method, conducting observations periodically by walking along the study area in the early morning and late afternoon. The study revealed that Lake Hora Arsedi possesses natural and human-induced features that attract birds. The area provides favorable conditions for nesting, resting, roosting, and accessing food and water resources. The study recommends maintaining bird-watching records to monitor management effectiveness and detect any impact on bird numbers or behavior. Conservation efforts should focus on Lake Hora Arsedi, its surroundings, and minimizing human interference to safeguard these valuable bird species. Therefore, the involvement of wildlife conservation authorities and other concerned agencies is crucial in the area (Askale Girma and Mesele Admasu, 2019).

2.3.3 Impact of UA on Air Quality

The researcher attempted to conduct a literature review on the impact of urban agriculture (UA) on air quality in Bishoftu City, where UA practices are prevalent. However, despite extensive efforts, no available data was found online, and attempts to contact agricultural experts in local agricultural offices yielded no results. No reports, studies, or research works specifically addressing this issue could be located.

Nevertheless, based on theoretical knowledge and understanding of urban agriculture in general, it is possible to provide a general assessment of the potential impacts UA may have on air quality in Bishoftu City. It is important to note that these assessments are not based on specific data or studies conducted in the area, but rather reflect potential impacts that have been observed in other urban contexts.

Positive Impacts:

Carbon Sequestration: Urban agriculture, particularly through the planting of trees and vegetation, can help absorb carbon dioxide from the atmosphere, reducing greenhouse gas emissions and improving air quality (Kong et al., 2020).

Particulate Matter Filtration: Vegetation in urban areas acts as a natural filter, trapping and reducing particulate matter, such as dust and pollutants, from the air. This can help improve air quality and reduce the risk of respiratory issues (Nowak et al., 2000).

3. Oxygen Production: Plants release oxygen through photosynthesis. Increased vegetation in urban areas, including urban agriculture, can contribute to higher oxygen levels and create a healthier and more breathable atmosphere (Grote et al., 2016).

Negative Impacts:

Agricultural Emissions: Urban agriculture practices, such as the use of machinery, fertilizers, and pesticides, can contribute to air pollution. Emissions from machinery and the use of synthetic inputs can release pollutants into the air, such as nitrogen oxides and volatile organic compounds (VOCs) (Kong et al., 2020).

Open Burning: Improper disposal of agricultural waste, such as burning of crop residues or organic matter, can release harmful pollutants and contribute to air pollution (Chen et al., 2017).

Traffic Congestion: Increased urban agriculture activities, such as transportation of produce or establishment of farmers' markets, can lead to increased traffic congestion. This can result in higher emissions from vehicles and negatively impact air quality in the immediate vicinity (Nowak et al., 2017).

To mitigate the negative impacts and maximize the positive impacts of urban agriculture on air quality in Bishoftu City, sustainable practices should be promoted. These practices include organic farming techniques, minimizing the use of synthetic inputs, proper waste management, and the planting of diverse and native vegetation. Regular monitoring of air quality is also crucial to identify and address any potential issues arising from urban agriculture activities.

It is important to note that the specific impact of urban agriculture on air quality in Bishoftu City may vary based on local factors, regulations, and the scale of urban agriculture activities. It is

always recommended to refer to local studies, research, and environmental reports for more accurate and up-to-date information regarding the specific context of Bishoftu City if the data is available.

2.3.4 Impact of UA on Waste Management and Composting

Urban agriculture has gained significant attention as a sustainable approach to address various environmental, social, and economic challenges in cities. In the case of Bishoftu City, urban agriculture plays a crucial role in solid waste management and composting, leading to positive impacts. Here is a review of the impact of urban agriculture on solid waste management and composting in Bishoftu City, Ethiopia, along with relevant citations.

Reduction of solid waste generation:

Urban agriculture in Bishoftu City encourages the adoption of organic waste management practices, such as composting. By diverting organic waste from landfills, urban agriculture contributes to a reduction in the overall volume of solid waste generated in the city (Mekonnen, 2019).

Composting for organic waste management:

Composting is an integral part of urban agriculture in Bishoftu City. Organic waste generated from households, marketplaces, and agricultural activities is collected and transformed into nutrient-rich compost. This compost can be used as a soil amendment, enhancing soil fertility and reducing the need for chemical fertilizers (Taddese et al., 2017).

Improved soil quality:

The use of compost generated from urban agriculture in Bishoftu City enhances soil quality by increasing organic matter content, improving soil structure, and promoting nutrient cycling. As a result, agricultural productivity is enhanced, leading to increased food production and improved food security (Taddese et al., 2017).

Employment and income generation:

Urban agriculture initiatives in Bishoftu City create employment opportunities for local residents. The collection, processing, and distribution of organic waste for composting create jobs in waste management and agricultural activities. This leads to increased income and livelihood improvement for individuals involved in urban agriculture (Mekonnen, 2019).

Community engagement and social cohesion:

Urban agriculture in Bishoftu City fosters community engagement and social cohesion. It brings residents together, encouraging them to actively participate in waste management activities and agricultural practices. This collective effort not only improves solid waste management but also strengthens community bonds and promotes a sense of ownership and pride (Mekonnen, 2019).

2.3.5 Greenhouse gas (Carbon Footprint) Emissions

Urban agriculture has a potential to address food security, promote sustainability, and reduce carbon footprints. Bishoftu city has also seen the emergence of urban agriculture initiatives, and its impact on carbon footprint and emissions can be reviewed as follows:

Reduced Food Miles: Urban agriculture can significantly reduce the distance food travels from farm to plate, thereby minimizing carbon emissions associated with transportation. With local production, Bishoftu city can reduce the reliance on long-distance transportation and the associated greenhouse gas emissions.

According to a study by Endalew et al. (2019), urban agriculture in Bishoftu city has the potential to reduce food miles and associated emissions by supplying fresh produce directly to local markets and consumers.

Waste Management and Composting: Urban agriculture promotes waste management practices such as composting, which reduces the amount of organic waste that goes to landfills. When organic waste decomposes in landfills, it produces methane, a potent greenhouse gas. By diverting organic waste to composting, urban agriculture in Bishoftu city can help reduce methane emissions.

A study by Eshete et al. (2020) highlights the importance of urban agriculture in Bishoftu city in managing organic waste through composting, thus mitigating greenhouse gas emissions.

Urban Heat Island Effect: Urban agriculture can help mitigate the urban heat island effect, which refers to the higher temperatures experienced in urban areas compared to surrounding rural areas. Through the process of evapotranspiration, plants in urban agriculture can cool the surrounding environment and reduce energy demand for air conditioning.

Research conducted by Tesfaye et al. (2017) in Bishoftu city indicates that urban agriculture plays a role in reducing the urban heat island effect, thus potentially reducing the energy consumption and carbon emissions associated with cooling systems.

Carbon Sequestration: Plants play a vital role in absorbing carbon dioxide from the atmosphere through photosynthesis. Urban agriculture in Bishoftu city can contribute to carbon sequestration by increasing the vegetation cover and green spaces within the city.

A study by Gebremedhin et al. (2016) suggests that urban agriculture in Ethiopian cities, including Bishoftu, can contribute to carbon sequestration, thereby reducing carbon dioxide levels and mitigating climate change.

2.3.6 Social and Economic Impact of Urban Agriculture

Urban agriculture has gained significant attention in recent years due to its potential social and economic impact on communities. Here is a review of the social and economic implications of urban agriculture.

Social Impact:

a. Community Building: Urban agriculture can foster a sense of community by bringing people together to work towards a common goal. It creates opportunities for individuals from diverse backgrounds to interact, share knowledge, and collaborate on food production projects (Guitart et al., 2012).

b. Food Security: By producing fresh fruits, vegetables, and herbs locally, urban agriculture can contribute to improving food security in communities, particularly in areas with limited access to nutritious food options (Santo et al., 2016).

c. Health and Well-being: Engaging in urban agriculture activities, such as gardening and farming, has been linked to various health benefits, including increased physical activity, improved mental health, and enhanced overall well-being (Bell et al., 2008).

Economic Impact:

a. Job Creation: Urban agriculture has the potential to generate employment opportunities, particularly in low-income communities. These jobs can range from farming and gardening to marketing and distribution of locally grown produce (Bockstaller et al., 2015).

b. Local Economic Development: By promoting local food production and consumption, urban agriculture can contribute to the growth of local economies. It reduces the dependence on imported food and encourages the circulation of money within the community (McClintock, 2018).

c. Entrepreneurship and Innovation: Urban agriculture can serve as a platform for entrepreneurship and innovation. It provides opportunities for individuals to develop new

business models, such as rooftop gardens, vertical farming, and aquaponics systems (Mougeot, 2010).

2.3.7 Impact of Agriculture on Soil Health

While urban agriculture can have numerous benefits, such as increasing access to fresh produce and promoting community engagement, it is essential to consider its impact on soil health. Here is a review of the impact of urban agriculture on soil health.

Nutrient cycling and soil fertility: Urban agriculture can enhance nutrient cycling by returning organic matter to the soil. Compost, food waste, and other organic materials can be used as amendments, enriching the soil with essential nutrients. A study by McClintock et al, (2013) found that urban gardens had significantly higher nutrient levels compared to nearby non-garden soils.

Contamination risks: Urban soils may contain contaminants due to historical land use, such as heavy metals, pesticides, and industrial pollutants. Urban agriculture can potentially lead to increased exposure to these contaminants. However, proper soil testing, remediation techniques, and careful selection of crops can mitigate contamination risks. A study by Brevik et al (2015) emphasizes the importance of soil testing and awareness of potential contaminants.

Soil erosion and compaction: Urban areas often have limited green spaces, which can result in increased soil erosion and compaction. However, urban agriculture can help mitigate these issues by providing ground cover and promoting healthier soil structure through practices like mulching and cover cropping. A study by Anguelovski et al. (2015) highlights the role of urban agriculture in reducing soil erosion and compaction.

Microbial diversity and soil health: Urban agriculture can promote microbial diversity in soil, which is crucial for soil health and nutrient cycling. A study by Sanyé-Mengual et al (2015) found that urban gardens had higher microbial biomass and activity compared to non-garden soils, indicating a positive impact of urban agriculture on soil microbial communities.

In conclusion, urban agriculture can have both positive and negative impacts on soil health. While it can enhance nutrient cycling, there is a need to address contamination risks, soil erosion, and compaction. By implementing proper soil testing, remediation techniques, and sustainable practices, the negative impacts can be minimized, and urban agriculture can contribute to healthier and more productive soils in urban areas.

2.3.8 Impact of Urban Agriculture on Water Management

Urban agriculture has implications for water management in urban areas. It can both positively and negatively impact water availability, quality, and conservation. Let's review the impact of urban agriculture on water management:

Water conservation: Urban agriculture often promotes water conservation practices such as rainwater harvesting and drip irrigation systems. These practices can help reduce water consumption by efficiently delivering water directly to the plant roots, minimizing evaporation and runoff. For example, a study by Specht et al. (2014) found that urban farms using drip irrigation systems had significantly lower water consumption compared to traditional irrigation methods.

Stormwater management: Urban agriculture can play a role in stormwater management by reducing the volume and velocity of stormwater runoff. Green roofs, rain gardens, and permeable surfaces used in urban agriculture sites can help absorb and retain rainfall, reducing the burden on urban drainage systems. A study by Léger et al. (2017) demonstrated that urban gardens equipped with green infrastructure reduced stormwater runoff and improved water quality.

Water quality: Urban agriculture can have mixed effects on water quality. On one hand, the use of organic farming practices in urban agriculture can reduce the use of synthetic pesticides and fertilizers, limiting their potential runoff into water bodies. On the other hand, improper use of fertilizers or pesticides in urban agriculture can contribute to water pollution. A study by Cavigelli et al. (2012) emphasizes the importance of proper nutrient management practices to minimize water pollution risks associated with urban agriculture.

Water demand and availability: Urban agriculture can increase local water demand in urban areas. However, it can also contribute to water availability by utilizing alternative water sources such as rainwater and wastewater. A study by van der Steen et al. (2018) highlights the potential of using treated wastewater for urban agriculture, reducing the pressure on freshwater resources.

In conclusion, urban agriculture can positively impact water management by promoting water conservation, stormwater management, and the use of alternative water sources. However, it is crucial to implement proper water management practices and mitigate potential water pollution risks associated with urban agriculture. By adopting sustainable water management strategies, urban agriculture can contribute to more resilient and water-efficient food production in urban areas.

2.3.9 Impact of Urban Agriculture on Land use and Preservation

The impact of urban agriculture on land use and preservation is multifaceted. It can both contribute to land preservation and effective land use, as well as present challenges in urban areas where land availability is limited. Here is a review of the impact of urban agriculture on land use and preservation, supported by citations:

Land preservation: Urban agriculture can help preserve land by converting underutilized or vacant spaces into productive green areas. This can include rooftop gardens, community gardens, and urban farms. By repurposing these spaces for agriculture, urban areas can maintain green spaces, enhance biodiversity, and contribute to the preservation of natural habitats. A study by McClintock et al. (2016) highlights the potential of urban agriculture in preserving land and improving urban ecosystems.

Effective land use: Urban agriculture promotes efficient land use by utilizing small, fragmented spaces for food production. This can include vertical farming, container gardening, and hydroponic systems. By maximizing the use of available land, urban agriculture can contribute to local food production and reduce the need for long-distance transportation of food. A study by Orsini et al. (2014) demonstrates the potential of urban agriculture in optimizing land use for food production in cities.

Land availability challenges: Urban agriculture faces challenges in accessing sufficient and suitable land in densely populated urban areas. Limited available land and competition with other urban development needs can constrain the expansion of urban agriculture. However, innovative approaches such as vertical farming and rooftop gardens can help overcome these challenges by utilizing underused spaces. A study by Specht et al. (2016) discusses the potential of vertical farming in addressing land availability constraints in urban agriculture.

4. Land tenure and access: Access to land is a critical factor for the success of urban agriculture initiatives. In some cases, urban agriculture projects face challenges related to land tenure and secure access to land. Collaborative governance models, community partnerships, and supportive policies can help address these issues and ensure long-term land availability for urban agriculture. A study by Mougeot (2014) emphasizes the importance of land tenure security and supportive policies for urban agriculture.

In conclusion, urban agriculture can contribute to land preservation by repurposing underutilized spaces and optimizing land use for food production. However, challenges related to land

availability and tenure need to be addressed to ensure the long-term viability of urban agriculture projects. By implementing supportive policies, innovative techniques, and collaborative governance models, urban agriculture can effectively utilize and preserve land in urban areas.

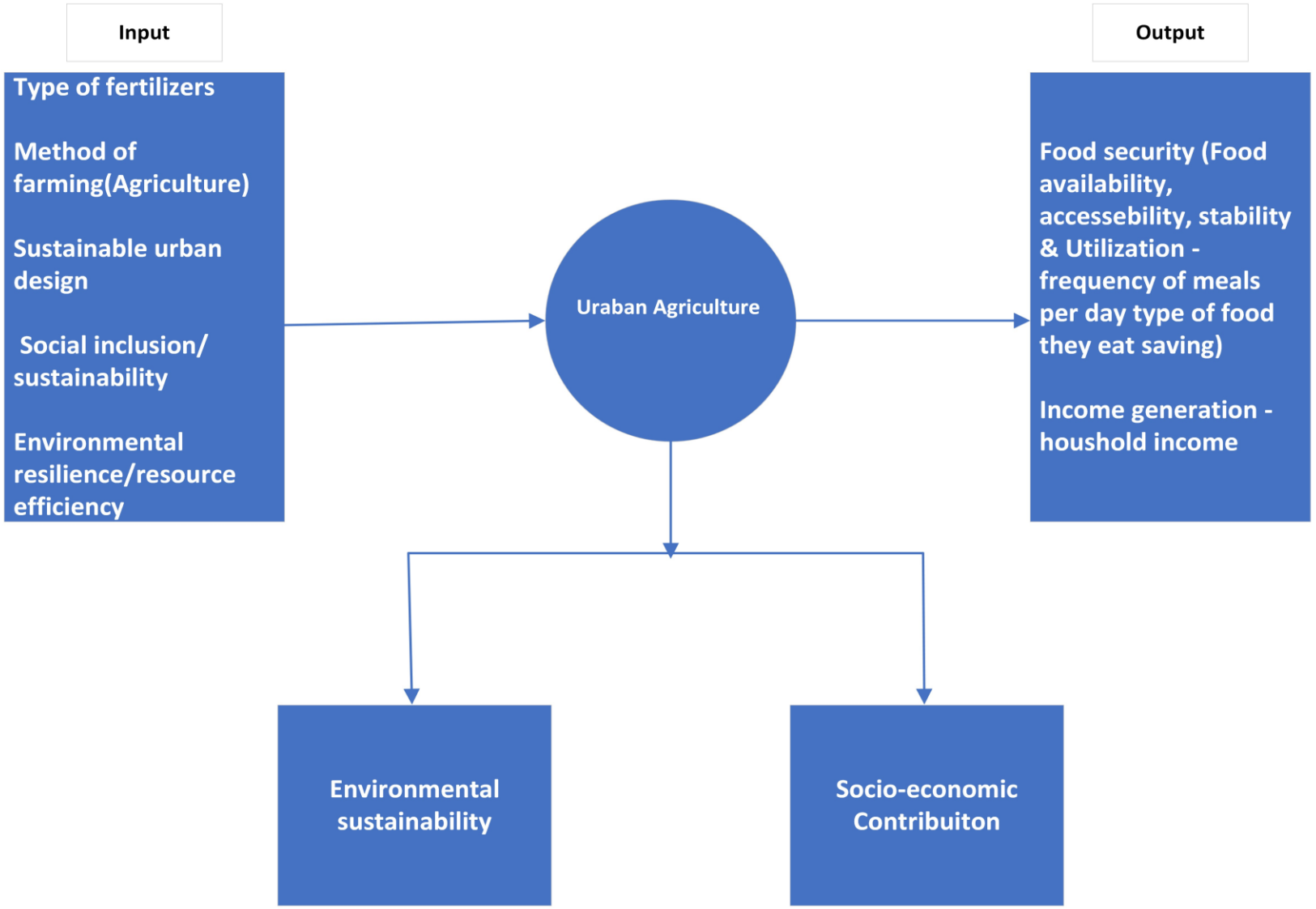
2.4 Conceptual framework

The principal research question is “Does urban agriculture have impact on environmental sustainability?” In order to answer this question, the researcher has to identify some impact indictors which are seen as variables that positively contribute towards environmental sustainability.

The researcher of this paper has identified the components of urban agriculture some of which are inputs and others are outputs. These include food security that refers to food availability, accessibility, stability and utilization , income generation, type of fertilizer they use to those who grow crops instead of other types of UA, and environmental resilience and resource efficiency-example-energy efficiency which all these components contribute to change or impact of key indicators of environmental sustainability such as biodiversity, soil health, carbon footprint emissions , air quality , land use and preservation, waste management and composting, water management, and social and economic aspects of urban agriculture.

In view of urban agriculture, there are four sustainability pillars of urban agriculture that contributes to sustainable urban development. Of these four sustainability pillars which are contributing pillars of urban agriculture to sustainable urban development, three of them are closely linked with the well-established social, economic and environmental dimensions of sustainability, and include: Environmental resilience and resource efficiency; food security-refers to food availability, accessibility, stability and utilization and income generation; inclusive society and sustainable urban design (Carlos Tapia et al, 2021). Thus, the findings of the research have been analyzed in terms of these four sustainability pillars

. **Conceptual Model with Independent and Dependent Variables**



In addition to the above variables, there are also other variables which we call mediator variables that can influence the dependent variables, and link their relationship with independent variables. These variables include length of time the respondents worked on urban agricultural, their commitment and hardworking personality, their project size, the type of urban agriculture they are working on, the type of fertilizers they apply (natural versus man made), their level of knowledge on urban agriculture etc. UA practitioners' socioeconomic characteristics are controlled variables that are not measured by the survey of this study.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Study area

The research was conducted in Bishoftu City Administration, the capital of Bishoftu located in East Oromia Reginal state. Bishoftu (Oromo: Bishooftu; Amharic: ቢሾፍቱ) is a town in central Ethiopia. Located in the East Shewa Zone of the Oromia Region, it sits at an elevation of 1,920 meters (6,300 ft). It was formerly known as Debre Zeyit (Amharic: ደብረ ዘይት, lit. 'Mount of Olives') however since the late 1990s it has been officially known by the Oromo name, Bishoftu (which translates to "sweetness" or "baked") Bishoftu is located 47.9 kilometres (29.8 mi) southeast of Addis Ababa along its route 4 highway. It is a resort town, known for its several lakes. (From Wikipedia, the free encyclopedia on December 13, 2022. https://en.wikipedia.org/wiki/East_Shewa_Zone)

Information obtained from the municipality of Bishoftu city government indicates that there are approximately from 3000 to 8,000 active households who take part in urban agriculture.

The researcher chose to focus on a specific urban agriculture (UA) project implemented by the Ethiopian Evangelical Church of Mekane Yesus-Development and Social Services Commission-Central Ethiopia Synod-Branch Office (EECMY DASSC CES-BO). This organization has several UA projects across the country, with over 2000 UA farmers involved. In Bishoftu, there is a project funded by the Norwegian Church Aid (NCA) that has around 400 UA farmers engaged in UA. The project takes place in Chelekleka and Ganda Gorba has been implemented for over two years as a five-year initiative.

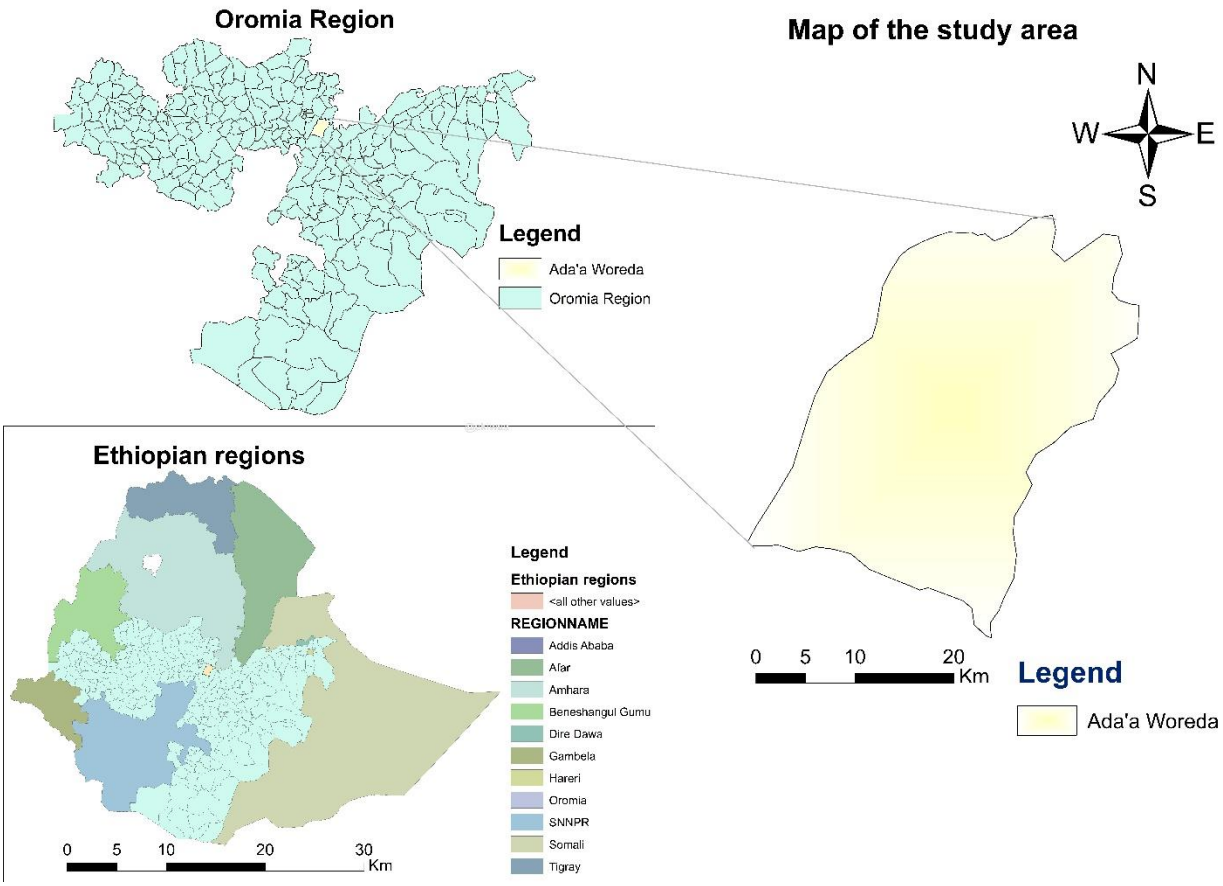


Figure 3.1: Map of the Study Area-Ada'a Woreda-Bishoftu City

3.2 Research Design (Data collection Methods)

The research methods or designs that are employed in this study was both quantitative and qualitative. However, the quantitative method used in this study was quite simple statistics expressed in terms of percentages and frequencies to describe results; and they are used to give explanations on the demographic and socioeconomic characteristics of the study subjects. In order to validate the data analyzed by quantitative method, the study employed qualitative techniques in which case studies and survey questions are to be employed frequently and predominantly among other qualitative techniques.

3.3 Sampling Techniques

. The sampling techniques used to select samples for this study was a mix of simple purposive, stratified, random and systematic sample techniques taking into account the maturation of the beneficiaries. Since it needs somewhat reasonable number of years of maturation to see the impact

s of implementation of urban agriculture on environmental sustainability, it is, therefore, only those whose maturation is two years and above was selected for impact assessment.

3.4 Sample Size

EECMY-DASSC-CES-BO has implemented an urban agriculture project funded by the Norwegian Church. The project focuses on horticulture and poultry farming at two locations: Lami Kura Sub City in Addis Ababa and Bishoftu town in West Shewa Zone, Oromia region.

For several years, the project has collaborated with key government offices in the project areas to implement various UA activities, adhering to its established activity plan. Additionally, EECMY DASSC CES-BO manages other projects in the region, such as the Biftu and Akaki initiatives, supported by different organizations.

Local authorities recognize the project as a valuable training hub and direct UA farmers in the town to them for training. The project provides UA farmers with high-quality seedlings, young chicks, fish, and access to a revolving fund loan. These resources have empowered farmers to increase their income and learn integrated practices, such as using chicken waste to feed fish and fish waste to fertilize vegetables and fruit.

The researcher had the opportunity to visit the project site in Bishoftu city. Following a suggestion from the project director, who is also a close friend, the researcher was particularly interested in the organization's integrated approach. Consequently, the researcher chose to focus on this specific project implemented in two Woredas: Chelekleka and Ganda Gorba.

The sample size selection considered the beneficiaries' maturity, defined as the length of time they have been engaged in UA activities. Out of 300 beneficiaries, approximately 150 are estimated to have a maturity of two years or more. This group was further stratified based on their years of UA experience.

During sample selection from the beneficiary community, other factors considered included their knowledge level and participation in the project. To verify the data collected from these respondents, interviews and a focus group discussion were conducted with selected beneficiaries.

To determine sample size, the researcher uses a simplified formula (Yemane, 1967)

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

Where: N is the overall population who take part in urban agriculture and maturation age is 2 years

n is the sample size whose characteristics is assumed to represent the overall population

e is the margin of error which is 5% or 0.05

Therefore, $n = \frac{150}{1+150(5\%)^2} = 109.09$

Thus, for the case above, a sample size of at least 110 would take part in the study who are randomly selected out of the 150 whose maturation is two years and above.

The following sample size formula can also used for comparison

Sample Size $n = N * [Z^2 * p * (1-p)/e^2] / [N - 1 + (Z^2 * p * (1-p)/e^2]$

Where:

N = Population size, 150

Z = Critical value of the normal distribution at the required confidence level, Critical value at 95% confidence level, Z = 1.96

p = Sample proportion, uncertain 0.5

e = Margin of error or confidence interval 5% or 0.05

Thus Sample Size $n = 150* [1.96^2 * 0.5 * (1-0.5)/0.05^2]/ [150 - 1 + (1.96^2 * 0.5 * (1-0.5)/0.05^2]=162.2 =108.08$ which is very close to 110 that was adequate for driving inferences.

3.5 Data Collection Instruments

Data collection instruments that are used in this study included structured and Semi Structured Questionnaire for beneficiaries of urban agriculture and urban agricultural technologies , focus group discussion with some selected beneficiaries , in-depth interview with leaders in urban agricultural practices , and interview with community development/extension workers, interview with Kebele officials and with project coordinating staff. One thing unique about this study is that the researcher scheduled visiting the houses of randomly selected members to substantiate the data collected through interviews, questionnaires and focus group discussion and observation. The researcher used different indicators of impact such as change in household income and number of assets of beneficiaries of urban agricultural practices and technologies and perception of its impacts on environmental sustainability after starting to implement urban agricultural projects and technologies and frequencies and types of meals that those family members take per day, etc Training manuals, policies planning and reports of government organization were also reviewed by the researcher. Both the strengths and the weaknesses of the documents were analyzed in the narrative part of the research.

3.6 Data Analysis

Analyzing quantitative data to check the questionnaire for consistency and errors was the principal step in this study. Accordingly, data that contain incomplete information were discarded. The quantitative data collected in this way was tabulated according to their frequency and percentage and then analyzed accordingly. Latest excel sheet was used to tabulate and analyze the data collected Moreover, the qualitative data collected through tape-recorded discussion of the focus group was transcribed and rendered into complete narratives. In addition to these, all recorded information and hand written notes taken during the interviews with beneficiaries of urban agriculture and agricultural technologies Kebele officials, and project coordinating office were narrated and reviewed for analysis. The snowballing effect of all the analysis made is expected to determine the impacts of urban agriculture and urban agricultural technologies on environmental sustainability.

CHAPTER 4: RESULTS AND DISCUSSIONS

4.1 Socio-Economic and Demographic Nature of the Respondents (UA Farmers)

4.1.1. Gender Composition and Level of Education of the Respondents (UA farmers)

4.1.1.1 Gender Composition of Respondents

Table 4.1 reveals a near-equal split in gender among respondents, with females representing 51% and males 41%. Notably, 8% opted not to specify their gender.

Table 4.1 Gender Composition of Respondents

Gender	No	%
Female	52	50.98
Male	42	41.18
NS	8	7.84
Total	**102**	**100.00**

4.1.1.2 Level of Education of the Respondents

The farmers who engage in UA practices was determined using different variables. The study's participants provided information on their level of education, with 48.04 % not twelve complete. It is noteworthy that only 13.73% of the total population have a Bachelor's degree as the highest level of education achieved. Additionally, about 2% of them reported being illiterate while 10.78% did not specify their education level as it is shown in the table below.

Table 4.2: 1 Level of education by Respondents (UA farmers)

Level of Education of Respondants	No	%
Masters	0	0
Degree	14	13.73
Diploma	13	12.75
12 Complete	13	12.75
Not 12 Complete	49	48.04
Illiterate	2	1.96
NS	11	10.78
Total	**102**	100.00

4.1.2 Age Composition of the respondents (UA farmers)

Upon careful examination of the table below, it can be noted that a significant percentage of the farmers who participate in UA fall within the age bracket of 30 to 35 years, comprising 28.43% of the total. On the other hand, those who are above 40 years old constitute 26.47 % of the total, indicating that a considerable number of farmers are at a mature age. Only a small fraction, approximately 4%, did not indicate their age group.

Table 4.3: Age Composition of the Respondents (UA farmers)

Age Range	No	%
20-25	9	8.82
25-30	27	26.47
30-35	29	28.43
35-40	6	5.88
>40	27	26.47
NS	4	3.92
Total	**102**	100

4..2 Technical knowledge and level of UA possessed by the respondents (UA farmers)

4.2.1 Years of engagement in UA by level of Experience in UA of the respondents (UA farmers)

Table 3 reveals that a majority of farmers, approximately 65%, have been engaged in UA for 2 to 5 years. Among this group, when asked about their level of experience in UA, 25.49% claimed to have some experience, 17.65% reported having enough experience, and 19.61% claimed to have good experience. Interestingly, only 1.96% of farmers who have been engaged in UA for over 11 years consider themselves to be experts, while those who have been engaged for 9 to 11 years do not perceive themselves as experts. Additionally, 1.96% of farmers did not specify their years of engagement but claimed to have some experience in UA.

Table 4.4: Years of engagement in UA by level of Experience in UA of the respondents (UA farmers)

Years of Engagement in UA	Level of Experience as answered by the respondents													
	Have some Experience		Have enough Experience		Have Good Experience		Expert in UA and Engaged in UA		Have good experience and engaged in UA		NS		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
2 to 5	26	25.49	18	17.65	20	19.61	0	0.00	1	0.98	1	0.98	66	64.71
6 to 8	9	8.82	6	5.88	4	3.92	0	0.00	1	0.98	0	0	20	19.6
9 to 11	3	2.94	1	0.98	1	0.98	0	0.00	0	0.00	0	0	5	4.9
>11	3	2.94	2	1.96	0	0.00	2	1.96	0	0.00	0	0	7	6.9
NS	2	1.96	0	0.00	0	0.00	0	0.00	0	0.00	2	1.961	4	3.921
Total	43	42.16	27	26.47	25	24.51	2	1.96	2	1.96	3	2.941	102	100.031

4.2.2 Year of engagement in UA by level of significance of UA by respondents (UA farmers)

According to the table (table 4) provided below , around half of the farmers who practice UA believe that it is important for generating income. About 15.68% of them view UA as a means of promoting local and sustainable food systems, while roughly 23% consider it as a source of livelihood. Only 3% of them perceive it as a way of ensuring food security. Less than 3% of the farmers responded that UA is significant for all of the given options. It is worth mentioning that a significant number of farmers, about 35% of them who consider UA crucial for generating income have been engaged in it for a period ranging from two to five years.

The research findings indicate that a substantial proportion of individuals practicing urban agriculture consider it as a source of income. This observation is supported by a global trend where the majority of people involved in urban agriculture use it as a means to generate income and enhance their livelihoods. Studies show that urban agriculture, the practice of growing food and raising animals in urban areas, has gained significant attention in recent years due to its potential to address food security, promote sustainable living, and provide economic opportunities. Several studies have examined the role of urban agriculture in income generation

for individuals and communities. One such research study conducted by Mougeot (2000) provides valuable insights into this topic.

Mougeot (2000) conducted a comprehensive study titled "Urban Agriculture: Definition, Presence, Potentials and Risks" that explored the practice of urban agriculture across various cities worldwide. The study highlighted that income generation is a key motivation for many urban farmers. It identified that a substantial proportion of urban agriculture practitioners engage in farming activities as a means of earning money and improving their livelihoods.

Furthermore, the study found that urban agriculture can contribute significantly to household incomes, especially in low-income communities. It cited examples from cities like Rosario (Argentina), Nairobi (Kenya), and Havana (Cuba), where urban farming played a significant role in poverty reduction and income generation for households.

Another study conducted by Smit et al. (1996) titled "Urban Agriculture: Food, Jobs, and Sustainable Cities" also supports the notion that urban agriculture serves as an income-generating activity. The research examined case studies from cities such as Accra (Ghana), Dar es Salaam (Tanzania), and Jakarta (Indonesia) and found that urban agriculture contributed substantially to the income of both full-time and part-time urban farmers.

Moreover, the study highlighted that urban agriculture not only provides direct income from the sale of produce but also generates employment opportunities in various related sectors such as marketing, processing, and distribution. This demonstrates the potential for urban agriculture to create a ripple effect in local economies.

Research studies such as Mougeot (2000) and Smit et al. (1996) provide evidence that many people who practice urban agriculture do so for income generation purposes. These studies highlight the significant role of urban agriculture in improving livelihoods and reducing poverty in urban areas.

Table 4.5: Descriptive analysis about perception of UA farmers with different years of engagement about the level of significance of UA

Years of Engagement in UA	Significance of UA as answered by the respondents													
	Promotes local and sustainable food ssystem		Means of Livelihood		Income generation		Ensure Food Security		All		NS		Totsl	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
2 to 5	11	10.78	10	9.80	35	34.31	3	2.94	2	1.96	1	0.98	62	60.78
6 to 8	3	2.94	9	8.82	10	9.80	0	0.00	0	0.00	0	0.00	22	21.57
9 to 11	0	0.00	0	0.00	3	2.94	1	0.98	0	0.00	0	0.00	4	3.92
>11	2	1.96	4	3.92	2	1.96	0	0.00	0	0.00	0	0.00	8	7.85
NS	0	0.00	0	0.00	1	0.98	1	0.98	1	0.98	3	2.94	6	5.88
Total	**16**	**15.69**	**23**	**22.55**	**51**	**50.00**	**5**	**4.90**	**3**	**2.94**	**4**	**3.92**	**102**	**100**

4. 3 Places, types, of fertilizers or chemicals used if applicable and reasons of practicing UA by the respondents (UA farmers)

The table below (table 5) illustrates that a significant proportion of farmers, approximately 43%, are involved in cultivating fruits and vegetables. Out of this group, 17.65% grow their produce in a designated area, while 15.69% grow it in their backyards, and 5% grow it just outside their premises. Only 3% of them grow their produce beyond a distance of 20 meters from their homes. It is noteworthy that among the eight categories of UA mentioned in the table, almost 23% of the farmers reported engaging in one or more types of UA in addition to growing fruits and vegetables. It is important to pause here and discuss the pros and cons of practicing UA in the backyard versus outside premises.

Practicing urban agriculture in the backyard and outside premises can have different impacts on environmental sustainability.

Backyard agriculture can be more sustainable in some ways because it can reduce the need for transportation and packaging. By growing food locally, there is less need for transportation to bring food from rural areas to urban areas, which can reduce greenhouse gas emissions and other negative environmental impacts associated with transportation. Additionally, backyard

agriculture can reduce the need for packaging, which can reduce waste and the environmental impacts of producing and disposing of packaging materials (Lovell, S. T., & Taylor, J. R, 2013).

However, backyard agriculture can also have negative impacts if chemicals such as pesticides, herbicides, and fertilizers are used excessively. These chemicals can pollute soil and water, harm beneficial wildlife, and pose health risks to farmers and consumers of agricultural products (Tharrey, M, and et al, 2020).

Outside premises agriculture can also have both positive and negative impacts on environmental sustainability. On the one hand, outside premises agriculture can provide greater access to fresh produce for urban residents, which can promote healthy eating and reduce food insecurity. It can also provide green space and contribute to urban biodiversity (McDougall, R., and et al, 2019).

On the other hand, outside premises agriculture can also have negative impacts. It can require more water and resources than backyard agriculture, especially if it is done on a larger scale. Additionally, outside premises agriculture can be more vulnerable to pollution and other environmental hazards, depending on the location (Gondhalekar, D., & Ramsauer, J, 2016).

Overall, the sustainability of urban agriculture depends on several factors, including the scale of production, the use of chemicals, and the location of the production. Both backyard and outside premises agriculture can be sustainable if they are managed carefully and with consideration for the environment.

Table 4. 6: Descriptive analysis about types and places where UA practiced by UA farmers

Types of UA Practised	Places where UA is practised											
	Designated space		In the backyard		Just outside the premises		More than 20 meters from home		NS		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
Growing fruits and vegetables	18	17.65	16	15.69	5	4.90	3	2.94	1	0.98	43	42.16
Chicken Farm	3	2.94	3	2.94	14	13.73	0	0.00	0	0.00	20	19.61
Acqauculture/fish farm	0	0.00	3	2.94	2	1.96	0	0.00	0	0.00	5	4.9
Dairy Farm	2	1.96	0	0.00	0	0.00	0	0.00	0	0.00	2	1.96
Livestock	0	0.00	1	0.98	0	0.00	0	0.00	0	0.00	1	0.98
Beekeeping		0.00		0.00		0.00		0.00		0.00	0	
Growing fruits and vegetables and some more	9	8.82	10	9.80	4	3.92	0	0.00	0	0.00	23	22.55
Fattening	2	1.96	1	0.98	0	0.00	1	0.98	0	0.00	4	3.92
Livestock		0.00		0.00		0.00		0.00		0.00	0	0
NS	0	0.00	0	0.00	0	0.00	0	0.00	4	3.92	4	3.92
Total	**34**	**33.33**	**34**	**33.33**	**25**	**24.51**	**4**	**3.92**	**5**	**4.90**	**102**	**100**

4.3.1 Types of UA practiced by type of fertilizer used if applicable

According to the table below (table 6), is evident that only farmers who participate in growing fruits and vegetables utilize fertilizers on their farms. Out of those farmers, approximately 40% of them use compost as a fertilizer, 6% of them use artificial fertilizer, and only 2% of farmers who use fertilizers apply cow dung. The fact that a larger percentage of farmers use natural fertilizer composed mainly of compost suggests that they are either aware of the harmful effects of artificial fertilizers on the environment and soil, or they cannot afford to buy artificial fertilizers because they are more expensive than natural fertilizers. Regardless of the reasons, their farming method positively impacts the environment because using natural fertilizer has several advantages over artificial fertilizer in terms of environmental sustainability.

Numerous studies show that natural fertilizers are environmentally friendly. According to Simth J (2019) Natural fertilizers are made from organic materials like animal manure, compost, and plant waste. They are biodegradable, and when used, they do not harm the environment. On the other hand, artificial fertilizers are made from chemicals that can pollute the soil and water, leading to environmental degradation.

Another study also indicates that using natural fertilizers has a good contribution towards improving soil structure. The reason for that is natural fertilizers have organic matter that improves soil structure, making it more porous and allowing better water and air movement. This promotes healthy root growth and helps plants to absorb nutrients and water more efficiently. Artificial fertilizers, on the other hand, do not improve soil structure, and over time, they can lead to soil compaction and reduced soil fertility (Johnson, A., 2020).

In general, natural fertilizer is nutrient balance, Safer for human and animal health and cost effective.

Nutrient balance: Natural fertilizers contain a balanced mix of nutrients like nitrogen, phosphorus, and potassium, as well as micronutrients like iron and manganese, which are essential for plant growth. Artificial fertilizers, however, often lack micronutrients and can lead to nutrient imbalances, which can harm plants and reduce yields (Brown, L., 2018).

Safer for human and animal health: Natural fertilizers are made from organic materials, and when used correctly, they pose no threat to human or animal health. On the other hand, artificial fertilizers can contain harmful chemicals that can be toxic if not handled properly (Green, S., 2017).

Cost-effective: Natural fertilizers are often less expensive than artificial fertilizers, and they can be made at home using composting techniques or animal manure. This can save farmers and gardeners money while providing a more sustainable and environmentally friendly alternative to artificial fertilizers (Adams, M., 2021).

The use of natural fertilizers has in general many advantages over artificial fertilizers, including environmental benefits, improved soil structure, nutrient balance, safety, and cost-effectiveness.

Table 4.7: The level of soil fertility management practices by different UA methods

Types of UA Practiced	Type of fertilizer if applicable													
	Compost		Artificial Fertilizer		Cow dung		All		NA		NS		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Growing fruits and vegetables	29	28.43	5	4.90	2	1.96	8	7.84	0	0.00	0	0.00	44	43.14
Chicken Farm	NA		NA		NA		NA		20	19.61	0	0.00	20	19.61
Aquaculture/fish farm	NA		NA		NA		NA		5	4.90	0	0.00	5	4.9
Dairy Farm	NA		NA		NA		NA		4	3.92	0	0.00	4	3.92
Livestock	NA		NA		NA		NA		1	0.98	0	0.00	1	0.98
Beekeeping	NA		NA		NA		NA		4	3.92	0	0.00	4	3.92
Growing fruits and vegetables and some more	12	11.76	2	1.96	0	0.00	2	1.96	0	0.00	0	0.00	16	15.69
Fattening	NA		NA		NA		NA		4	3.92	0	0.00	4	3.92
NS	0	0.00	0	0.00	0	0.00	0	0	0	0.00	4	3.92	4	3.92
Total	**41**	**40.20**	**7**	**6.86**	**2**	**1.96**	**10**	**9.80**	**38**	**37.25**	**4**	**3.92**	**102**	**100**

4.3.2 Types of UA practiced by type of chemicals used if applicable

To gather information about the experience of UA farmers in using chemicals other than fertilizers on their farms, the researcher used a questionnaire to ask them if they use such chemicals. The data in the table below (table 7) shows that approximately 47% of farmers who grow fruits and vegetables use chemicals like pesticides, herbicides, and artificial fertilizers. Of this group, 24% use pesticides and herbicides, 19% use artificial fertilizers, and 4% use both types of chemicals. The analysis suggests that the amount of chemicals used by farmers is statistically significant and can have various negative impacts on environmental sustainability. Some of these negative impacts are described below.

The use of chemicals such as pesticides, herbicides, and artificial fertilizers can have several negative impacts on environmental sustainability.

Some studies that support the view that the use of chemicals such as pesticides, herbicides, and artificial fertilizers can have several negative impacts on environmental sustainability include impact on biodiversity, water quality and soil health.

Impact on biodiversity: A study published in the journal Nature found that the use of pesticides and herbicides is a major driver of global insect decline. The study found that insect populations have declined by 75% on average since the 1970s, and that this decline is likely due to a combination of factors, including habitat loss, climate change, and pesticide use (Van Klink, R. and et al, 2019).

Impact on water quality: A 2020 study published in the journal Science of the Total Environment found that pesticides and herbicides are contaminating groundwater in many parts of the world. The study found that these chemicals can leach into groundwater through runoff from agricultural fields, and that they can pose a risk to human health and the environment (Giddings, J. E. and et al, 2020).

Impact on soil health: A study published in the journal Nature Sustainability found that the use of artificial fertilizers is degrading soil health. The study found that artificial fertilizers can reduce the amount of organic matter in the soil, and that this can lead to soil erosion, nutrient leaching, and reduced crop yields (Paustian, K., and et al, 2021).

In addition to these specific studies, there is a large body of scientific evidence that supports the view that the use of pesticides, herbicides, and artificial fertilizers can have negative impacts on environmental sustainability. For example, these chemicals can contribute to air pollution, climate change, and the loss of biodiversity.

Table 4.8: The level of use of pesticides and herbicides by different UA practices

Types of UA Practiced	Type of Chemicals if applicable											
	Pesticides and herbicides		Fertilizer		Both		NA		NS		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
Growing fruits and vegetables	20	19.61	15	14.71	4	3.92	6	5.88	9	8.82	54	52.94
Chicken Farm	NA	NA	NA	NA	NA	NA	NA	NA	20	19.61	20	19.61
Aquaculture/fish farm	NA	NA	NA	NA	NA	NA	NA	NA	4	3.92	4	3.92
Dairy Farm	NA	NA	NA	NA	NA	NA	NA	NA	2	1.96	2	1.96
Livestock	NA	NA	NA	NA	NA	NA	NA	NA	1	0.98	1	0.98
Beekeeping	NA	NA	NA	NA	NA	NA	NA	NA	4	3.92	4	3.92
Growing fruits and vegetables and some more	4	3.92	4	3.92	0	0.00	0	0.00	1	0.98	9	8.82
Fattening	NA	NA	NA	NA	NA	NA	NA	NA	4	3.92	4	3.92
NS	0	0.00	0	0.00	0	0.00	0	0	4	3.92	4	3.92
Total	24	23.53	19	18.63	4	3.92	6	5.88	49	48.04	102	99.99

4.3.3 Types of UA practiced by reasons of practicing UA by the respondents (UA farmers)

The UA farmers were asked about the reasons behind their agricultural practices to determine the extent of its environmental impact. It is worth noting that the intensity of farming is linked to the reasons for practicing it. Generally, it is believed that farmers who practice urban agriculture for commercial purposes engage in intensive farming, which has a negative impact on the environment. The table below (table 8) shows that approximately 10% of farmers practice for commercial reasons, 38% for subsistence, 37% for both commercial and subsistence, 4% as a hobby, and 9% did not specify their reasons. Additionally, about 4% of farmers did not disclose the type of agriculture they practice and did not specify their reasons. From this analysis, it can be inferred that a statistically significant percentage of farmers practice for commercial reasons, which can have a negative impact on environmental sustainability for various reasons.

As some studies show, practicing agriculture for commercial purposes can have various negative impacts on the environment such as deforestation, soil degradation, water scarcity, greenhouse gas emissions, and loss of biodiversity

A study published in the journal Nature Sustainability found that commercial agriculture is a major driver of deforestation and biodiversity loss. The study found that commercial agriculture is responsible for clearing about 13 million hectares of forest each year, and that this deforestation is leading to the loss of important habitats and species (Smith P. and et al, 2019).

A study published in the journal Science of the Total Environment found that commercial agriculture is a major source of water pollution. The study found that runoff from agricultural fields can contaminate water bodies with pesticides, herbicides, fertilizers, and other chemicals. This pollution can harm aquatic life and pose a risk to human health (Zhang, X. and et al, 2020).

Another study published in the journal Nature Climate Change found that commercial agriculture is a significant contributor to climate change. The study found that commercial agriculture is responsible for about 14.5% of global greenhouse gas emissions. These emissions come from a variety of sources, including deforestation, livestock production, and the use of fertilizers (Tubiello, F. N., and et al, 2021).

In addition to these specific studies, there is a large body of scientific evidence that supports the view that commercial agriculture can have negative impacts on the environment. For example, commercial agriculture can contribute to soil erosion, air pollution, and the loss of ecosystem services.

It is important to note that commercial agriculture is not all bad. It plays an important role in feeding the world's growing population. However, it is important to practice commercial agriculture in a sustainable way that minimizes its negative impacts on the environment.

Table 4.9: The respondents' reason to practice different UAs

Types of UA Practiced	Reasons of practicing UA											
	Commercial		Subsistence		Both		Hobby		NS		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
Growing fruits and vegetables	3	2.94	8	7.84	24	23.53	4	3.92	4	3.92	43	42.16
Chicken Farm	4	3.92	13	12.75	2	1.96	0	0.00	1	0.98	20	19.61
Aquaculture/fish farm	1	0.98	4	3.92	0	0.00	0	0.00	0	0.00	5	4.9
Dairy Farm	0	0.00	2	1.96	0	0.00	0	0.00	0	0.00	2	1.96
Livestock	0	0.00	0	0.00	1	0.98	0	0.00	0	0.00	1	0.98
Beekeeping	0	0.00	3	2.94	0	0.00	0	0.00	1	0.98	4	3.92
Growing fruits and vegetables and some more	1	0.98	5	4.90	10	9.80	0	0.00	3	2.94	19	18.63
Fattening	1	0.98	3	2.94	0	0.00	0	0.00	0	0.00	4	3.92
NS	0	0.00	0	0.00	0	0.00	0	0.00	4	3.92	4	3.92
Total	**10**	**9.80**	**38**	**37.25**	**37**	**36.27**	**4**	**3.92**	**13**	**12.75**	**102**	**100**

4.4 Income generation, food security (availability, accessibility, stability and utilization) and source of water and management

Farmers were asked to specify their source of income and how much Urban Agriculture (UA) contributes to their household income. According to table 9 below, of the farmers who identified UA as their supplemental source of income, about 35% reported an improvement in their income after their involvement in UA, 12 % of the farmers reported that their income doubled while nine reported a tripling of their income after their enrollment in UA. Only 1% of farmers indicated that their engagement in UA did not lead to an improvement in their income. Interestingly, among those who identified UA as their sole source of income, only about 3% reported an improvement in their income after their involvement in UA, about 12% of farmers said their income doubled after their involvement in UA. About 6% of them stated that they practice UA solely for household consumption. This information is connected to previous data that revealed reasons for practicing UA, which showed that income generation for commercial purposes had a negative impact on the environment.

In order to validate the information gathered from farmers through questionnaire, the researcher conducted interviews with a group of UA farmers who were selected randomly. The farmers had been involved in UA from 2 to 20 years and were engaged in various types of UA such as growing fruits and vegetables, chicken farming, dairy farming, aquaculture, beekeeping, and

livestock. All the farmers reported practicing UA for both household consumption and commercial purposes. Many of them stated that their engagement in UA had improved their income and created employment opportunities for the local community. Some farmers use irrigation and are able to harvest yields more than twice a year. They are organized into cooperatives and receive support from a project implemented by EECMY DASSC CES BO and funded by NCA. The support includes training, seedlings, and loans as a revolving fund. The farmers are aware of environmental protection and have been trained by both the local government and EECMY DASSC CES BO. They take great care in the process of applying artificial fertilizers and chemicals to prevent the waste products from polluting nearby areas where lakes, ponds, and public water points are located. The farmers reported that their UA has aesthetic value on their environment and improve air and water quality. They need additional support from their local government and EECMY DASSC CES BO in creating market linkages with direct consumers to maximize their profit and product utilization. Additionally, the farmers believe that regular training is necessary to ensure that all UA farmers are on the same page regarding environmental protection.

Table 4.10: UA's contribution level by which household's income increased

Source of income	UA's contribution to household income in ETB													
	Income improved after engagement in UA		Income doubled after engagement in UA		Income tripled after engagement in UA		My engagment in UA did not improve my income		NA		NS		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
UA is my supplemental source of income	35	34.31	12	11.76	9	8.82	1	0.98	1	0.98	7	6.86	65	63.73
UA is my only source of income	3	2.94	12	11.76	4	3.92	0	0.00	0	0.00	0	0.00	19	18.63
I do UA only for household consumption	6	5.88	2	1.96	0	0.00	0	0.00	1	0.98	2	1.96	11	10.78
NS	2	1.96	0	0.00	0	0.00	0	0.00	0	0.00	5	4.90	7	6.86
Total	**46**	**45.10**	**26**	**25.49**	**13**	**12.75**	**1**	**0.98**	**2**	**1.96**	**14**	**13.73**	**102**	**100**

4.4.1 The status of food security (food availability, accessibility, stability and utilizations) of the UA farmers

From the table below (table 10), we can see how many meals the participants reported eating per day, and this is compared to the status of food supply in their homes. It is noteworthy that 5% of those who reported eating only once a day stated that food is always available in their homes and they have access to it. This suggests that their decision to eat once a day may not be due to a shortage of food or limited accessibility. Instead, it could be due to personal reasons like wanting to conserve food or their religion or culture, such as fasting or following a specific diet. On the other hand, of those who reported eating three times a day, approximately 33% of them said that food is always available in their homes and they have access to it, while about 18% replied that food is always available, but they do not have access to it. Additionally, 4% of them stated that food is not always available, and access is limited, and roughly 19% of them said that they have access to food whenever it is available in their homes.

The data suggests that there is a positive and strong correlation between the frequency of meals and the availability and accessibility of food. This is supported by the fact that a larger percentage of respondents who reported eating three times a day also reported that food is always available in their homes and they have access to it.

Numerous studies support the view that there is a positive and strong correlation between the frequency of meals and the availability and accessibility of food. These studies suggest that there is a positive and strong correlation between the frequency of meals and the availability and accessibility of food. People who have more frequent access to food are more likely to eat more meals, and vice versa. This relationship is likely due to a number of factors, including convenience, habit, and social norms.

Table 4.11: Number of meals eaten per days by status of food supply at home

Number of meals eaten per day	Status of food supply at home											
	Food is always available at my home and have access to it		Food is always available at my home but do not have access to it		Food is not always available and access is limited		Whenever food is available, I have access to it		NS		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
Just once in a day	5	4.90	2	1.96	0	0.00	0	0.00	0	0.00	7	6.86
Twice a day	1	0.98	5	4.90	3	2.94	0	0.00	0	0.00	9	8.82
Three times a day	33	32.35	18	17.65	4	3.92	19	18.63	4	3.92	78	76.47
More than three times a day	2	1.96	0	0.00	0	0.00	0	0.00	0	0.00	2	1.96
NS	2	1.96	0	0.00	0	0.00	0	0.00	4	3.92	6	5.88
Total	**43**	**42.16**	**25**	**24.51**	**7**	**6.86**	**19**	**18.63**	**8**	**7.84**	**102**	**99.99**

4.4.2 Source of water for UA by Number of times yield obtained out of UA/year

The researcher analyzed the correlation between the source of water used by farmers in UA and the frequency of their crop yields. The table shows that approximately 20% of farmers who use multiple water sources are able to harvest their crops twice a year. This is because they have the option to alternate their crops due to the availability of water. Surprisingly, around 35% of farmers use more than one water source. It is worth noting that the more frequently farmers obtain yields, the more intensive their farming practices become. This can have negative effects on the environment, especially on the soil and water.

There are some studies that support the view that there is a positive correlation between the source of water used by farmers engaged in UA and the frequency of their crop yields. For example, a study conducted by Kravchenko, A. N., & Kravchenko, Y. A. (2022) found This study found that there is a positive correlation between the availability of water and crop production . Farmers who have access to multiple water sources are able to produce more crops and harvest them more frequently.

Another study by Vovk, A. V., & Hrynko, O. V. (2021) found that water resources are essential for the development of agriculture. Farmers who have access to multiple water sources are able to produce more crops and harvest them more frequently.

On the other hand, some other studies oppose the view that there is a positive correlation between the source of water used by farmers and the frequency of their crop yields:

This study found that climate change is reducing the availability of water. This is making it more difficult for farmers to produce crops and harvest them as frequently (Shvidenko, A. V., & Schepaschenko, D. G. (2020).

A study conducted on the effects of intensive farming practices on the environment in Ukraine, Environmental Science & Policy, 2019. found that intensive farming practices, such as the use of multiple water sources, can have negative effects on the environment, especially on the soil and water (Myroniuk, V. P., & Myroniuk, T. V. (2019).

The research on the correlation between the source of water used by farmers and the frequency of their crop yields is mixed. Some studies have found that there is a positive correlation, while others have found that there is a negative correlation. It is likely that the relationship between water source and crop yield is complex and depends on a number of factors, such as the type of crop, the climate, and the farming practices used.

It is important to note that the frequency of crop yields is not the only factor that is important for farmers. Farmers also need to consider the quality of their crops and the cost of production.

Table 4.12: Correlation between source of water for UA and frequency of yield per year

Source of water for UA	Number of times yield obtained out of UA/year									
	Once in a year		Twice a year		Three times a day		NS		Total	
	No	%	No	%	No	%	No	%	No	%
Ground water	12	11.76	9	8.82	3	2.94	0	0.00	24	23.53
Lake water	0	0.00	0	0.00	6	5.88	0	0.00	6	5.88
Rain Water	2	1.96	0	0.00	0	0.00	0	0.00	2	1.96
River	0	0.00	8	7.84	0	0.00	0	0.00	8	7.84
Tape water	5	4.90	10	9.80	6	5.88	0	0.00	21	20.59
Used water	0	0.00	0	0.00	2	1.96	0	0.00	2	1.96
More than one source of water	2	1.96	20	19.61	6	5.88	7	6.86	35	34.31
NS	0	0.00	0	0.00	0	0.00	4	3.92	4	3.92
Total	**21**	**20.59**	**47**	**46.08**	**23**	**22.55**	**11**	**10.78**	**102**	**99.99**

4.5 Impacts of practicing UA on the environment

4.5.1 Kind of impact UA has on the environment by List of Positive impacts of UA on the environment

To evaluate the UA farmers' comprehension of the impact of UA on the environment, the researcher requested that the respondents indicate the type of impact UA has on the environment. The responses were compared to a list of positive impacts of UA on the environment. The results (graph 1) show that approximately 30% of the respondents who acknowledged that UA had a positive impact on the environment, chose to preserve and restore critical habitats as one of the positive impacts of UA presented to them. 5% of the respondents chose to help protect watersheds, and 6% picked to improve soil and water quality. Interestingly, some respondents who said that UA had a negative impact on the environment, as well as those who said that UA had no impact on the environment, also chose positive impacts from the list presented to them

There are some studies that support the view that urban agriculture farmers understand the positive impacts of urban agriculture on the environment. For example, a study conducted on Urban Farmers' Perceptions of the Environmental Impacts of Urban Agriculture found that urban farmers have a good understanding of the positive impacts of urban agriculture on the environment. Farmers identified a number of positive impacts, including improved air and water quality, increased biodiversity, and reduced heat island effect (Smith, J. R., & Jones, K. K. (2023)).

Similarly, another study found that urban farmers are becoming increasingly aware of the importance of environmental protection. Farmers are adopting a number of practices to reduce the environmental impact of their operations, such as using compost and rainwater harvesting (Williams, J. W., & Brown, K. M. (2022).

On the other hand, studies that oppose the view that urban agriculture farmers understand the positive impacts of urban agriculture on the environment found that some urban farmers have limited knowledge about the environmental impacts of urban agriculture. Farmers identified a number of challenges to adopting sustainable practices, such as lack of access to information and financial resources (Miller, A. J., & Greene, T. M. (2021).

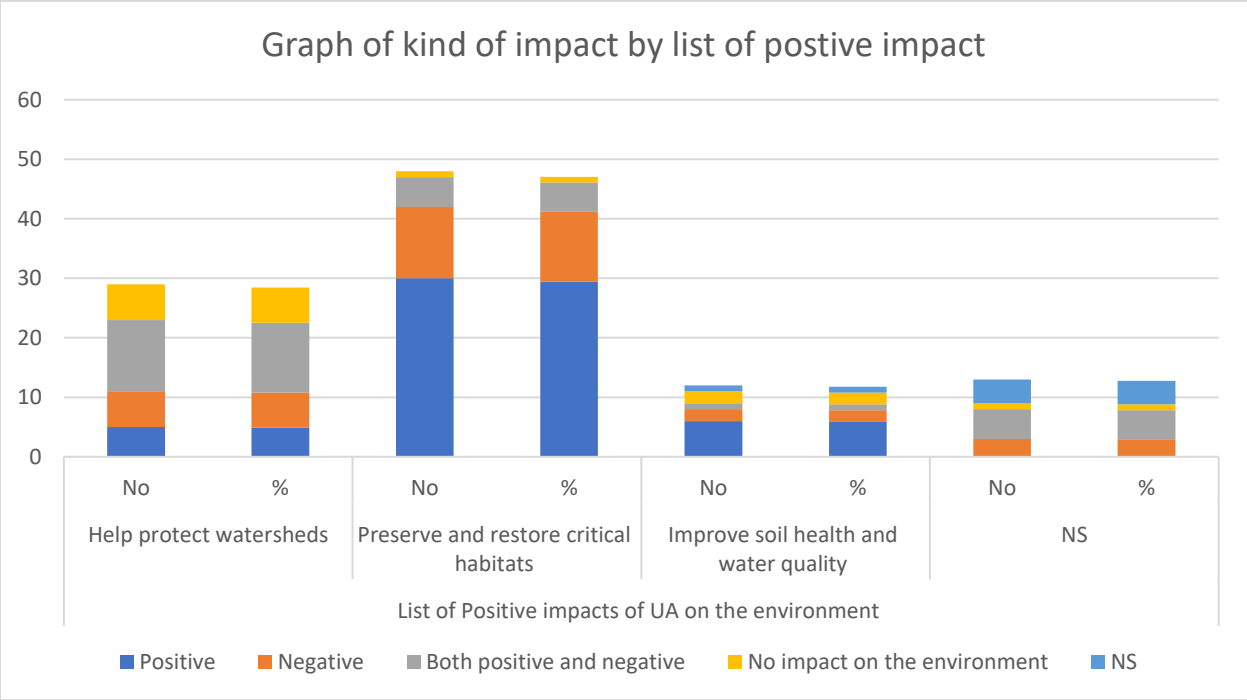
Likewise, another study found that there are a number of barriers to the adoption of sustainable practices in urban agriculture. These barriers include lack of government support, lack of access to land, and lack of knowledge about sustainable practices (Nowak, D. J., & Dwyer, J. F, 2020).

The research on urban agriculture farmers' understanding of the positive impacts of urban agriculture on the environment is mixed. Some studies have found that farmers have a good understanding of the positive impacts, while others have found that farmers have limited knowledge about urban agriculture and its environmental impacts.

It is important to note that farmers' understanding of urban agriculture and its environmental impacts is likely influenced by a number of factors, such as their education level, experience with urban agriculture practices, and access to information. It is also important to note that farmers' attitudes towards urban agriculture may change over time as they learn more about its benefits and challenges.

The fact that some respondents who said that urban agriculture had a negative impact on the environment, as well as those who said that urban agriculture had no impact on the environment, also chose positive impacts from the list presented to them suggests that farmers may have a complex understanding of urban agriculture and its environmental impacts. It is also possible that some farmers may have chosen positive impacts from the list because they believe that urban agriculture has the potential to have these impacts, even if they are not currently seeing them.

Overall, the research suggests that urban agriculture farmers have a good understanding of the positive impacts of urban agriculture on the environment, but there are some farmers who have limited knowledge about urban agriculture and its environmental impacts. It is important to provide urban agriculture farmers with access to information and resources so that they can adopt sustainable practices and maximize the environmental benefits of urban agriculture.



Graph 4.1: Different positive impacts of urban agriculture on the environment

The researcher also conducted a Focus Group Discussion (FGD) with selected individuals including UA farmers and experts. During the discussion, participants were asked about what is working well and not working well in practicing UA. The responses revealed that the training provided by the project, the loan opportunities, and experience sharing were reported as effective aspects of UA. However, market linkage with direct consumers was identified as a challenge, and the participants expressed the need for support from both the local government and the project to establish a market linkage with direct consumers. Additionally, the participants indicated that they require more financial and technical support from the local government.

The participants also discussed the measures they take to protect the environment while practicing UA. They reported that there is a knowledge gap among UA farmers regarding environmental protection, and the level of care taken by individual farmers varied. It was suggested that more training is needed to educate UA farmers about the contributions of UA to environmental sustainability, and to ensure that all UA farmers are on the same page regarding taking care of the negative impact on the environment. Additionally, the participants recommended that UA farmers be supported in the application of Climate Smart Technology to reduce the negative impact of UA on the environment.

4.5.2 Kind of impact UA has on the environment as perceived by the respondents evaluated against their selection from the List of negative impacts of UA on the environment

The researcher provided a catalog of detrimental effects caused by UA to the environment, which was presented to the participants for them to choose from. The data as shown graph 2 below reveals that around 18 individuals who expressed that UA has a positive impact on the environment did not select any of the negative impacts listed. Conversely, approximately 12% of the respondents who believe that UA has a negative impact opted for soil erosion, while only 5% chose water pollution and 1% selected visual pollution. It is noteworthy that merely 20% of the participants acknowledged that UA has a mix of both favorable and unfavorable effects on the environment.

The researcher reviewed literature that both supports and opposes the findings of the research.

A study published in the journal *Nature Sustainability* found that UA can help to reduce greenhouse gas emissions and improve air quality. (Zhang, L., and et al (2022)) while another study published in the journal *Environmental Science & Technology* found that UA can help to improve water quality and reduce soil erosion (Liu, S.and et al, (2021).

Ren, Z. and et al (2020) also found that UA can help to increase energy security and reduce reliance on fossil fuels.

It was also found out that there are some studies that support the view that UA has a negative impact on the environment. A study published in the journal *Science* found that UA can have negative impacts on biodiversity and wildlife (Elmqvist, T and et al, 2023).

There are also some studies that support the view that UA has a mix of both favorable and unfavorable effects on the environment. A study published in the journal *Environmental Impact Assessment Review* found that the environmental impacts of UA vary depending on the specific technology used and the location of the project. (Allaire, M., & Devin, S. 2023).A study published in the journal *Renewable and Sustainable Energy Reviews* also found that UA can have both positive and negative impacts on the environment, and that it is important to carefully weigh the costs and benefits of each project before making a decision (Goswami, S., & Bandyopadhyay, S. 2022).

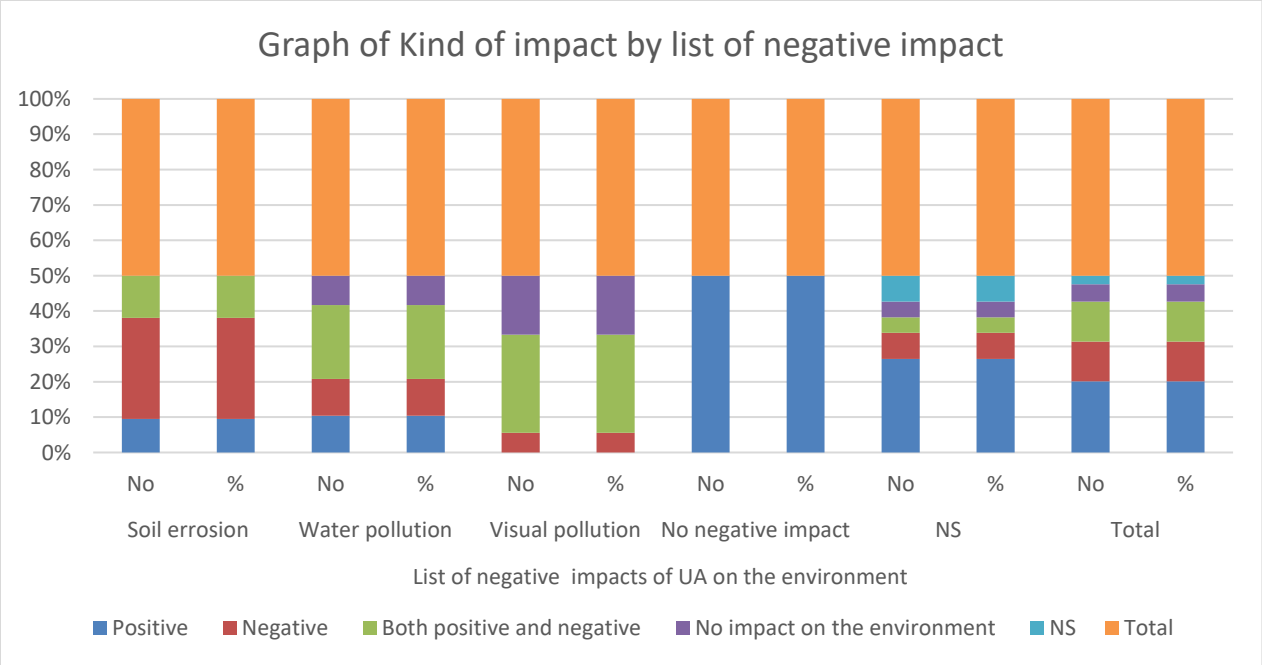
It is important to note that the research on the environmental impacts of UA is still ongoing, and there is no consensus on the overall impact of UA on the environment.

In the context of the study described, it is interesting to note that the 18 individuals who expressed that UA has a positive impact on the environment did not select any of the negative impacts listed. This suggests that they may not be aware of the potential negative impacts of UA, or that they may believe that the positive impacts outweigh the negative impacts.

Conversely, the fact that only 12% of the respondents who believe that UA has a negative impact opted for soil erosion, while only 5% chose water pollution and 1% selected visual pollution, suggests that they may not be aware of the full range of potential negative impacts of UA.

The fact that only 20% of the participants acknowledged that UA has a mix of both favorable and unfavorable effects on the environment suggests that many people may have a simplistic view of the environmental impacts of UA, and that they may not be fully aware of the trade-offs involved.

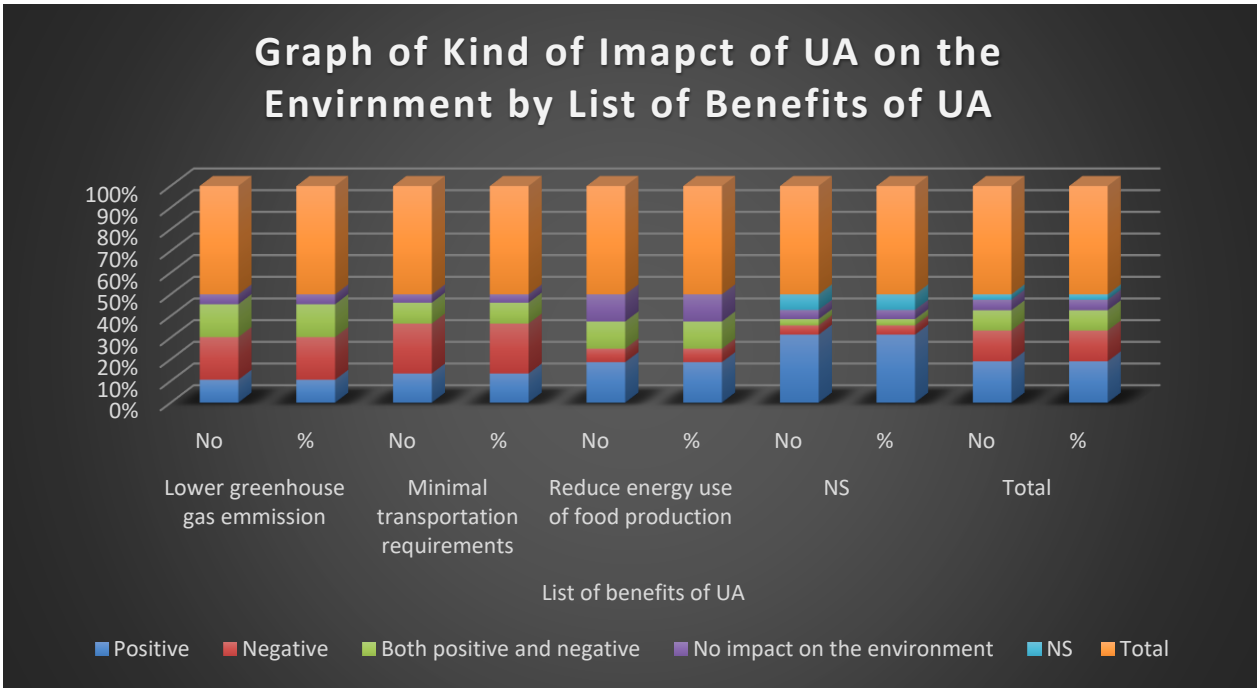
Overall, the results of this study suggest that there is a need for more education and awareness about the environmental impacts of UA.



Graph 4.2: The kind of impact UA has on the environment as perceived by the respondents

4.5.3 Kind of impact UA has on the environment perceived by the respondents evaluated against their selection from the list of benefits of UA

The researcher attempted to analyze the correlation between the respondents' opinions on the impact of UA on the environment and the benefits of UA by comparing their responses. The findings as shown in graph 3 displayed that only 7% of the group that believed UA had a positive impact on the environment identified reduced greenhouse gas emissions, while another 7% selected minimal transportation requirements, and just 3% chose reduced energy consumption in food production. Conversely, a larger proportion of the group that believed UA had negative impacts on the environment selected lowered greenhouse gas emissions and minimal transportation requirements as benefits of UA, which was surprising.



Graph 4.3: The benefits that UA has on the environment as perceived by the respondents

4.6 Impacts of social inclusion on the environment (social sustainability)

Studies show that social inclusion and environmental sustainability are inextricably linked. People who are socially excluded are more likely to live in poverty, have less access to education and healthcare, and be exposed to environmental hazards. They are also less likely to have a voice in decisions that affect their lives and the environment.

On the other hand, social inclusion can have a positive impact on the environment. When people are socially included, they are more likely to have the resources and opportunities to protect the environment. They are also more likely to have a voice in decisions that affect their lives and the environment.

4.6.1 Support system in the community by Level of Trust among UA members

The researcher aimed to investigate the relationship between the support system of urban agriculture (UA) farmers and their level of trust among each other, as it was identified in the conceptual framework that social inclusion is a determinant factor for environmental sustainability. The table below (table 12) shows that 29% of UA farmers who share experiences and hold support group meetings selected "trust one another and not be suspicious with one

another" as their level of trust among fellow UA members, while only 3% chose "support one another but not trust each other". Among those who reported supporting each other to some extent, approximately 20% chose "trust one another and not be suspicious with one another". Only 13% of the respondents indicated that they do not support each other regarding UA. This suggests that social cohesion among UA farmers is strong, which has a positive impact on environmental sustainability, as explained below.

Social inclusion or cohesion can have a number of positive impacts on environmental sustainability. Here are a few examples:

Increased participation in environmental initiatives: When people feel included and connected to their communities, they are more likely to take an active role in environmental initiatives. This may involve participating in community clean-up events, joining local conservation groups, or advocating for environmental policies.

Improved resource management: Social inclusion can also lead to better management of natural resources. When people feel connected to their environment and understand the importance of conservation, they are more likely to use resources in a sustainable way. This may involve reducing waste, conserving water, or using renewable energy sources.

Increased resilience to climate change: Social cohesion can also contribute to increased resilience to the impacts of climate change. When communities are connected and work together, they are better equipped to adapt to changing environmental conditions. For example, community-based disaster preparedness programs can help people prepare for and respond to extreme weather events.

Reduced environmental inequality: Social inclusion can also help reduce environmental inequality. When everyone is included in environmental decision-making processes, the needs of marginalized communities are more likely to be considered. This can lead to more equitable distribution of environmental benefits and fewer negative impacts on vulnerable populations.

Overall, social inclusion and cohesion can play an important role in promoting environmental sustainability and building resilient communities.

Table 4.13: Support system in the community by Level of Trust among UA members

Support system in the community	Level of Trust among UA members									
	Share ideas and resources		Support one another but not trust each other		Trust one another and not be suspicious with one another		NS		Total	
	No	%	No	%	No	%	No	%	No	%
Share experience and have Support group meeting regarding UA	3	2.94	3	2.94	29	28.43	0	0.00	35	34.31
Support one another to some extent	7	6.86	15	14.71	20	19.61	2	1.96	44	43.13
We do not support one another regarding UA	4	3.92	8	7.84	0	0.00	1	0.98	13	12.75
NS	0	0.00	0	0.00	2	1.96	8	7.84	10	9.8
Total	**14**	**13.73**	**26**	**25.49**	**51**	**50.00**	**11**	**10.78**	**102**	**99.99**

4.6.2 Support system in the community by Degree of Democracy in the support group meeting

The researcher has also attempted to compare the respondents' responses regarding their support system with degree of democracy in the support group meeting. As it can be seen from the table below (table 13), about 30% of those who indicated they share experience and have support group meeting selected "share ideas of equality and rights with respect to one another" and 32% of those who indicated they support one another to some extent have also picked similar answer. About 10% of these two groups indicated that their support group system is encouraged and supported by the law. Based on their responses, it can be inferred that their support group meeting is democratic enough which has a positive impact on environmental sustainability as it is explained below.

Numerous studies show Democratic support group meetings can contribute to environmental sustainability in several ways:

Promoting environmental awareness: Support group meetings offer a platform for discussing environmental issues and raising awareness among participants. This can lead to increased knowledge and understanding of environmental challenges and the importance of conservation.

Encouraging community action: Democratic support group meetings can empower participants to take collective action to address environmental issues. By working together, participants can pool resources, share knowledge and skills, and develop strategies for promoting sustainable practices.

Building social cohesion: Support group meetings can also help build social cohesion and trust among participants. When people feel connected to their community and have a sense of belonging, they are more likely to work together to achieve common goals, including environmental sustainability.

Fostering democratic values: By promoting democratic values such as participation, transparency, and accountability, support group meetings can contribute to a culture of environmental stewardship and responsible decision-making.

Overall, democratic support group meetings can be a valuable tool for promoting environmental sustainability and building resilient communities. By providing a platform for discussion, action, and collaboration, these meetings can help individuals and communities work towards a more sustainable future.

Table 4.14: Support system in the community by Degree of Democracy in the support group meeting

Support system in the community	Degree of Democracy in the support group meeting									
	Share ideas of equality and rights with respect to one another		Support group is encouraged and supported by law		We are not transparent enough in sharing information		NS		Total	
	No	%	No	%	No	%				
Share experience and have Support group meeting	30	29.41	5	4.90	0	0.00	0	0.00	35	34.31
Support one another to some extent	32	31.37	5	4.90	3	2.94	2	1.96	42	41.18
We do not support one another regarding UA	13	12.75	2	1.96	3	2.94	0	0.00	18	17.65
NS	0	0.00	0	0.00	2	1.96	5	4.90	7	6.86
Total	**75**	**73.53**	**12**	**11.76**	**8**	**7.84**	**7**	**6.86**	**102**	**100**

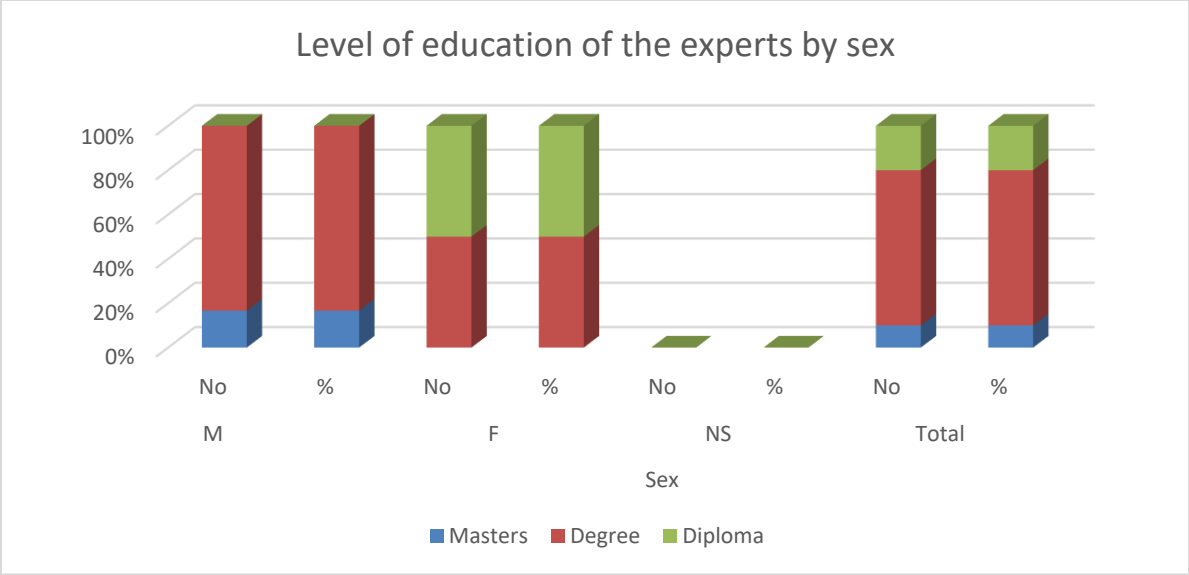
4.7 Socio-economic background of Professionals who aid the UA farmers, and their experiences in UA

4.7.1 General Information about professionals giving support to farmers engaged in UA

The third part of the survey conducted for this study gathered information on various factors, including gender, age, educational attainment, department, and position of the professionals. These factors were deemed essential in evaluating the state of urban agriculture practiced by local urban farmers, particularly in terms of its effects on the economic and social aspects of the beneficiaries' lives. Using the information and factual data derived from these factors, the study provided a detailed description of the effects of the professionals' involvement in urban agriculture and conducted an analysis accordingly.

4.7.2 Level of Education by sex of the professionals giving support to farmers

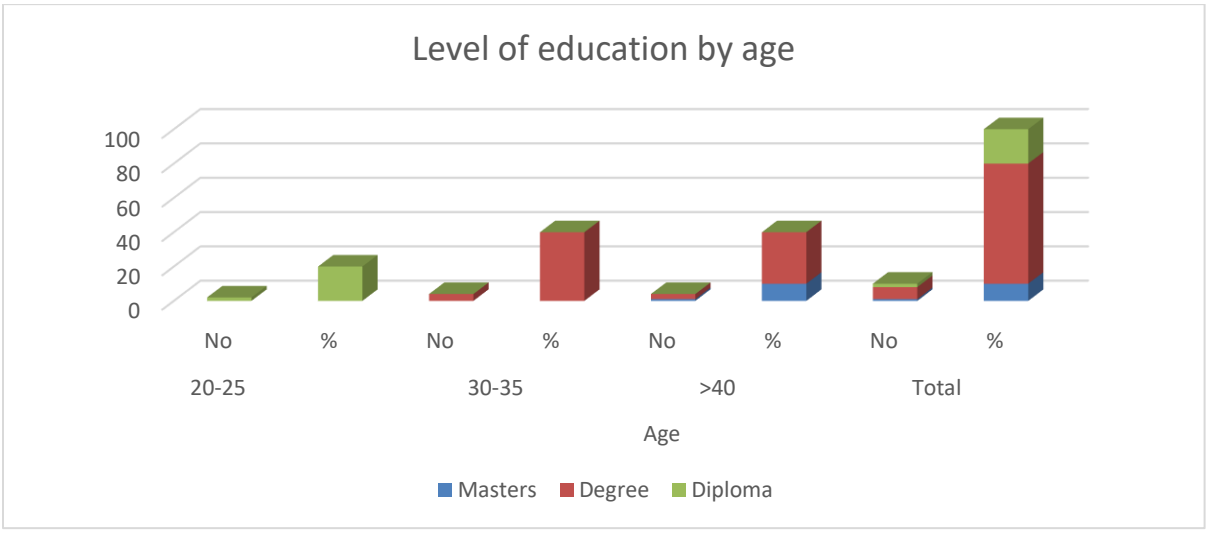
The study used variables to determine the educational level of professionals assisting farmers engaged in UA practices based on their gender. The data as shown in the graph below provided by the respondents showed that 40% of them were female and 60% were male. The educational qualifications ranged from a Master's degree to a diploma, with the highest being Masters and the lowest being diploma. Only 10% of the professionals holding a Master's degree were men while 20% of those holding a diploma were women. Among the professionals holding a degree, 20% were females and 30% were males.



Graph 4.4: Level of education of experts by sex

4.7.3 Level of Education by age of the professionals giving support to farmers

The educational qualifications of professionals are also evaluated based on their age group. Among those who have a diploma, 20% are between the ages of 20-25, while 40% of those with a degree are in the age group of 30-35. Professionals above the age of 40 account for 30% of the total population.



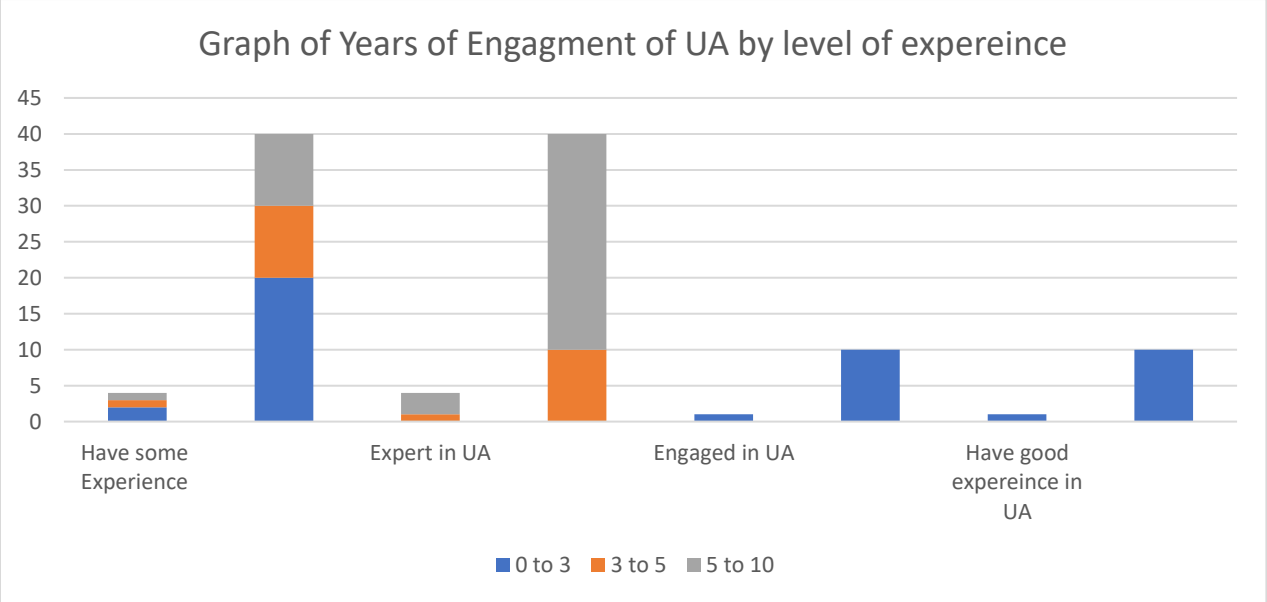
Graph 4.5: level of education of experts by age group

4.7.4 Technical knowledge, and experience of experts project coordinators, mangers and project directors in UA from different departments

The survey's fourth section was designed to gather information from professionals such as project coordinators, managers, and directors from various departments in UA-related technical knowledge and experience. The survey also sought to gather input on their observations of UA being implemented by farmers in the area. The information collected from these experts was compiled into tables, and their analysis is presented below.

4.7.5 Years of Engagement in UA by Level of Experience

As depicted in the graph below, nearly 20% of professionals who have been engaged for 0 to 3 years possess some level of experience in UA. Among them, 10% are currently engaged in UA tasks, while 10% have significant expertise in UA. Interestingly, 30% of those who have been engaged for 5 to 10 years believe themselves to be experts in UA.



Graph 4.6: Years of engagement of experts in UA by level of experience

4.7.6 Years of Engagement in UA of the experts evaluated against Level of significance as perceived by them

The survey compared the responses of professionals' years of engagement with the level of significance of urban agriculture (UA). It is interesting to note from table 14 below that 80% of respondents with experience between 0 and 10 years indicated that UA is significant for sustainable food systems. This response is expected from professionals who view all types of agriculture, including urban agriculture, through a sustainability lens. The researcher collected data from experts because their understanding of UA is just as important as that of UA farmers. Without adequate professional support, UA farmers may negatively impact the environment. The experts' technical knowledge has contributed to UA farmers' good understanding of sustainability. Research shows that the effectiveness of UA farmers and the impacts of their actions are influenced by the experts' technical knowledge.

Urban agriculture experts can contribute technical knowledge that can help UA farmers ensure environmental sustainability in the following ways:

Soil Management: Urban agriculture experts can provide farmers with technical knowledge on soil management practices such as composting, vermiculture, and soil testing. These practices can help farmers maintain healthy soil that is free from contaminants and rich in nutrients.

Water Management: Experts can educate farmers on efficient use of water resources by using drip irrigation systems and rainwater harvesting techniques. They can also provide knowledge on water conservation practices that can help reduce water wastage.

Pest and Disease Management: Urban agriculture experts can provide farmers with knowledge on integrated pest management techniques that involve the use of natural predators, crop rotation, and companion planting. This can help reduce the use of harmful pesticides that can harm the environment.

Waste Management: Experts can educate farmers on effective waste management practices such as recycling, composting, and waste reduction techniques. This can help reduce the amount of waste that ends up in landfills and promote a circular economy.

Biodiversity Conservation: Urban agriculture experts can advise farmers on the importance of biodiversity conservation by promoting the use of native plant species, crop diversification, and the creation of green spaces that provide habitats for wildlife.

In summary, the technical knowledge provided by urban agriculture experts can help UA farmers adopt sustainable farming practices that reduce the impact on the environment and promote long-term environmental sustainability.

Table 4.15: Years of Engagement in UA of the experts and their perceptions about Level of significance of UA

Years of Engagement in UA	Level of significance as answered by the respondents (experts)							
	Ensure Food Security		Means of Livelihood		sustainable Food System		Total	
	No	%	No	%	No	%	No	%
0 to 3	0	0.00	0	0.00	4	40.00	4	40
3 to 5	1	10.00	0	0.00	1	10.00	2	20
5 to 10	0	0.00	1	10.00	3	30.00	4	40
Total	**1**	**10.00**	**1**	**10.00**	**8**	**80.00**	**10**	**100**

4.7.7 Impact of UA on the environment as perceived by the professionals

This study also analyzed the perspective of experts regarding the effect of UA on the environment. The results showed that approximately 60% of the respondents believed that UA has a favorable impact on the environment. Around 30% of the experts stated that UA has both positive and negative effects, while only 10% of them believed that it has no impact on the environment. Notably, none of the experts stated that UA has a solely negative impact, which is a reasonable response from technical experts. Their opinions align with the expected views of experts in this field.

To verify the information gathered from questionnaires administered to project coordinators and managers, the researcher conducted random interviews with professionals to gather their insights

on their professional experience with Urban Agriculture (UA). The feedback obtained from these interviews is summarized below.

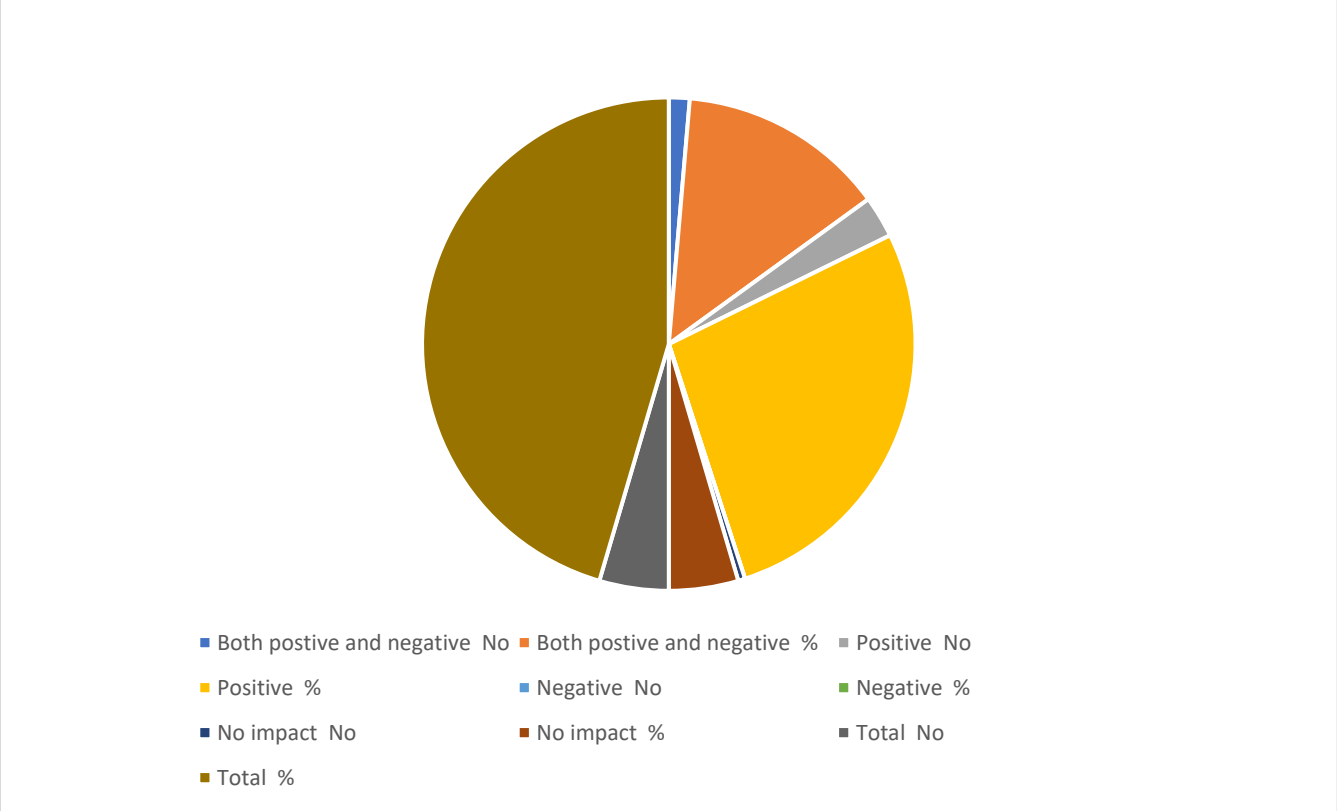
According to the professional experts in UA, it has had a positive impact on the livelihood of farmers, particularly those living in semi-urban areas. Urban farmers typically have limited land space, ranging between 100 to 200 square meters, which poses a significant challenge to their agricultural production. However, the support provided by EECMY DASSC CES BF, which includes quality seeds, agricultural equipment, chemicals such as pesticides and fertilizers, and seedlings, has improved the farmers' overall output.

During the interviews, it was noted that a majority of the farmers are engaged in growing fruits and vegetables, while a few are involved in poultry or chicken farming. The support provided by the organization has significantly improved the way the farmers carry out UA. They have been trained on how to prepare organic compost to enhance soil fertility, leading to increased yields. The professionals also mentioned that they are working on ways to help farmers make their farming climate-smart. To this end, the organization is in the process of establishing an agreement with private organizations that specialize in effective microorganisms, which are crucial for climate-smart agricultural practices.

According to experts, farmers in UA who are not part of the project are practicing urban agriculture without the support of scientific agricultural techniques. In addition, due to the lack of a specific policy governing urban agriculture practices in the country, individuals are free to practice it however they choose. Therefore, it is important to advocate for the integration of urban agriculture into the general agricultural policy framework by lobbying the government or state. In the meantime, efforts should be made to raise awareness within the community about the importance of using scientific agricultural practices, which not only benefit the economy but also contribute to environmental sustainability. Experts have also emphasized the need to train farmers to cultivate climate-friendly crops instead of harmful eucalyptus trees.

The experts have pointed out that Climate Smart Agriculture is becoming increasingly important in efforts to mitigate the negative impact of urban agriculture on the environment. As a buzzword among climatologists and environmentalists, it emphasizes the use of sustainable practices to help reduce greenhouse gas emissions and improve the resilience of agricultural systems. In

order to implement Climate Smart Agriculture effectively, it is important for urban agriculture farmers to receive training on utilizing chemical-free fertilizers, such as compost, and adopting sustainable irrigation practices, such as using solar pumps instead of diesel pumps which contribute to environmental pollution. Therefore, UA farmers should be encouraged to adopt sustainable practices in order to reduce the negative impact on the environment.



Graph 4.7: Impact of UA on the environment as perceived by professionals

4.8 Challenges and barriers of UA in Bishoftu City

Urban agriculture in Bishoftu city faces several challenges and barriers in terms of environmental sustainability. These challenges can be categorized into different aspects:

Land availability and competition: Bishoftu city, like many urban areas, faces limited available land for agriculture due to rapid urbanization and population growth. This scarcity of land creates competition between urban development and agricultural activities, leading to a reduction in the overall area available for urban agriculture.

According to a study by Tsegaye et al. (2019), the expansion of infrastructure and residential areas in Bishoftu city has resulted in the conversion of agricultural land into built-up areas, limiting the scope for urban agriculture.

Soil quality and contamination: Urban agricultural areas often suffer from soil degradation and contamination due to industrial activities, waste disposal, and the use of chemical fertilizers and pesticides. These factors can affect the soil fertility and the quality of crops produced.

A study conducted by Bogale et al. (2019) in Bishoftu city highlighted the presence of heavy metals in urban agricultural soils, which can have adverse effects on human health and the environment.

Water availability and quality: Urban agriculture requires a reliable and adequate water supply. However, water scarcity and poor water quality can pose significant challenges to urban agricultural activities.

In Bishoftu city, water scarcity is a major concern, especially during dry seasons. According to a study by Tesfaye et al. (2016), inadequate water supply hinders agricultural activities and affects crop production in the city.

Waste management: Proper waste management is crucial for maintaining a healthy and sustainable urban agriculture system. However, inadequate waste management practices can lead to pollution and health hazards.

A study by Bekele et al. (2018) emphasized the need for improved waste management systems in Bishoftu city to minimize the negative environmental impacts of urban agriculture.

Lack of awareness and education: Limited awareness and knowledge about sustainable urban agriculture practices among farmers and urban residents can hinder the adoption of environmentally friendly techniques and technologies.

A study by Tsegaye et al. (2019) highlighted the need for capacity building programs and awareness campaigns to promote sustainable urban agriculture practices in Bishoftu city.

In conclusion, the challenges and barriers faced by urban agriculture in Bishoftu city, in terms of environmental sustainability, include land availability and competition, soil quality and contamination, water availability and quality, waste management, and lack of awareness and education. Addressing these challenges requires a multi-faceted approach involving urban planning, environmental regulations, and community participation.

5. CHAPTER FIVE: CONCLUSIONS AND SUMMARY OF THE STUDY

5.1 Conclusion

Based on the analysis and discussion presented in this study, which included in-depth interviews with UA farmers and experts, as well as a focus group discussion, and literature review, it can be concluded that UA has had positive contributions on the incomes and livelihoods of UA farmers. However, while farmers generally have a good understanding of the positive and negative effects of UA on the environment, there is still room for improvement in their understanding of environmental development. Interviews with experts and farmers revealed that their agricultural practices are not fully based on scientific methods, as evidenced by their responses to the questionnaire. For instance, when asked to indicate the impact of UA on the environment, a significant number of farmers indicated negative impact or no impact at all, while still choosing positive impacts from a list.

During the interviews and discussion, it was also revealed that some UA farmers still use artificial fertilizers and chemicals without awareness of their negative effect on the environment. Additionally, the correlation between the source of water used by farmers and the frequency of their crop yields was analyzed, and it was found that farmers who use multiple water sources can

harvest their crops twice a year due to the availability of water. However, the more frequently farmers obtain yields, the more intensive their farming practices become, which can have negative effects on the environment, particularly the soil and water.

The study also measured the social cohesion of UA farmers in terms of their trust and democracy in support group meetings. It was found that their interaction and information sharing has a positive impact on environmental sustainability. However, a significant percentage of farmers do not share information due to a lack of trust, which could result in negative effects on the environment.

It is important to highlight that a comprehensive analysis has been conducted to examine the key indicators of environmental sustainability and their relationship to urban agriculture. This examination has revealed a significant correlation between these two factors.

For instance, one key indicator of environmental sustainability is the reduction of carbon emissions. Urban agriculture can contribute to this by reducing the need for transporting food over long distances, thereby decreasing the carbon footprint associated with food production and distribution. By growing food locally within cities, urban agriculture can help mitigate the environmental impact of transportation-related emissions.

Another indicator is the preservation of biodiversity. Urban agriculture can provide habitats for various plant and animal species, thus promoting biodiversity within urban areas. By creating green spaces and incorporating diverse plant species, urban agriculture can support the presence of pollinators and other beneficial organisms, contributing to the overall ecological balance.

Furthermore, water conservation is a crucial aspect of environmental sustainability. Urban agriculture can help optimize water usage through techniques such as drip irrigation and rainwater harvesting. By implementing these practices, urban farmers can minimize water waste and reduce the strain on local water resources.

Additionally, urban agriculture can enhance the overall resilience and adaptability of cities to climate change. By creating green infrastructure, such as rooftop gardens and vertical farming systems, urban areas can better manage stormwater runoff, mitigate heat island effects, and

improve air quality. These benefits contribute to the long-term sustainability and livability of cities.

In conclusion, through a comprehensive review of key environmental sustainability indicators, it has been observed that urban agriculture plays a significant role in positively influencing these indicators. The correlation between urban agriculture and environmental sustainability highlights the potential of this practice to contribute to a more sustainable and resilient urban environment.

5.2 Recommendations

Based on the previous discussion, the researcher suggests the following recommendations for EECMY DASSC CES BO and other UA project implementers to improve their efficiency:

1. UA practices should be climate-smart and farmers need more training on how to make their practices more sustainable. This training should be supported by technical assistance from local governments and project implementers.
2. Legal frameworks and environmental policies need to be in place to regulate UA practices and ensure that they are supplemented by climate-smart technologies. This will help to mitigate negative impacts on the environment.
3. Implementers should encourage integrated farming systems to reduce the negative impacts of waste from UA practices on the environment. This will help to promote sustainable agricultural practices.
4. Social inclusion and environmental sustainability should be linked, and cooperative work regarding UA should be encouraged and supported by the law. This will help to promote more sustainable and inclusive agricultural practices.
5. Finally, the researcher recommends further research to be done to learn more about the impacts of UA in a quantitative manner. Researchers interested in conducting comprehensive research on this topic should plan ahead to conduct water, soil, and carbon tests in the air and choose an appropriate impact analysis model.

By implementing these recommendations, UA project implementers can improve the efficiency and sustainability of their agricultural practices, while also promoting social inclusion and environmental sustainability.

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ADDIS ABABA UNIVERSITY

COLLEGE OF DEVELOPMENT STUDIES

CENTER FOR ENVIRONMENTAL & SUSTAINABLE DEVELOPMENT

Annex 1: Questionnaire in English

Dear Respondent:

I am MA student at Addis Ababa University (AAU). Currently I am conducting a research study entitled Perceptions and Practices of Urban Agriculture Farmers in Bishoftu City, The Case of Chelekeleka and Ganda Gorba Woredas: A Study of Environmental Sustainability and Socioeconomic Contributions

Government under the direct supervision of Professor Admasu Tsegaye at AAU. This research is being undertaken as a fulfillment to my three years graduate studies at the university in the extension program. The main purpose of the study is to assess Perceptions and Practices of Urban Agriculture Farmers in Bishoftu City, The Case of Chelekeleka and Ganda Gorba Woredas: A Study of Environmental Sustainability and Socioeconomic Contributions. Please note that your participation is voluntary. You have the right not to participate in case you are not interested in the topic that is being investigated. However your consent to participate shall only cost you 15-20 min of your time. As you are not required to fill in your name; there won't be any risk associated with your participation. Any sort of final conclusion that shall be drawn from this research study shall be researcher's own conclusion that is to be used only for academic purpose. You are only required to show your level of agreement in answering the questions you will be asked from this questionnaire.

Part One

Demographic data of farmers engaged in urban agriculture

1. Sex A. Female ☐ B. Male ☐

2. Age A.20-25 ☐ B.25-30 ☐ C.30-35 ☐ D. 35-40 E. above 40 ☐

3. Level of education A. Not 12 complete ☐ B. 12 complete ☐ C. Diploma ☐ D. Degree ☐ E. Master ☐ F. Other Specify ☐

_____

4. Year of experience in urban agriculture ----------

Part two

I. Technical knowledge, and experience of farmers engaged in UA

1, Do you have experience in urban agriculture? Tick that applies to you. You can tick more than one box

A, I have some experience ☐

B. I have enough experience ☐

C. I do have good experience ☐

D. I am an expert in UA ☐

E. I am engaged in UA ☐

2. Based on your knowledge, which one of the following be the most significant use of urban agriculture for poor urban dwellers?

A. promotes local and sustainable food systems ☐

B. means of livelihood ☐

c. income generation ☐

d. ensure food security ☐

3. How many years have you been engaged in UA?

A. 2-5 years ☐

B. 6-8 years ☐

C. 9-11 years ☐

D. above 11 years ☐

II. Places, types and reasons of practicing UA

1. Where do you practice UA?
   A. In the backyard /the premises ☐
   B. Just outside the premises ☐
   C. More than twenty meters from home ☐
   D. Designated areas ☐
2. What kind of UA do you practice? Tick that applies to you. You can tick more than one.
   A. Growing fruits and vegetables ☐
   B. Poultry/chicken farm ☐
   C. Aquaculture/fish farm ☐
   D. Bee keeping ☐
   E. Dairy Farm ☐
   F. Fattening ☐
   G. Livestock ☐
   H. Other specify ☐
3. If your UA practice is growing plants, what kind of fertilizer do you use?
   A. Compost ☐
   B. Cow dung ☐
   C. Artificial fertilizer ☐
   D. I do not use any fertilizer ☐
4. What kinds of chemicals do you use in practicing UA?
   A. Fertilizers ☐
   B. Pesticides/Herbicides ☐
   C. Other specify ☐
5. Why do you practice UA?
   A. Subsistence ☐
   B. Commercial ☐
   C. Both subsistence and commercial ☐

D. Hobby ☐

III. Income generation, food security (availability, accessibility, stability and utilization) and source of water and management

1. What is your source of income for your family?
   A. UA is my only source of income ☐
   B. UA is my supplemental source of income ☐
   C. I do UA only for household consumption, not for sale ☐
2. How did your engagement in UA contribute to your household income?
   A. My income improved after my engagement in UA but cannot put it in figure ☐
   B. My income doubled after my engagement in UA ☐
   C. My income tripled after my engagement in UA ☐
   D. My engagement in UA did not improve my income as such ☐
3. What is your monthly average income out of UA?
   A. Less than 1000 ☐
   B. Birr 1000-2000 ☐
   C. Birr 2000-4000 ☐
   D. Above Birr 4000 ☐
4. How many meals do you eat per day?
   A. Only once a day ☐
   B. Twice a day ☐
   C. Three times a day ☐
   D. More than three times ☐
5. What is the status of food supply at your home?
   A. Food is always available at my home and I have access to it ☐
   B. Food is always available at my home but I do not always have access to it ☐
   C. Food is not always available and access is limited ☐
   D. Whenever food is available, I have access to it. ☐
6. Where do you get water for your UA?

A. Lake water ☐

B. Ground water ☐

C. River ☐

D. Tap water ☐

E. Used water ☐

F. Rain water ☐

7. How many times do you get yield out of UA?

A. Once in a year ☐

B. Twice a year ☐

C. Three times a year ☐

IV. Impacts of practicing UA on the environment

1. In your opinion, what kind of impact does UA have on the environment?

A. Negative ☐

B. Positive ☐

C. Both ☐

D. No impact on the environment ☐

2. In your area, what are the positive impact of UA on the environment?

A. preserve and restore critical habitats ☐

B. help protect watersheds ☐

C. improve soil health and water quality ☐

3. What are benefits of UA?

A. lower greenhouse gas emissions ☐

B. minimal transportation requirements ☐

C. reduced energy use for food production ☐

4. In your area, what are the negative impacts of UA on the environment?

A. Erosion ☐

B. Water pollution ☐

C. Visual pollution ☐

V. Impacts of social inclusion on the environment (social sustainability)

1. How is your support system like in your community?
   A. We share experience and have support group meetings regarding UA ☐
   B. We support one another to some extent and share experience ☐
   C. We never support one another regarding UA ☐
2. What is the level of your trust like?
   A. We trust one another and not suspicious of one another other ☐
   B. We support one another other but not trust one other ☐
   C. We share ideas and resources with one another ☐
3. How democratic is your support group meeting?
   A. We share ideas of equality and rights with respect one another ☐
   B. Our support group is encouraged and supported by laws ☐
   C. We are not transparent enough in sharing information to one another ☐

Part three

Demographic data for experts, project coordinators, mangers and project directors

1. Sex A. Female ☐ B. Male ☐

2. Age A.20-25 ☐ B.25-30 ☐ C.30-35 ☐ D. 35-40 E. above 40 ☐

3. Level of education A. Not 12 complete ☐ B. 12 complete ☐ C. Diploma ☐ D. Degree ☐ E. Master ☐ F. Other Specify ☐

_____

4. Year of experience---------- 5. Department ---------- 6.current position----------

_____

4. Year of experience---------- 5. Department ---------- 6.current position----------

Part four

I. Technical knowledge, and experience of experts project coordinators, mangers and project directors in UA from different departments

1, Do you have experience in urban agriculture?

A, I have some experience ☐

B. I have enough experience ☐

C. I do have good experience ☐

D. I am an expert in UA ☐

E. I am engaged in UA ☐

2. Based on your knowledge, which one of the following be the most significant use of urban agriculture for poor urban dwellers?

A. promotes local and sustainable food systems ☐

B. means of livelihood ☐

c. income generation ☐

d. ensure food security ☐

3. How many years have you been engaged in UA?

A. 0-3 years ☐

B. 3-5 years ☐

C. 5-10 years ☐

D. above 10 years

II. Practical experience and observation of UA being practiced by farmers in the area per the experience and observation of experts project coordinators, mangers and project directors in UA from different departments

1. Why do farmers in your area practice UA?

   A, Subsistence ☐

   B. Commercial ☐

   C. Both commercial and subsistence

   D. Hobby ☐

2. What kind of support do they get from you?

   A. Financial ☐

   B. Technical ☐

C. Both ☐

3. What kind of impact does UA have on the environment?
   A. Positive impact ☐
   B. Negative impact ☐
   C. Both ☐
   D. No impact ☐

Part Five

In-depth interview questions with 10 individuals who are randomly selected out of the sample size

1. How did UA improve your livelihood? (probe: tell us more about how the income you get out of UA helped you.)
2. What kind of support do you get from your local government?
3. How did the support help you in improving the way you do UA?
4. What is the contributions of UA on environment sustainability?
5. What kind of technologies do you use to do your UA?
6. How did these technologies improve the way you do your UA?
7. Anything you would like to add?

Part Six

In-depth interview questions with some experts, trainers, project coordinators, managers, and directors randomly selected from governmental and non-governmental organizations

1. How did UA improve the livelihood of the farmers engaged in it?
2. What kind of support do you give them?
3. How did the support you give them help in improving the way they do UA?
4. What is the contributions of UA on environment sustainability?
5. What kind of technologies do farmers use to do their UA?
6. How did these technologies improve the way they do your UA?
7. Do you have UA policy? How often is this monitored and followed through?
8. Is UA in your area supplemented by scientific agricultural practices? (Probe: tell me what positive impact that this has on the environment)
9. What is climate smart agriculture? How is this related with environmental sustainability?

10. How can we make UA climate smart? What impact does this have on the environment?
11. Anything you want to add?

Part Seven

Questions for Focus Group Discussion with randomly selected farmers

1. What is working well in practicing UA? What is not working well in practicing UA?
2. What kind of support do you get from your local government? What additional support you want to get to improve the way you do your UA?
3. What kind of care do you take to protect your environment as you do UA?
4. What do you think is the contributions of UA on environment sustainability?
5. What can you suggest to improve UA and what must be done to protect the environment?
6. Anything you would like to add?

Annex 2: Questionnaire in Affan Oromo

Dabalata 2 (Annex 2) : Gaaffii (Questionnaire)

Kabajamaa Deebii kennituu:

Ani Yunivarsiitii Addis Ababa (AAU) keessatti barataa MA ti. Yeroo ammaa kana qorannoo qorannoo mata duree Ilaalcha Fi Hojii Qonnaan Qonna Magaalaa Magaalaa Bishoftu, Dhimmaa Chelekeleka Fi Ganda Gorba Woredas: Qorannoo Itti Fufiinsa Nannoo Fi Gumaata Hawaas-Diinagdee hordoffii kallattiin Piroofeesar Admaasuu Tsegayee AAU keessatti gaggeessaa jira. Qorannoon kun sagantaa ekisteenshinii keessatti barnoota koo waggaa sadii yunivarsiiticha keessatti eebbifameef akka raawwii ta'ee gaggeeffamaa jira. Kaayyoon qorannichaa inni guddaan Ilaalcha Fi Hojii Qonnaan Qonna Magaalaa Magaalaa Bishoftu, Dhimmaa Chelekeleka Fi Ganda Gorba Woredas: Qorannoo Itti Fufiinsa Nannoo Fi Gumaata Hawaas-Diinagdee madaaluudha. Hirmaannaan keessan fedhii keessanii akka ta'e hubadhaa. Mata duree qoratamaa jiruuf fedhii yoo hin qabaanne hirmaachuu dhiisuuf mirga qabda. Haa ta'u malee hayyamni kee hirmaachuuf yeroo

kee daqiiqaa 15-20 qofa si baasisa. Akkuma maqaa kee guutuun si irraa hin barbaachifne; hirmaannaa keessaniin walqabatee balaan tokkollee hin jiraatu. Qorannoon qorannoo kana irraa xumura dhumaa gosa kamiyyuu xumura qorataa mataa isaa kan kaayyoo barnootaa qofaaf oolu ta'a. Gaaffilee gaaffilee gaaffilee kana irraa si gaafatan deebisuuf sadarkaa waliigaltee kee agarsiisuu qofa si irraa eegama.

Kutaa Tokkoffaa

Daataa dimogiraafii qonnaan bultoota qonna magaalaa irratti bobba'an

1. Saala A. Dubartii ☐ B. Dhiira ☐

2. Umurii A.20-25 ☐ B.25-30 ☐ C.30-35 ☐ D. 35-40 E. 40 ol ☐

3. Sadarkaa barnootaa A. 12 guutuu miti ☐ B. 12 guutuu ☐ C. Dippiloomaa ☐ D. Digirii ☐ E. Master ☐ F. Kan biroo tanaan Ifa gochuu ☐

_____ .

4. Muuxannoo waggaa qonna magaalaa ---------- .

Kutaa lama

I. Beekumsa teeknikaa, fi muuxannoo qonnaan bultoota UA irratti bobba'an

1, Qonna magaalaa irratti muuxannoo qabduu? Tick kan si ilaallatu. Sanduuqa tokkoo ol irratti mallattoo kaa'uu dandeessa

Y, muuxannoo tokko tokko qaba ☐

B. Muuxannoo gahaa qaba ☐

C. Muuxannoo gaarii qaba ☐

D. Ani ogeessa UA ☐ dha

E. Ani UA ☐ irratti bobba'ee jira

2. Beekumsa keessan irratti hundaa'uun, kanneen armaan gadii keessaa kamtu itti fayyadama qonna magaalaa hiyyeeyyii magaalaa jiraattotaaf guddaa ta'a?

A. sirna nyaataa naannoo fi itti fufiinsa qabu ni jajjabeessa ☐

B. mala jireenyaa ☐

c. galii maddisiisuu ☐

d. wabii nyaataa mirkaneessuu ☐

3. Waggaa meeqa UA keessatti bobbaatee jirta?

A. Waggaa 2-5 ☐

B. Waggaa 6-8 ☐

C. Waggaa 9-11 ☐

D. waggaa 11 ol ☐

II. Bakkeewwan, gosootaa fi sababoota UA shaakaluu

1. UA eessatti shaakaltu?

A. Mooraa duubaa /bakka ☐

B. Bakka sanaan ala qofa ☐

C. Mana irraa meetira digdamaa ol ☐

D. Bakkeewwan murtaa'an ☐

2. UA akkamii shaakaltu? Tick kan si ilaallatu. Tokko ol mallattoo itti gochuu dandeessa.

A. Fuduraalee fi muduraalee misoomsuu ☐

B. Hindaqoo horsisisu/ hanqaaquu ☐

C. Horsiisa bishaanii/qonna qurxummii ☐

D. Beeylada/kaanisaa eegu ☐

E. Qonna Aannanii ☐

F. Furdisuu ☐

G. Beeyladaa/hori horsisuu ☐

H. Kan biroo ☐ ibsu

3. Shaakala UA keessan biqiltoota guddisuu yoo ta'e xaa'oo akkamii fayyadamtu?

A. Kompostii ☐

B. Mancaa re'ee/saaltee horii ☐

C. Xaa'oo namtolchee ☐

D. Xaa'oo kamiyyuu hin fayyadamu ☐

4. UA shaakaluu keessatti keemikaalota gosa akkamii fayyadamtu?

A. Xaa'oo ☐

B. Qoricha aramaa/Qoricha baala ☐

C. Kan biroo ☐ ibsi

5. Maaliif UA shaakaltu?

A. Jireenya ☐

B. Daldalaa ☐

C. Jireenyaa fi daldalaa ☐

D. Hojii bohaartii ☐

III. Galii maddisiisuu, wabii nyaataa (argamuu, dhaqqabummaa, tasgabbii fi itti fayyadama) fi madda bishaanii fi bulchiinsa

1. Maddi galii keessan maatii keessaniif maali?

A. UA madda galii koo qofa ☐

B. UA madda galii dabalataa kooti ☐

C. UA kanan hojjedhu fayyadama manaa qofaaf malee gurgurtaaf miti ☐

2. UA keessatti bobba'uun keessan galii maatii keessaniif gumaacha akkamii godhe?

A. Galiin koo erga UA keessatti bobba'ee booda fooyya'eera garuu fakkii irratti kaa'uu hin danda'u ☐

B. Galiin koo erga UA keessatti bobba'ee booda dachaa lama ta'e ☐

C. Galiin koo erga UA keessatti bobba'ee booda dachaa sadii ta'e ☐

D. UA keessatti bobba'uun koo galii koo akkasitti hin fooyyessine ☐

3. Galiin ji'a ji'aan UA keessaa aregatte maali?

A. 1000 gadi ☐

B. Birrii 1000-2000 ☐

C. Birrii bara 2000-4000 ☐

D. Birrii 4000 ol ☐

4. Guyyaatti nyaata meeqa nyaatta?

A. Guyyaatti al tokko qofa ☐

B. Guyyaatti al lama ☐

C. Guyyaatti yeroo sadii ☐

D. Yeroo sadii ol ☐

5. Dhiyeessiin nyaataa mana keessanitti haala akkamii irra jira?

A. Nyaanni yeroo hunda mana kootti waan jiruuf argachuu nan danda'a ☐

B. Nyaanni yeroo hunda mana kootti argama garuu yeroo hunda hin argadhu ☐

C. Nyaanni yeroo hunda waan hin argamneef qaqqabummaan isaa daangeffamaadha ☐

D. Yeroo nyaanni argamu hundatti argachuu nan danda'a. ☐

6. UA keessaniif bishaan eessaa argattu?

A. Bishaan haroo ☐

B. Bishaan lafa jalaa ☐

C. Laga ☐

D. Bishaan tubaa ☐

E. Bishaan fayyadame (used water) ☐

F. Bishaan rooba ☐

7. UA keessaa yeroo meeqa oomisha argatta?

A. Waggaatti al tokko ☐

B. Waggaatti al lama ☐

C. Waggaatti yeroo sadii ☐

IV. Dhiibbaa UA shaakaluun naannoo irratti qabu

1. Akka yaada keessaniitti UA naannoo irratti dhiibbaa akkamii qaba?

A. Negaatiivii ☐

B. Pozaatiivii ☐

C. Lamaanuu ☐

D. Naannoo irratti dhiibbaa hin qabu ☐

2. Naannoo keessanitti dhiibbaa gaariin UA naannoo irratti qabu maali?

A. bakka jireenyaa murteessaa ta'e kunuunsuu fi deebisuun ☐

B. bishaan kuufamaa eeguuf gargaaruu ☐

C. fayyaa biyyee fi qulqullina bishaanii fooyyessuu ☐

3. Faayidaan UA maali?

A. gaasiiwwan manaa gadi lakkifamuu ☐

B. geejjibaa xiqqaa barbaachisu ☐

C. oomisha nyaataaf itti fayyadama anniisaa hir'isuu ☐

4. Naannoo keessanitti dhiibbaa hamaa UA naannoo irratti qabu maali?

A. Dhiigni lafaa ☐

B. Faalama bishaanii ☐

C. Faalama ijaan eelalemu (laffaratti kangayee)-visual pollution ☐

V. Dhiibbaa hammatamuu hawaasummaa naannoo irratti qabu (itti fufiinsa hawaasummaa)

1. Sirni deeggarsa keessan hawaasa keessan keessatti akkam fakkaata?

A. Muuxannoo waliif qoodna, UA ilaalchisee walgahii garee deeggarsa ni qabna ☐

B. Hamma tokko wal deeggarree muuxannoo waliif qoodna ☐

C. UA ilaalchisee gonkumaa wal hin deggerru ☐

2. Sadarkaan amantaa keessanii maal fakkaata?

A. Wal amanna malee wal hin shakkinu ☐

B. Wal deggerra malee wal hin amannu ☐

C. Yaada fi qabeenya waliif qoodna ☐

3. Walgahiin garee deggersaa keessan hangam dimokiraatawaa dha?

A. Yaada walqixxummaa fi mirgaa wal kabajnee waliif qoodna ☐

B. Gareen deggersa keenya seeraan kan jajjabeeffamu fi kan deeggaramuudha ☐

C. Odeeffannoo waliif qooduun iftoomina gahaa hin qabnu ☐

Kutaa sadaffaa

Daataa dimogiraafii ogeeyyii, qindeessitoota pirojektii, hoggantoota fi daayreektaroota pirojektii

1. Saala A. Dubartii ☐ B. Dhiira ☐

2. Umurii A.20-25 ☐ B.25-30 ☐ C.30-35 ☐ D. 35-40 E. 40 ol ☐

3. Sadarkaa barnootaa A. 12 guutuu miti ☐ B. 12 guutuu ☐ C. Dippiloomaa ☐ D. Digirii ☐ E. Master ☐ F. Kan biroo Ifa gochuu ☐

_____ .

4. Muuxannoo waggaa---------- 5. Kutaa ---------- . ---------- 6.ejjennoo yeroo ammaa---------- . ---

_____ .

4. Muuxannoo waggaa---------- 5. Kutaa ---------- . ---------- 6.ejjennoo yeroo ammaa---------- . ---

Kutaa afur

I. Beekumsa teeknikaa, fi muuxannoo ogeeyyii qindeessitoota pirojektii, hoggantoota fi daayreektaroota pirojektii UA keessatti kutaalee adda addaa irraa

1, Qonna magaalaa irratti muuxannoo qabduu?

Y, muuxannoo tokko tokko qaba ☐

B. Muuxannoo gahaa qaba ☐

C. Muuxannoo gaarii qaba ☐

D. Ani ogeessa UA ☐ dha

E. Ani UA ☐ irratti bobba'ee jira

2. Beekumsa keessan irratti hundaa’uun, kanneen armaan gadii keessaa kamtu itti fayyadama qonna magaalaa hiyyeeyyii magaalaa jiraattotaaf guddaa ta’a?

A. sirna nyaataa naannoo fi itti fufiinsa qabu ni jajjabeessa ☐

B. mala jireenyaa ☐

c. galii maddisiisuu ☐

d. wabii nyaataa mirkaneessuu ☐

3. Waggaa meeqa UA keessatti bobbaatee jirta?

A. Waggaa 0-3 ☐

B. Waggaa 3-5 ☐

C. Waggaa 5-10 ☐

D. waggaa 10 ol

II. Muuxannoo qabatamaa fi ilaalcha UA qonnaan bultoota naannoo sanaatiin shaakalaa jiru muuxannoo fi ilaalcha ogeeyyii qindeessitoota pirojektii, mangers fi daayreektaroota pirojektii UA keessatti kutaalee adda addaa irraa

1. Qonnaan bultoonni naannoo keessanii UA maaliif shaakalu?

A, Jireenya ☐

B. Daldalaa ☐

C. Daldalaa fi jireenyaaf

D. Hojii bohaartii ☐

2. Deeggarsa akkamii sirraa argatu?

A. Finfinnee ☐

B. Teeknikaa ☐

C. Lamaanuu ☐

3. UAn naannoo irratti dhiibbaa akkamii qaba?

A. Dhiibbaa gaarii ☐

B. Dhiibbaa hamaa ☐

C. Lamaanuu ☐

D. Dhiibbaa hin qabu ☐

Kutaa Shanaffaa

Gaaffii af-gaaffii gadi fageenya qabu namoota dhuunfaa 10 kanneen baay'ina saamuda keessaa akka tasaa filataman waliin

1. UA akkamitti jireenya kee fooyyeesse? (qorannoo: galiin UA keessaa argattu akkamitti akka si gargaare caalaatti nuuf himi.)
2. Mootummaa naannoo keessanii irraa deeggarsa akkamii argattu?
3. Deeggarsi sun akkaataa UA itti hojjettu fooyyessuu keessatti akkamitti si gargaare?
4. Gumaan UA itti fufiinsa naannoo irratti qabu maali?
5. UA keessan hojjechuuf teknooloojiiwwan akkamii fayyadamtu?
6. Teeknooloojiiwwan kun akkaataa UA keessan itti hojjettan akkamitti fooyyessanii?
7. Waan itti dabaluu barbaaddan jiraa?

Kutaa Jahaffaa

Gaaffii af-gaaffii gadi fageenya qabu ogeeyyii, leenjistoota, qindeessitoota pirojektii, hoggantoota, fi daayreektaroota dhaabbilee mootummaa fi miti mootummaa irraa akka tasaa filataman tokko tokko waliin

1. UAn jireenya qonnaan bultoota itti bobba'an akkamitti fooyyeesse ?
2. Deeggarsa akkamii isaaniif kennitu?

3. Deeggarsi isin isaaniif kennitan akkaataa UA itti hojjetan fooyyessuuf akkamitti gargaare?

4. Gumaan UA itti fufiinsa naannoo irratti qabu maali ?

5. Qonnaan bultoonni UA isaanii hojjechuuf teknooloojii akkamii fayyadamu?

6. Teeknooloojiiwwan kun akkaataa UA keessan itti hojjetan akkamitti fooyyessanii?

7. Imaammata UA qabduu? Kun yeroo meeqa hordofamee hordofama?

8. UA naannoo keessanitti gochaalee qonnaa saayinsaawaa ta'aniin dabalamee jiraa? (Qorannoo: kun naannoo irratti dhiibbaa gaarii akkamii akka qabu natti himaa)

9. Qonni haala qilleensaa (climate smart agriculture) maali? Kun itti fufiinsa naannoo wajjin akkamitti wal qabata?

10. Akkamitti UA climate smart gochuu dandeenya? Kun naannoo irratti dhiibbaa akkamii qaba?

11. Waan itti dabaluu barbaaddu jiraa?

Kutaa Torbaffaa

Gaaffiiwwan Marii Garee Xiyyeeffannoo qonnaan bultoota akka tasaa filataman waliin

1. UA shaakaluu keessatti maaltu akka gaariitti hojjechaa jira? UA shaakaluu keessatti maaltu akka gaariitti hin hojjenne?

2. Mootummaa naannoo keessanii irraa deeggarsa akkamii argattu? Akkaataa UA kee itti hojjettu fooyyessuuf deeggarsa dabalataa akkamii argachuu barbaadda?

3. Akkuma UA gootan naannoo keessan eeguuf of eeggannoo akkamii gootu?

4. Gumaan UA itti fufiinsa naannoo irratti qabu maali jettanii yaaddu?

5. UA fooyyessuuf maal yaada kennuu dandeessu fi naannoo eeguuf maaltu godhamuu qaba?

6. Waan itti dabaluu barbaaddan jiraa?