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Investigating Sustainable Urban Agriculture in Hokmabad Neighborhood in Tabriz

Morteza Mirgholami,[1], Saeedeh Gharachourlou[*2], Sepideh pouri
[1] *Faculty of urbanity, Tabriz Islamic Art University*
[2] *Faculty of urbanity, Tabriz Islamic Art University*
[3] *Faculty of Civil Engineering, Tabriz University*
Corresponding Author Email:S.garachorllu@tabriziau.ac.ir

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Abstract

This article, examines the sustainability and health of agricultural products in Hokmabad urban agricultural lands which relates to the three dimensions: social, economic and environmental. The inhabitants of this region, which is located in the west of Tabriz, have been engaged in agriculture for nearly thousand years and have passed on their unique activities and methods from generation to generation over centuries.
In this study, semi-structured interviews are used in combination with statistics and information collected from organizations, and sampling to obtain information.
The results show that Hokmabad farmlands are a clear example of sustainable agriculture and increase urban sustainability using special vernacular methods. These methods include farmers' unique terracing that results in optimal water use, soil enrichment with organic fertilizers, non-use of pesticides, and use of self-produced organic seeds. In addition, they have healthy and organic products and have good economic potentials for the city of Tabriz.

1.Introduction

The number of urban dwellers has increased significantly in the last century, today 55% of the world's population lives in urban areas, a proportion that is expected to increase to 68% by 2050 (1) Recent studies suggest that accelerating urbanization in developing countries poses a serious threat to sustainable development, including urban ecological services, social sustainability, and health systems.(2) Therefore, the combination of these problems has caused urban planners and designers to focus on urban sustainability issues.(3)
Following the growing concern about sustainability, the sustainability of food production has become a crucial issue among scientists. Global interest such as climate change, the need for fairer economic models, and food security have increased attention to urban agriculture.(4) Urban agriculture can be considered as one of the food sources supply and alternatives to household food security, it can also provide one of the productive activities of urban open space, source of revenue and employment opportunities, and improve the quality of the urban environment. (5) In addition to providing food, urban agriculture also offers a variety of other functions such as waste management, energy conservation, biodiversity, nutrient cycling, microclimate control, economic revitalization, community socialization, human health, preservation of cultural heritage, and education. These functions of urban agriculture help cities to achieve sustainability goals.(6) In the following, sustainable development, sustainable urban agriculture and its dimensions will be stated, then the dimensions of sustainable urban agriculture and the health of Hokmabad products will be reviewed and the results will be presented.
Sustainable development and its dimensions

Population growth and the industrialization of urban society in the mid-twentieth century created new environmental problems. The first reference to the ecological crisis is in the 1996 book "Silent Spring" by Rachel Carson. Some refer to this book as the initiator of the environmental movement. In this book, she points to the non-renewability of energy and the limitation of resources. (7) The term sustainable development was first used in the book "Limits to Growth" by Meadows et al. In 1972. In this book, he discusses the future of humankind and the process of formation of sustainable development. He had also survey growth, agricultural production, natural resources, industrial production, and environmental pollution.(8)
Sustainable development was first defined in the Brundtland Commission as; "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs". (9)
Sustainable development is directly related to the health of a community, the application of sanitary measures, and the monitoring of environmental hazards. Climatic changes, poverty, lack of food, and safe water resources are problems, which hundreds of millions of people face in the developing world. Nowadays, the advancement of technology has turned the world into a global village so everything can be interconnected. With sustainable urban design and its goals, worldwide people enable to satisfy their basic needs and enjoy a better quality of life without compromising that of future generations. (10)
Scientists in their studies have enumerated various dimensions of sustainability. One of the most common classifications divides sustainability into three dimensions: social, economic, and environmental. This division pointed out that sustainability is achievable when all these pillars are observed, and each dimension is balanced with other dimensions. (11) In environmental sustainability, attention is paid to the preservation of natural capital, which is provided through territorial and environmental sustainability.

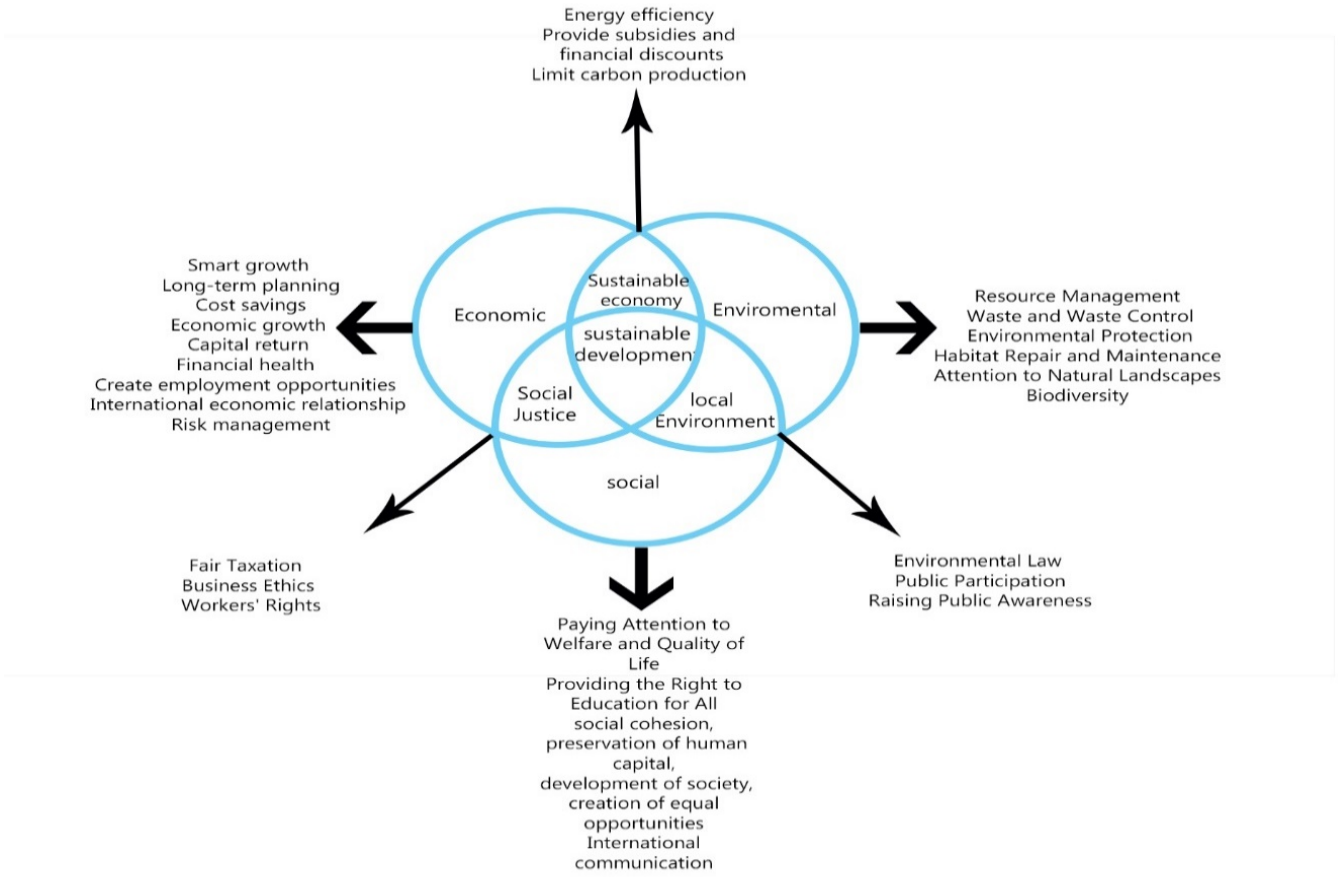

Figure 1. sustainable development dimensions

It includes everything that is related to the Earth's ecosystemsuch as sustainability of climate systems, air quality, soil and water, land use and soil erosion, biodiversity, and ecosystems (eg, plant pollination and photosynthesis). (KTH,2020) Economic sustainability refers *to* practices *that* supportlong-term economic growth without negatively affecting social, environmental, and cultural aspects of society. In economic sustainability, more and more attention is paid to the efficiency of economic systems (institutions, policies, and operating laws), thus ensuring quantitative and qualitative progress and social equality. (13)

2.Urban Agriculture

In a comprehensive definition, urban agriculture can be introduced as all agricultures that take place in and around urban areas. (14) According to the Food and Agriculture Organization of the United Nations (FAO) urban agriculture is: “the growing of plants and the raising of animals within and around cities”. (15)
Urban agriculture (UA) is the way for producing, processing and marketing food, plant- and animal-sourced pharmaceuticals, fiber and fuel on land and which can occur throughout the urban and peri-urban areas, usually applying intensive production methods. (16)
With urban and Peri-urban agriculture, it is possible to supply food from different types of plant products (cereals, summer crops, vegetables, mushrooms, fruits), animals (chicken, goats, sheep, cattle, fish, etc.), and Non-edible products (aromatic and medicinal plants, ornamental plants, trees)
Urban agriculture is generally seen as a resource that helps provide food security for families and communities and improve slum's condition in both developing and industrialized countries. (17)
presently, urban agriculture is one of the most important elements of the local food system, which is gaining more and more popularity among urban.(18)
Urban agriculture can play an important role in household food security, especially in times of crisis or food shortages. The products produced are either consumed by the manufacturer or sold in urban markets. Because locally produced food requires less transportation and refrigeration, they can provide a close market with fresher, more nutritious products at competitive prices. (19)
The benefits of urban agriculture are not just horticulture in the city, it is a significant and fundamental component of many cities. Nutrition is one of the most valuable categories of urban human society due to its main role in life, health, culture, and environment.(20) Urban agriculture reduces the poverty and food insecurity resulting from urbanization, while also improving the health of city residents and preserving the environment.Urban agriculture's integration into the urban economic and ecological system is the main feature that makes it different from rural agriculture.(6)

3. Sustainable Urban Agriculture

Urban agriculture Discusses theoretically ideas about sustainable design, lifestyle, and participatory uses of urban space or local food. (21) Urban agriculture systems can be used as a tool to maintain or develop local level employment and income, it also increases environmental quality. (22) , Pearson et al. In an article about the sustainability of urban agriculture examined it from three dimensions: social, economic, and environmental. They introduced three elements for urban agriculture: urban agriculture in isolation, its interface with the people and environment within which it is situated; and its contribution to the design of built form.(16)

Urban agriculture is an ideal platform for social relations between different people in society. children can see and taste local fruits and vegetables and observe different stages of their growth in urban farms. Students can study and experiment with new botanical theories on farms and test them up close. Parents can eat fresh food.

And get a place from this place and, local people can earn extra income by working on the farms. (23)urban agriculture types can support different communities by providing environmental and social services among community members.(24)Agriculture activities in cities make spaces safer by helping to create safe, healthy, and green environments and create social relationships between residents in neighborhoods, schools, and abandoned areas.(25) Urban agriculture creates secondary jobs for people and increases their self-sufficiency, income, and savings, which results in social stability and increased self-confidence.(6)

In general, urban agriculture in urban areas is seen as a resource that helps to improve conditions in slums (Melgarejo de Berry, 2014).Food justice programs, if implemented in areas with high unemployment, can serve as sustainable employment and catalyst for entrepreneurship. Agricultural markets can also act as centers for business growth. Due to their flexible and low-risk nature, these markets allow people to start earning money by creating jobs and attracting a handful.(23) One of the examples of helping the city's economy through urban agriculture is planting saffron in Birjand(a city in Iran). As a rare plant with low water consumption, saffron is economical than other agricultural products.The reliance of traditional communities on local agricultural products and the proper and economic use of water, land, and labor has provided a suitable economic base and has established a suitable urban design in the neighborhood and historical gardens of this city.(26)

World temperature increasing become a crucial phenomenon in the last decades. It mainly occurs in cities, especially in metropolitan areas, compared to the suburbs or the surrounding rural area, which calls the heat island phenomenon. Heat islands are urbanized areas that experience higher temperatures than outlying areas. The *phenomenon was first* investigated and *described* by Luke *Howard* in the *1810s*. The foremost cause of urban heat islands is the change in land level due to urban development and the loss of vegetation and their replacement with asphalt, cement, roads, and buildings. Urban agriculture reduces the effect of heat islands by creating green spots in the city.(27) In addition to this, urban agriculture can be considered as a solution to protect the remaining green spots in the city and preserve urban gardens.(22)

4. Urban Agriculture And Health

Research shows that horticulture activities have several benefits for mental and physical health(28) Urban agriculture, directly and indirectly, affects human health, for instance, the local cultivation of vegetables and fruits increases the consumption of them. (29)the use of fruits and vegetables in people who work in social gardens is higher than their neighbors who do not work (30)Further use of fruits and vegetables improves physical condition And prevents chronic diseases such as obesity and diabetes.(6)

Citizens' participation and activity in urban agriculture are closely related to the amount of public awareness about the benefits of urban agriculture. For having successful social activities in urban agriculture, the participation of citizens is necessary. In general, the level of awareness and people participation plays a significant role in creating a sustainable urban environment through urban agricultural activities.(31)

Economic issues and cost-effectiveness have always been one of the major concerns of urban agriculture. Therefore, urban farmers often reuse the materials available in cities. They use unusable rubber, glass, and municipal products to build their infrastructure. Reuse of these products, in addition to reducing the resources and costs required, also reduces the amount of waste in cities.(32)

Agricultural areas significantly reduce the risk of flooding through heavy rains due to their high water absorption capacity.(32)

The process of agriculture and food production in cities can be more effortless than in rural areas due to better access to harvest technologies and proximity to the markets.(33)

In developed countries, urban agricultural activities are often carried out on small plots of land, in the corners of neighborhoods, on a leased basis, or by the landowner in groups in the form of partnership gardens or organizational gardens such as school gardens. (6)

5.Urban Agriculture Activists

Urban agriculture is a sensible program for low-income families in disadvantaged communities due to the need for low capital and a high labor force. Therefore, the need for agriculture in deprived areas is more than in other areas. Because deprived urban areas do not have access to fresh food sources and at the same time have vacant lands. For this reason, most of the urban agricultural activities are in deprived areas and by poor people.(32)

Globally, about 800 million people work in urban and suburban agriculture, which provides 15 to 20 percent of the world's food. (34) Some of these people are more involved than others. Rio Metro staff, for example, grow cotton on vacant lots between stations, patients at a rehabilitation center in Sandigo grow and sell hydroponic lettuce in nearby markets and supermarkets, and women in Harare, Zimbabwe. They are informal cooperatives that earn their food and money by farming on vacant land, a group of men gardening on small plots of unbuilt church land, and in the Tanzanian capital, Dar es Salaam, almost all dairy products are consumed by Dairy cows are provided to people who raise them on their private property.

However, most urban farmers are low-income people who grow food mainly for food on land that does not belong to them.
A study of gender ratios in urban agriculture shows that women are more active than men. Gender ratios can be diverse from city to city depending on various cultural, religious, economic activities, production systems, scales, and areas of involvement.
Urban farming activities are more involved with women because of their adaptation to traditional housework and childcare. The proximity of agricultural lands to homes gives women the opportunity to raise their families in addition to do household chores and cooking food. (35)

6. Methodology

This research consisted of a series of semi-structured interviews. Questions were raised about urban agriculture, the sustainability of urban agriculture, the sustainable way of life of people in the past, and food security. Interviews were conducted from December 21, 2020 to February 19, 2021. We asked agricultural experts and university professors about the problems and opportunities in the area. Interviews were 20 different people who were involved in the issue. In total, we interviewed seven farmers who worked in Hokmabad farms, five professors from the Department of horticulture, two historians, and six university professors. In the interviews, we tried to interview farmers, experts, and professors to clarify different points of view on the subject. All data collections were audio-recorded and transcribed for later analysis. All data collections were audio-recorded and transcribed for later analysis. The resulting summary statements were then compared across data collections for each research question, which provided the basis for the final analysis. while maintaining fidelity to the verbatim transcripts.(36)
We used a nitrate test to check the health of vegetables. All vegetables were collected from Hokmabad farms in two levels morning (8 am) and afternoon (5 pm). 4 forms were selected as a pilot farm. Then they were transited to the physiology lab of the Horticulture department of Tabriz University in middle winter 2019. After gathering, vegetables were carried to Tabriz Agriculture departments laboratory.

7. Case Study

Hokmabad is the name of a neighborhood in the city of Tabriz, which is located in the west of this city. The history of the neighborhood dates back to about a thousand years ago. The people of the region are famous for their vegetable growing and have a special mastery in plotting and enriching the agriculture areas. The lands of Hokmabad are in the form of the neighborhood center surrounded by orchards and vegetable plots. As these plotted lands in the historical period of Qajar had reached the back of the central fort of Tabriz known as the fort of Najaf Gholikhani.

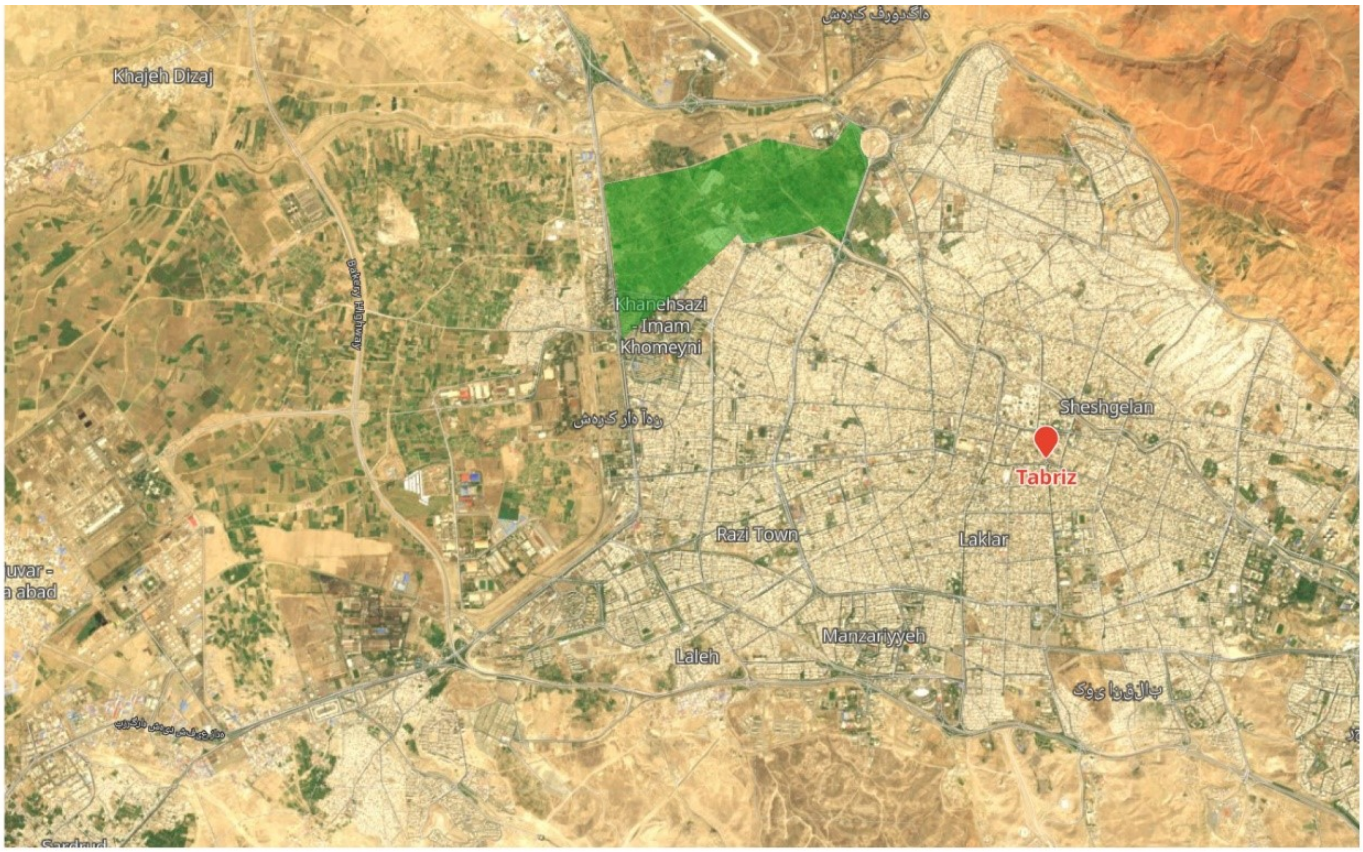

Figure 2. Location Of Hokmabad Urban Agricultural Lands In Tabriz City

Hokmabad vegetable gardens have been specially located for vegetables during the Ilkhanate period. Special attention has been paid to the slope of the city to locate these vegetable and summer gardens. Since the irrigation of these gardens has been with aqueducts. By examining the topography of the land of Tabriz, the east-west slope has caused water springs in the east and the manifestation of water in the west of Tabriz, which means that all aqueducts under construction for people to use their water after reaching the Hokmabad area and irrigating their farms.(37)

8. Environmental Sustainability Of Hokmabad Agricultural Lands

Rich soil is one of the most important components for agriculture and this necessity becomes double in vegetable farming. Because in vegetable farming, unlike most farms, crops are harvested once or twice a year, there is a weekly harvest. Therefore, this type of agriculture requires rich soil. Hokmabad lands have rich soil that is the result of millions of years of natural activities and manual enrichment and observance of traditional agricultural principles by farmers through thousands of years, so every inch of this soil is very valuable.

Professors of the Agriculture Faculty of Tabriz University and experts of Tabriz agricultural department in their interviews referred to the rich soil of Hokmabad and called the soil of this region the richest soil in East Azerbaijan and estimated the depth of fertile soil in this region up to 6 to 7 meters.

In interviews with farmers, they addressed the important issue of unique soil enrichment in the region and described the method. Hokmabad farmers use organic fertilizers for their vegetables. In addition to helping environmental sustainability, these fertilizers are also very effective in soil enrichment. farmers go to people's homes at the beginning of winter and collect human manure then spread it on the land. In addition to increasing soil richness, these spread fertilizers keep the earth warm and prevent it from freezing.

According to Dr. Siroos Masiha, another method of enrichment is the use of animal manure which also requires special skills. Farmers in Hokmabad buy animal manures annually, but do not use them for five to six years. They protect the fertilizer from fermenting and rotting completely, and then use it as an organic fertilizer that does not contain harmful trace elements such as nitrate.

9. Social sustainability of Hokmabad agricultural lands

The vegetable grower of Hokmabad, with firm faith in God, sows the seeds without leaving the slightest doubt in his heart that this seed may not come from the heart of the earth. Vegetable growers have an emotional connection with their agricultural lands and do not just think economically about their land. They have emotional contact with the farms like a mother who takes care of her child and understands what her child wants by looking at her beloved. They sow their seeds squatting in the heart of the earth, like a skilled carpet weaver, who weaves his rug with great effort and sincere love.

Mr. Hasan Rezayi, a local farmer in the area, recalls in memory of his father that his father always advised them: "Ask about your land every morning and walk around the farm, otherwise the land will get angry." he further explained that the purpose of this walk was to pay attention to the condition of the farm and to understand the need for water or fertilizer and other faults.

10. Economic sustainability of Hokmabad agricultural lands

According to the statistics of the of Tabriz agricultural department, 853.5 hectares of the best agricultural lands are located in Hokmabad orchards. In these lands, more than 1287 farming families engaging in urban agriculture, which annually provide 19037.5 tons of vegetables. This amount of vegetables is Meets the vegetable needs of

Tabriz citizens and, also significant quantities of vegetables transported to other provinces, like West Azerbaijan and Ardabil. With the reduction of products in this region, people will be forced to provide their vegetables from other provinces and cities. In addition to creating a dependent city, this significantly increases the cost of transportation, as result the price of vegetable rice and providing vegetables become hard. (38)

In another study the Tabriz Department of Agriculture showed that 80% of Tabriz citizens at least one time have bought vegetables directly from Hokmabad farms. This shows the importance of Hokmabad gardens in providing the city's vegetables need.(38)

According to Professor Ghader Dashti due to The great aroma of these vegetables and their organic nature, several of these vegetables are exported to neighboring countries such as Iraq and Saudi Arabia every year and bring good cash to the country. This case shows the adequate potential of Hokmabad vegetables, which can be marketed and exported at a higher price by branding vegetables.

11. Health and organic nature of Hokmabad vegetables

The Agriculture Faculty of Tabriz University, in collaboration with the Agricultural Organization, has conducted several studies on the health of Hokmabad vegetables in terms of the amount of nitrate which we will examine in the following. The amount of plant nitrate has been considered due to its effects on human health and is a determining factor in the health of vegetables. Therefore, standards have been set for the measurement of nitrate in some vegetables.(39) Nitrate limit per ($mgkg^{-1}fm$)of vegetables according to EU standards and the table of results of nitrate in the products of Hokmabad farms in Tabriz is in the table below. (Data collected in 2019.)

By comparing the collected standards and the amount of nitrate in vegetables in Hokmabad orchards, the amount of nitrate in these vegetables shows that the amount of nitrate in Hokmabad orchards is very low and even in the case of spinach, the amount of nitrate in samples taken is one-tenth of the standard nitrate It is prescribed scientifically. The very low amount of nitrate along with issues such as not using industrial fertilizers, chemical pesticides, and the use of safe water makes the products of these orchards healthy product. Dr. Sahib Ali Boland Nazar[1], Professor of Horticulture, Faculty of Agriculture, University of Tabriz, expresses his confidence about the health of these vegetables and introduces them as semi-organic.

Table 1. Amount of Nitrate in harvesting plants

No.	Sample specifications	Farm name	Nitrate content (mgkg^(-1) fm) wet matter at 8 am	Nitrate content (mgkg^(-1) fm) wet matter at 5 pm	Allowable limit
1	Purple Basil	Zarehmanesh	221	165	996.2
2	White basil	Zareh manesh	234	219	996.2
3	Mint	Zareh manesh	220	128	N
4	Purple Basil	Rezayi	220	81	996.2
5	Coriander	Rezayi	119	170	569
6	Spinach	Rezayi	221	98	3000
7	Purple Basil	Koosheshi	86	110	996.2
8	White basil	Koosheshi	119	121	996.2
9	Purple Basil	Parnian	148	132	996.2
10	parsely	Parnian	208	103	358.6
11	Coriander	Parnian	188	209	569
12	Leek	Parnian	106	96	N
13	mint	Parnian	156	146	N[1]

Table 2. Summary Of Interviews

		Examples Of Urban Agriculture Sustainability İn Hokmabad Fields	Principles Of Urbanity
Sustainable Development Dimensions	Social	Farmers' special emotional connection with their lands	Sense of belonging
		Employment of young children of families along with their fathers and grandfathers	Increase youth self-confidence
		Establishment of a union assembly among farmers in Hokmabad	Create ghettos
		Establish a friendly relationship between the customer and the landowners through buying and selling	Civil partnership
		Creating collaborative opportunities for neighborhood youth	Creating youth involvement
		Creating sightseeing opportunities for the citizens of Tabriz	Sense of Place
		Increasing the environmental quality of the neighborhood and creating an urban space for citizen interaction	Quality of urban space
		Create opportunities for practical observation and learning for agricultural students	Youth education
		Creating a safe space in the suburbs due to social interactions and direct purchases from gardens	Increase security
		Creating equal employment opportunities for women	Equal job opportunities for men and women
	Economical	Job creation for neighborhood residents	Employment
		Provide cheap food for the city	Cheap food for everyone
		Create added value by selling dried, cleaned vegetables and medicinal plants	Value Added
		Possibility of several harvesting times due to rich soil	Produce more product
		the opportunity of exporting organic vegetables	Export
		Ability to brand due to the high aroma of vegetables	branding
		Reduce transportation costs due to being located inside the city	reduction in costs
		Elimination of intermediaries and the possibility of direct sale of products	Remove intermediaries
	Enviremental	Prevent water wastage with the unique Sari plot method and aqueduct	Optimal use of water
		Reduce soot and carbon dioxide and soften the air	Fresh air
		Reduce the effect of thermal islands and create air conditioning	Reduce the effect of geothermal
		Having a sustainable and different agricultural method	Sustainable agriculture
		use any pesticides Lack of	Healthy food
		Use of organic fertilizers and no use of chemical fertilizers	organic products
		Use their own production seeds and do not use modified species	Healthy food
		Increase green space and thus increase animal species	Biodiversity of urban wildlife
		Preparation of organic paint for handicrafts	Organic handicrafts

[1] » N: Data do not find. *- Data (Sohn & Yoneyama, 1996) and (EFSA,2008)

12. Conclusion

Urban agriculture as a method of providing healthy food for citizens can play an effective role in revitalizing urban environments. Agricultural activities Citizens with the help of social organizations can lead to social sustainability. Beyond that, environment quality and ecosystem directly influence urban areas. Urban agriculture activities with providing fresh air, potable water, healthy food, and protection from flood Promote environmental sustainability of urban areas. (Jasionkowski & Lewandowska-Czarnecka, 2016)Urban orchards also provide economic sustainability by creating good employment and reducing the cost of transportinggoods and commuting between work and life.

In this study, according to studies, interviews, and statistical analysis, the social, economical, and environmental sustainability of urban agriculture in Hokmabad and the health and organic nature of its products were proven. According to the comments and suggestions of the interviewees, these gardens, in addition to providing the required sausages in Tabriz and surrounding cities, also have the opportunity and potential to become a brand and export. By registering these products and designing and packaging them, a good source of income can be created for the farmers of this neighborhood and even the city.

Declaration of Conflict of Interests

The authors declare that there is no conflict of interest. They have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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