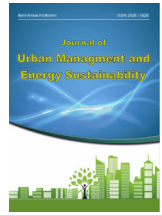


Journal of Urban Management and Energy Sustainability (JUMES)

Homepage: <http://www.ijumes.com>



ORIGINAL RESEARCH PAPER

Explanation of evaluation indicators of public spaces in high-rise residential complexes in order to provide productive green spaces

Mozhgan Koohi¹, Sina Razzaghi Asl^{2*}, Hassan Monirifar³

¹ Ph.D. Candidate of Architecture, Department of Architecture, Shahrekord branch, Islamic Azad University, Shahrekord, Iran

^{2*} Department of Urban Design, Shahid Rajaee Teacher Training University, Tehran, Iran

³ Associate Professor, Horticulture and Corps Research Department, East Azerbaijan Agriculture and Natural Resources Research and Education Center, AREEO, Tabriz, Iran

ARTICLE INFO

Article History:

Received 2023-07-07

Revised 2023-12-11

Accepted 2024-03-02

Keywords:

productive green spaces, public spaces, residential complexes, urban agriculture, urban population

ABSTRACT

Due to the increase in the urban population and the decrease in urban land, the creation of vertical housing was proposed in order to respond to the problem of land shortage. On the other hand, the growing trend of people's migration from villages to cities, the problem of the lack of farmers and suitable agricultural land, as well as the introduction of sustainable development issues led to the ideas of creating productive green spaces under the headings of productive environments, urban agriculture in urban environments were raised. Considering that the country of Iran is also facing the problem of lack of suitable agricultural land, the growth of the urban population and the growing trend of vertical housing, the present research has investigated the evaluation criteria of the establishment of productive green spaces in the public spaces of residential complexes. The purpose of this research is to present the proposed criteria for the evaluation of productive green spaces in residential complexes, because the common spaces are considered as public spaces, these principles have been examined by measuring the views and satisfaction of the residents with local architecture. Based on the purpose, this research is of applied research type and in terms of descriptive-analytical method. The findings show that the perceptual, physical, social, economic and environmental criteria in the sample of residential complexes rely more on the perceptual and environmental components. Although it is possible to predict the social and physical consequences based on the perception of people. In future researches, each of the criteria can be evaluated based on case examples and its results can be examined.

DOI: [10.22034/IJUMES.2024.711844](https://doi.org/10.22034/IJUMES.2024.711844)

Running Title: Indicators of public spaces in high-rise residential complexes in order to provide productive green spaces



NUMBER OF REFERENCES

24



NUMBER OF FIGURES

00



NUMBER OF TABLES

05

*Corresponding Author:

Email: Sinarazzaghiasl@gmail.com

Phone: +989125025808

ORCID: <https://orcid.org/0000-0003-1656-8912>

INTRODUCTION

One of the most important strategies used to solve the land problem is the policy of moving from horizontal growth to vertical growth, which has shown its clearest form of realization in residential complexes consisting of high-rise apartment blocks (Bahrapour, 2014). In Iran, along with the growth of urbanization and the increase in population and the lack of land suitable for construction, the construction of residential complexes has been one of the measures to respond to the ever-increasing need for housing (Amini, 2012). On the other hand, the reduction of agricultural land and the increase of energy and food prices in the long term had made it the best way to feed people to rely on food imports from far distances (food trips) (Shibani and Sadeghi, 2013: 68). Food travels an average of 2,500-1,500 miles from the ground to the table, which in return produces a higher level of carbon dioxide at the same time (Germer et al. 2009, 10). Therefore, concerns about the economy and food security lead to movement. Food production has been growing in the cities of developed countries including the United States (Todd and Todd, 1994: 1). Advanced countries have adopted many measures in this regard in some of their national and local programs, such as Victory Gardens in World Wars (Nelkin and Caplow, 2008: 2), Canadian Rooftop Gardens, Canadian CED Network (Komisar et al., 2009). American Backyard Gardens, (Pothukuchi and Kaufman, 1999: 44), Acropolis Program to Encourage Students to Research Urban Agriculture by Red-wood) (IUCN, 2006: 1) Adoption of 20% Roof Green Space Law in Japan Idea Edible roofs in England (Hui, 2011: 2) mentioned roof farming and urban green spaces in countries like Thailand, Singapore and Taiwan are also among the cases to be mentioned. In this regard, public spaces in residential complexes have been suitable spaces for planning to design and implement green environments. The public spaces of residential complexes as an environment that provides the possibility of residents

to be together with each other, can be the basis for creating interaction between them. Failure to pay attention to this need of people and the lack of ability of the environment to provide it causes the physical environment of many residential complexes to be a set of the volumes and the empty space between them are transformed (Yazdanfar et al.; 2016:1). In contemporary residential complexes, due to the lack of land and the lack of attention to psychological needs, the role of public spaces has diminished. In these complexes, the ownership of part of the public and semi-public spaces is usually shared, and their use is subject to special and collective regulations (Mohammadzadeh, 2013). Most of the residents usually prefer those public spaces that are closer to their living environment. In fact, the value of the open and public spaces of the residential complex is not its importance or its size, but its value is the spatial intimacy and its proximity to the private living environment. (Samadifar et al., 2012: 5).

The presence of productive green spaces and productive environments in high-density complexes will lead to an increase in the presence of people and social interactions as a result of the residents' participation in producing, planting and growing crops, and as a result, it will lead to their mental health. On the other hand, the design of public spaces with the aim of implementing productive green space in these places, taking into account the climatic and regional conditions and relative to the type of plant, in addition to providing a model for the implementation of this type of environment as a new green infrastructure, causes vitality and dynamism. Such complexes and the participation of residents of residential complexes in all stages of production of agricultural products, including production and supply, and the possibility of obtaining fresh seasonal agricultural products, and ultimately lead to the reduction of the destruction of human effects on the environment and the development of an ecological approach and ecological balance and environmental sustainability. With

the knowledge of the importance and role of architecture in sustainable urban development, the present research tries to compensate for the lack of green space with the aim of creating productive environments in places and architectural buildings. Due to the expansion of urbanization and vertical constructions and the increase in urban density, the need to address issues that are able to respond to the discussion of creating productive environments in high-density residential environments becomes more and more obvious. The expansion and expansion of emphasis on green space on the mental and psychological health of urban people in recent decades, as well as theories such as ecological design of green architecture, etc., have led to the presentation of ideas to use the open spaces of residential complexes as green spaces. On the other hand, problems Economic and environmental, the lack of food and energy resources and attention to the problem (food trips) emphasize the need to introduce the discussion of urban agriculture or productive green space in residential complexes with high density.

Since urban green space can also happen in private environments and home gardens or back gardens are one of the 11 types of urban agriculture classified by André Viljoen in the book "Ever Fruitful Urban Landscape", so considering the public spaces of complexes Housing for the production of agricultural products can lead to the creation of a productive green space, which ultimately leads to the development of people's participation in the process of preparing the production and exploitation of agricultural products, as well as access to fresh seasonal agricultural products, and as a result, the improvement of the mental and psychological health of the residents. The urban landscape and environmental and ecological standards will be improved. In order to provide part of the required food, especially in cold and dry climates, where access and the supply of the daily food needs of people is accompanied by hardships. This thesis seeks to look at the category of production environments through the lens of architectural expertise. For

this purpose, the main goal of this research is to analyze the hidden values in the establishment of production environments in high-rise residential complexes. On the other hand, the issue of climate, both in terms of architecture and in terms of its impact on the selection of different types of fruitful plants in such spaces, cannot be ignored, therefore, the design of public spaces of residential complexes should take into account architectural features in terms of form and function, as well as climatic features. Ecological and environmental to achieve a fruitful green architecture in order to improve cultural, social and environmental criteria makes the importance of the issue more obvious.

MATERIALS AND METHODS

Methodology

The type of research is analytical and it is applied in purpose, and in addition to the developing character, we can also refer to the exploratory approach of the research. The research process has included library studies, gathering information, categorizing theoretical bases and presenting the current research framework. First, the variables of the research were introduced, then the globally successful examples were introduced, and based on the findings, the background classification of related researches was done. First, in a table of influential components in the quality of public spaces, as well as in another table of influential components and micro-components in the satisfaction of residents, and finally in the final table, from the results of the tables and soliciting opinions from professors and thinkers, architects and experts, the effective components and micro-components It is provided in the establishment of productive green spaces in public spaces.

DISSCOUSION AND FINDINGS

Cultural and social importance and necessity

- 1- To improve the social interactions of the residents as a result of participation in the creation and use of productive green spaces in residential complexes

- 2- Improving the level of satisfaction due to the creation of productive green spaces in residential complexes

Ecological and environmental importance and necessity

- 1- Improving environmental standards due to the creation of productive green spaces in public spaces of residential complexes

Economic importance and necessity

- 1- Converting the public spaces of residential complexes into productive environments with agricultural products
- 2- The return of consumables for the productive green spaces of residential complexes in the food cycle and their non-waste in purely green lands of the urban landscape

Public spaces in residential complexes

In a general classification, spaces can be divided into two categories: public (open and community-oriented) and private. Different types of social interactions occur in spaces in terms of time and place. In today's housing and residential complexes, which have the capabilities of common spaces for use All residents are in the form of open and closed spaces, these spaces can play the role of mediator to improve social interactions (Mohammadi et al., 2015). The environments that are located as public space or common space between the blocks of residential complexes belong to a large number of families, which are usually neglected by people (Nowak, 2004). These spaces in residential complexes are very effective in providing situations for the development of creativity, socializing, interaction and social interaction and uses such as creating communication, relaxation, entertainment and a place for circulation in reducing pollution and improving the living environment (Cohen et al., 2012). The physical quality of a public space is related to accessibility, location, physiological comfort in different climatic conditions and security. In addition, the presence of natural elements in public spaces that increase the excitement and liveliness of the environment and invite passers-by to these spaces and the possi-

bility of rest, pleasant experiences and healthier for people is also very important (Lee-smith and Prain, 2006). In explaining the components and characteristics of successful public spaces, there are many studies and perspectives in recent decades, including Aldenberg (1999), Lirap (1972), Gol (1987), PPS Institute (2000), British Deputy Prime Minister's Office (2004) and Vanraj (1983), Lennard (1984) and... Pointed out. By examining and analyzing the components and features mentioned by these researchers, a successful public space can be considered as a space that has components such as access, suitable body, diverse landscape, activity, comprehensiveness, security, social interaction, sociability, comfort and convenience in a proportional degree. The existence of these factors together can make a public space successful or unsuccessful. As it emerged from the comparison of opinions of experts, one of the important factors of the success of public spaces is their sociability. Researchers consider sociability as one of the most important components of such spaces.

Campbell et al consider the quality of life and life satisfaction as a set of satisfaction from different environmental areas. This satisfaction is the result of the evaluation process of perception and imitation behaviors. Their proposed model became popular during the 70s and is based on a hierarchical structure and a special distinction between the objective and subjective characteristics. This model emphasizes that the context, the way of evaluating people's conditions and characteristics is effective in the quality of life. In this model, the context refers to the objective conditions or the current state of the citizens' living environment. Based on the dimensions of satisfaction, Campbell et al. Show that satisfaction is a reflection of the type of assessment and understanding of the people living in any geographical scale, which is also influenced by the objective conditions of the environment. For example, a person's level of satisfaction in the work environment is related to the type of evaluation and his understanding of the salary level, communicate with colleagues, the level of

independence, etc. (Saber et al., 2015: 12). Also, Maranz (2003) has paid attention to various dimensions of satisfaction, including the satisfaction of the place of the city, community and neighborhood, which he presented in the form of a model. In this model, he tries to show the relationship between the objective conditions of the environment and the subjective responses of citizens to them, as he states that the degree of satisfaction of citizens with the objective and environmental conditions plays an important role in determining the quality of life and satisfaction of people. In this model, the quality of life and satisfaction in The micro level of the places have been taken into consideration. In the table below, the researches related to the influencing factors in the level of satisfaction of residents

of residential complexes are categorized in the form of a table 1. (Tab.1)

The quality of public spaces results from the quality of the components of a given area, but rather than referring to the sum of the components of the environment, it refers to the overall perception of a place, the components of the natural environment, open space, man-made environment infrastructures (artifacts, physical environment facilities and natural reserves, social relations, etc.) each has its own characteristics and qualities (Vogel., 2008, 9). In the table below, researches and models proposed by global researchers about the components and sub-components affecting the quality of public spaces are categorized in a table 2. (Tab. 2)

Table 1: Researches related to the influencing factors in the level of satisfaction of residents of residential complexes

Author	Subject	Components affecting satisfaction
Dehnad and Karimi (2016)	Evaluation of the role of effective components in the open space of residential complexes in the creation of social interactions	Perceptual -social-physical
Mohammadi and Bina (2024)	Investigating the factors affecting the design quality of residential space in inefficient middle contexts, case study: Amman Samani neighborhood of Isfahan	Perceptual -social-physical
Abim and Amal (2014)	Survey of satisfaction with living in public houses in urban areas	Services, income level, materials, residential unit area, connection with nature and building form
Mohammadi and et al. (2021)	The role of physical and perceptual -psychological components of public spaces in promoting social interactions, a case study: residents of the residential complexes in district 22 of Tehran.	Open and semi-open spaces - environment - form and function - color and light - scale - dimensions - place - sense of belonging - landscape and connection with nature
Moulai Hashtjin and et al. (2021)	Analysis of vitality in the spaces of residential complexes (concept, components and influential indicators)	Formal, functional, environmental, social and cultural
Naqeibi and Hosseini (2013)	The effect of psychological, physical and environmental components in improving the satisfaction of residents of residential complexes	Physical-mental-environmental
Mojtaboi and et al. (2022)	The effect of semi-open space in improving the health of residents in residential space	Social-physical-functional
Kafashzadeh and Sabri (2021)	Investigating the desirability of working private semi-open spaces from the perspective of residents (case example: Sabzevar residential apartments)	physical-perceptual -social-functional

Table 2: Factors, components and effective indicators of the quality of public space from the perspective of scholars

Researcher	Components	Source
Kevin Lynch	The beginning of life, the possibility of human biological survival and sociology The meaning of being mentally stimulating and meaningful Ease of physical penetration access to different departments Control and monitoring the availability of the possibility of people's choice and intervention in matters related to the management and use of the public arena. Adaptation of form adaptation to different activities and different behaviors. The effectiveness of each of the above criteria according to the cost The justice of paying the cost of the standards through the organization or social class that they have to pay for	Lynch 1987
Ilan Bentli	Permeability, variety, legibility, flexibility of visual proportions, the sensory meaning of color belonging, which in 1990, due to the inadequacy and lack of concepts in these factors, Yan Bentley added three other criteria to these factors: efficiency in energy consumption, maintenance of ecosystems, cleanliness (at least delivering air pollution)	Faraji 2021
South Worth	Form structure and legibility, comfort and convenience, health and safety access, historical preservation, vitality, natural environment protection, diversity, adaptability, openness of social relations, equality and equality, maintenance of adaptability, meaning, supervision and authority	-
Lars Larup (1972)	Provision of security territory, coherent structure, continuity of legibility and predictability of spaces, existence of suitable facilities. In space, responsiveness, comfort and environmental comfort, the amount of information, environmental excitement, which requires the existence of dimensions such as complexity and the mystery of pollution, education, diversity and contrast, choice of solitude and attachment in space, and social interactions	Lang 1381
Bahrami Nejad 2003	Socio-cultural and physical	Bahrami Nejad 2003
PPS	Access and communication, comfort and mental image of uses and activities, sociality	PPS, 2009
Lang	safety-security-belonging-dependency-respect-self-fulfillment	Pakzad 2006
Andre Gotten	Breathing-resting-living together-leisure-fun-relaxation	2006
Canter	Physical-activity-mental	Golkar 2001
Golkar	Functional-aesthetic-environmental	Golkar 2001
Appleyard	Practical, inferential and responsive perception	Lang 2007
Carmona	physical-perceptual-social-visual-functional-temporal	Rafiyani 2012
Hutton and Hunter	Diversity, centralization, democracy, permeability, security, appropriate scale, organic design, economy of its appropriate tools, creative relationships, flexibility, consultation and participation of users in plans	Kalbadi 2018
Shirvani	Compatibility, external effects, architectural issues	Faraji 2021
Jane Jackobs 1961	Accessibility, flexibility, social mixing	Aref Hosseini 2021

In general, a part of public spaces and mostly open spaces in residential complexes have vegetation and green spaces, many researches have been conducted on the effects of green spaces and nature on the satisfaction of users, as well as many researches related to improving the quality of spaces with The use of green covers is available, among them, researches related to the effects of green spaces in residential environments are categorized in Table. Considering that the purpose of this thesis is to use productive green spaces in residential complexes (which are introduced and examined in the rest of this chapter), from the results of the presented tables, the components and micro-components

that are in the researchers' theories It is common and in a way it can be considered as one of the main and basic components introduced, extracted and presented as a criterion in the type of use of productive green spaces in Table 3. (Tab. 3)

Vertical farming is a world-changing innovation whose time has come. Dixon Despommer (2017) gives us an important plan to provide food in the world and solve a severe environmental crisis of today's world. When Dixon Despommer decided to do something to solve the crisis of food, water and energy in America, he did not imagine the idea of vertical farm. To the extent that it has excited scientists, architects and politicians around the world, Despomm-

Table 3: Researches related to the influencing factors in the quality of green spaces in residential complexes

Indicators	Indexes	Researcher	Subject	Results
environmental	-Air pollution control--Noise pollution control--Use of waste--Natural ventilation	Chao Yuan, Ruiqin Shan, Ayu Sukma Adelia, Abel Tablada, Siu Kit Lau, Stephen Siu-Yu Lau	Effects of vertical farming on natural ventilation of residential buildings	The necessity of observing the ratio of the green surfaces to the building blocks in the building surfaces to allow natural ventilation
Perceptual	Belonging-identity-green elements	Ghashghayi, Mansour, 2021	Factors affecting the improvement of the quality of urban green space (a case study of sidewalks in Yasouj city)	The necessity of designing green spaces with the aim of creating a sense of place and using green elements
Socio-physical	Social interactions/access	Faraji et al., 2021	Evaluation of the quality indicators of the public urban landscape	Access and social interactions are the most important influencing factors in improving the quality of the public landscape of the city
Physical-perceptual	Security access	Ibrahim abbas, zeinab, 2021	Green spaces in residential communities: the potential for ecological and health	Access and security components have the greatest impact on improving the health of residents
Social-perceptual	Interactions-vitality/belonging	Yaran, Ali,Behro, Hossein 2016	Investigating the effect of green spaces on the level of satisfaction of the residents of the high-rise residential complexes, Case example: several residential complexes in Tehran	The effect of green space on the level of satisfaction of the residents of the complexes
Environmental-physical-social	Diversity-green elements/landscapes/interactions	Karimi, Fatemeh et al., 2018	The effect of landscape environment in residential complexes on women's depression (a case study of Khatun and Chogan residential complex in Shiraz)	The effect of the quality of green space in reducing residents' depression

mers explains how vertical farming will have a dramatic effect on changing the face of the planet for generations to come. Imagine a world where every city has its own local food source. They grow in the safest possible place where no drop of water or particle of light is wasted, and where an elevator can transport you to nature's grocery store. Despommer takes readers on an incredible journey to a vertical form of buildings filled with fruits and vegetables and local food sources, which can be used for entire cities. Vertical farms can be created in self-governing

complexes, transforming cities into residential complexes that it grows and produces the fresh food it needs within itself. Perhaps the most important aspect of vertical farms is that they can make small countries redundant from agricultural producing countries. Of course, attention should be paid to the adverse environmental effects of vertical farms, which have been mentioned in some references, especially in energy consumption. (Tab. 4) Table 4. Has categorized and presented research related to productive urban green spaces in recent years.

Table 4: Researches related to productive urban green spaces

Field Book/ Thesis	Type		Topic	Brief description	Year	Researcher
	Article					
Urban agriculture and productive green spaces	✓		Continuosis productive urban landscapes: Designing urban Agriculture for sustainable cities	CPUL concepts of urban agriculture Examples and implemented examples of CPUL Cuba is a tested example for CPUL. Review of economic and social aspects They have paid in East and West Africa.	2005	Andre viljoen
	✓	Multifunctional Urban Agriculture for Sustainable Land Use Planning in the United States	Presenting urban agriculture literature and a history of agriculture	2010	Sarah Taylor lovell	
	✓	Landowner willingness to embed production agriculture and other land use options in residential areas of Chittenden County,vt	The desire of land owners to create urban agriculture	2011	Sarah Taylor lovell	
Urban agriculture and productive green spaces		✓	The case for urban agriculture as an essential element of sustainable urban infrastructure	History of urban food systems, urban agriculture project in Middelburg	2011	bohen, Katrin Andre viljoen
	✓	Green roof urban farming for buildings in high-density urban cities	The potential of big cities with high density like Hong Kong to create urban agriculture Through the green roof	2011	Dr.saw and et al.	

Field Book/ Thesis	Type		Topic	Brief description	Year	Researcher
	Article					
	✓		Design urban agriculture	Urban examples implemented under the headings: ecology + urban agriculture, landscape, integration and...	2013	April Philips
		✓	Urban agriculture of the future: an overview of sustainability aspects of food production in and on buildings	The role of zero agriculture in the future of food production They have made a city.	2013	Kathrin Spech
		✓	Self-sufficient Smart Prosumers of Tomorrow	A perspective of the architectural design of self-sufficient houses with the integration of vertical agriculture and have presented the aquaponics system	2015	Lakshmi Prakash
		✓	Vertical farming: Skyscraper sustainability?	Feasibility measurement of vertical agriculture from a social point of view is a combination of research methods. Results: Vertical farming is a hope for future cities and requires the cooperation of engineers, architects and vertical farming techniques.	2015	Malek Al-Chalabi
		✓	Urban planning and agriculture. Methodology for assessing rooftop greenhouse potential of non-residential areas using airborne sensors	Providing a special and automatic method to detect the possibility of implementing rooftop greenhouses for non-residential areas by using airborne sensors to detect some characteristics of rooftops such as (range, slope, materials and type of sunlight)	2015	Ana Nadal amón Alamús, Luca Pipia Antonio Ruiz Jordi Corbera Eva Cuerva Joan Rieradevall Alejandro Josa
		✓	Building-integrated agriculture: A first assessment of aerobiological air Quality in rooftop greenhouses (I-RTGs)	It investigates the biological quality of the air in rooftop greenhouses and evaluates whether the quality of the air accumulated in Is the greenhouse useful for circulation in the building or not, and the necessity of using a filter for the air used in the greenhouse for inside the buildings on certain days of the growing season has been stated.	2015	Mireia Ercilla-Montserrat, Rebeca Izquierdo Jordina Belmonte Juan IgnacioMontero PereMuñoz Concepción De Linares, Joan Rieradevall
		✓	Roofs of the future: rooftop greenhouses to improve buildings	Multi-faceted evaluation of the backyard greenhouse system Roof: Life cycle assessment; geographic information systems; Rainwater collection software (PluGriSost); Stability assessment; Modeling software Energy building (TAS) and sustainability assessment	2015	Oriol Ponsa*, Ana Nadalb, Esther Sanyé-Mengualb, Pere Llorach-Massanab,c, Eva Cuervad, David Sanjuan-Delmàs b, Pere Muñoz e, b, Jordi Oliver-Solà b, f, Carla Planasd, Maria Rosa Rovira

Field Book/ Thesis	Type		Topic	Brief description	Year	Researcher
	Article					
		✓	Case study of air quality above an urban rooftop vegetable farm	The effect of roof height and structure has been investigated in case studies in the city of Brooklyn and the following results have been obtained 1- The PM 2.5 index on the roofs is lower than the street level 2- Rooftop vegetables receive less air pollution with heavy metals than crops grown on the side of the street.	2015	Zheming Tong, Thomas H. Whitlow, Andrew Landers Benjamin Flanner
		✓	Urban farming construction model on the vertical building envelope to support the green building development in Slemon Indonesia	The method of creating urban agriculture in the cover of vertical buildings	2017	Suparwoko,a. Betri taufani,a
		✓	Is it time to take vertical indoor farming seriously?	It has stated the reasons for the importance and advantages of intentional agriculture inside the buildings and listed the existing limitations and obstacles against the advantages of this nascent industry.	2017	Per Pinstrup-Andersen
		✓	Urban farming construction model on the vertical building envelope to support the green building development in Slemon Indonesia	The method of creating urban agriculture in the cover of vertical buildings	2017	Suparwoko,a. Betri taufani,a
		✓	The High Garden: An architectural exploration on how to integrate vertical farming and modular architecture inside city centres	How to integrate vertical farming and modular architecture	2020	Farid Abbasi
	✓		Green Skyscraper: Integration of Plants into Skyscrapers	About the integration of plants in skyscrapers	2009	Shahrina Afrin

FAO estimated that urban agriculture, which produces food for a quarter of the world's people, reduces food transport, packaging, etc. and improves food health (Puri and Caplow, 2009: 1). The current systems of urban agriculture are different and include a wide range of approaches, models, scales, directions and goals that do not limit the urban and environmental environment (Mougeot, 2000: 2). In recent years, the issue of agriculture in urban buildings has attracted a lot

of attention and has been increasingly discussed in cities in Canada and the United States (Roman, 2010: 3). Regarding agriculture in buildings, various systems of agriculture have been used, including rooftop gardens, rooftop greenhouses, Zero acreage farming (agriculture in buildings without the need for soil), vertical agriculture, air framing, edible facades, and building integrated agriculture.

CONCLUSION AND RESULTS

The use of roofs and facades of buildings as one of the solutions proposed in line with the goals of sustainable development to increase urban green landscapes, and vertical landscaping and construction at height, put an organic issue in front of a huge mass of inorganic buildings (Razzaghi Asl et al., 2008: 8). Also, green facades have been able to play a role as an effective solution in reducing the harmful effects caused by ultraviolet rays (Raja et al., 2008). Some of the peugeots related to the different dimensions of productive green spaces in combination with the urban buildings are given below:

Beri taufania, (2017), in an article entitled Urban farming Suparwoko, construction model on the vertical building envelope to support the green buildings development in Slemon Indonesia, investigated the way of creating urban agriculture in the envelope of vertical buildings and came to the conclusion that its implementation in This type of buildings does not need vertical green cover, but public spaces on buildings, including walls and roofs, can be effectively used. In fact, urban agriculture in vertical buildings not only contributes to agricultural production, but also reduces the crisis of agricultural land; It also supports urban green spaces.

Ana Nadal & et al, (2017)in an article titled greenhouse urban planning and agriculture. Methodology for assessing rooftop potential of non-residential areas using airborne sensors, the potential in non-residential buildings to create rooftop greenhouses in terms of legal, economic, agricultural, technical and energy and environmental aspects and roof characteristics including materials, roof slope and angle The solar radiation and other technical characteristics of the roof have been investigated using airborne sensors and they have come to the conclusion that these sensors are reliable for identifying the technical characteristics of the roof, and if combined with other identification methods, the result is more favorable in detecting suitable roof structures for There will be a rooftop greenhouse.

Ana Nadal & et al, (2017), in an article entitled: Building-integrated rooftop greenhouses: An energy and environmental assessment in the Mediterranean context, conducted an environmental assessment of the performance of integrated rooftop greenhouse systems in the Mediterranean region and concluded that the amount Energy recovery is 43.78 mw/h and economic saving is 17.33 m²/yr and carbon storage CO₂(eg)/m²/yr is 5.5 kg compared to common greenhouse systems.

Oriol Pons & et al, (2015), in an article titled metabolism Roofs of the future: rooftop greenhouses to improve buildings, examined the results of a research project aimed at integrating greenhouse systems with buildings under the title of two-way robotic greenhouses and concluded that The higher temperature of rooftop greenhouses at night compared to normal greenhouses is due to the transfer of the temperature of the building below the roof, therefore using the remaining hot and cold air supplied by the building to provide an optimal range of temperatures for products or hot water or rain water. Collected inside or outside the building for irrigation using PluGriSost rainwater collection software) and also the possibility of using the remaining warm air accumulated in the greenhouse to heat other areas of the building with proper ventilation are the results of the relevant research.

Per instrup-Andersen, (2017) in an article entitled: Is it time to take vertical indoor farming seriously? The reasons for the importance and benefits of vertical farming inside the buildings have been stated and the limitations and obstacles against the benefits of this nascent industry have been listed.

Malek Al-Chalabi, (2015) in an article entitled: Vertical farming: Skyscraper sustainability? The feasibility of vertical agriculture from a social point of view has been investigated by combined and research methods, and it has come to the conclusion that vertical agriculture is a hope for future cities and requires the cooperation of architects, engineers and vertical farming techniques.

Rana Khan, & et al, (2017) in an article that is part of the thesis entitled: Modeling (BIAIM): An integrated Building Integrated Agriculture Information towards urban agriculture approach, the existing gap between agriculture and architecture and the gap in research to provide specific models and principles for creating He mentioned buildings combined with agriculture and examined the environmental conditions necessary for the production of tomato products and expressed the possibility of artificially creating these conditions in buildings and the need for more detailed future research and the use of software and validation of environmental factors for Stimulation and influence on the growth of plants is mentioned

Susanne Thomaier, & et al, (2014) in an article entitled: practice and specific novelties of Farming in and on urban buildings: Present Zero-Acreage Farming (ZFarming) and different types of zero-acreage farming suitable for It has known the cities of North America, Asia, Australia and Europe and has investigated its innovative methods and interviewed the veterans of rooftop farming and has introduced Zero Agriculture as a way to achieve a sustainable urban agriculture.

Mireia Ercilla-Montserrat & et al, (2017), in an article entitled: quality Building-integrated agriculture: A first assessment of aerobiological air in rooftop greenhouses (I-RTGs) examines the biological quality of air in rooftop greenhouses and evaluates whether the air quality Accumulated in the greenhouse is useful for circulation in the building or not, and it has been concluded that if greenhouse air is used for buildings, there is a possibility of contamination with fungal spores at certain times of the growing season, and therefore it is necessary to use suitable filters to purify the incoming air. .

Kathrin Specht, et al., (2013) in an article entitled: aspects of food Urban agriculture of the future: an overview of sustainability production in and on buildings using the principles of sustainability and examining 96 researches published in international sources on the effects of zero agri-

culture They have examined in different dimensions in terms of advantages, disadvantages, and limitations and have conducted investigations on how to understand the role of zero agriculture in the future of urban food production.

(Dr. Sam C. M. Hui): Dr. In an article entitled: “urban cities Green roof urban farming for buildings in high-density”, Sam and his colleagues have investigated the potential of large cities with high density such as Hong Kong to create urban agriculture through green roofs and have reached these results that with Considering that technical issues and local conditions should be carefully investigated, Hong Kong has a very high potential for creating rooftop agriculture and the need for design guidelines in this field is felt.

Lakshmi Prakash, et al., (2015), in an article entitled: Self-sufficient Smart Prosumers of Tomorrow, have presented a vision of the architectural design of self-sufficient houses with the integration of vertical agriculture and aquaponic system.

Sarah Taylor Lovell, et al., (2010), in an article entitled: Sustainable Land Use Planning in the Multifunctional Urban Agriculture for the United States, to present urban agriculture literature and a history of urban agriculture in the world, especially recent examples in the United States and also Obstacles and limitations of urban agriculture have been discussed.

Sarah Taylor Lovell and her colleagues in an article titled: “Landowner willingness to embed production agriculture and other land use options in residential “areas of Chittenden County, vt. the willingness of landowners to register part of their land in a cooperative management department (CLM) and obtained the following results. In the support section for embedding the agricultural sector and agricultural products, almost half of the respondents (45.5%) gave a positive answer and 28.4% gave the same answer, with the aim of making it cost-effective. Urban lands and planning have been done to increase the multi-functional landscape of the region.

Andre Viljoen, et al., (2005) in a book entitled: Continuous productive urban landscape:




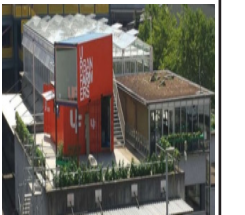
Designing urban agriculture for “sustainable cities” to present the concepts of ever-productive urban landscape, urban agriculture, introduction of urban open spaces for urban agriculture, and examples implemented as Ever fruitful urban landscape at the international level, ever fruitful urban landscape at the laboratory scale.

April Philips, (2013), in a book entitled “Design urban agriculture” to introduce and describe urban examples implemented at the international level through contracts in groups under the titles of ecology + urban agriculture, planning strategies for urban food systems, landscape, center and forum, combination and

Systems integration has addressed the life cycle operations of development and society.

Katrin Bohen, et al., (2011) and his colleague in an article entitled: “The case for urban agriculture as an essential element of sustainable urban infrastructure” provide a summary of urban agriculture, the history of urban food systems, the components of urban agriculture as the main infrastructure of the explanation. The benefits of urban agriculture and the urban agriculture project in Middleburrow urban agriculture opportunities for Middleburrow have addressed the environmental impacts of food production, at the level of employment in local food systems. (Tab. 5)

Table 5: Successfully implemented examples of productive green spaces in buildings

				
Project	The largest commercial rooftop greenhouse by Lufa farms. Cultivation of eggplants and tomatoes to meet local needs in about 15,000 square meters	The first rooftop greenhouse of lufa farms, growing 40 types of vegetables	The first rooftop greenhouse in America by the company Gotham greens growing vegetables in a greenhouse on the roof of a supermarket in Brooklyn	Rooftop farms and the first rooftop aquaponic farm in the world UF001 LokDepot
Year	2020	2011	2011	2013
Country	Montreal, Canada	Quebec, Canada	Brooklyn, New York, United States of America	Swiss land
Project	Greenhouse on the roof of the Spanish Institute of Environment and Technology (ICTA)	Agriculture in the building (an executive research project funded by the German Federal Ministry of Education and Research (BMBF) under the name Leibniz Agricultural Landscape Research Center (ZALF)	The idea of edible ceilings Edible roofs Roff gardens network of 'bee hotels' across London to help reverse solitary bee populations	Rooftop farming using hydroponic green roof in Jangi public housing complex in Singapore
Year	2014	2013	2010	1998
Country	Germany	Spain	England	Singapore
Project	Roof garden in Bangkok By the district company in Luxe Bangkok	The prominent Currotcity rooftops in Taiwan are recognized as accessible public spaces for owners and tenants	In Japan, small spaces have been created for urban agriculture. Tokyo rules: 20% of the roof is dedicated to green space.	Rooftop Farm on Eagle Street, New York
Year	2009	1995	2010	2014
Country	Bangkok, Thailand	Taiwan	Japan	United States of America

Based on the findings of previous researchers and the theoretical foundations presented, the effective components in improving the quality of public spaces from the perspective of different researchers were categorized and presented in Table ,as well as the components and micro-components that are effective in the satisfaction level of residents of residential complexes. And categorized in Tables Based on these tables, the components and micro-components which in most of the theories and researches were common and main components affecting the quality and as a result the satisfaction of the residents. In future researches, each of the criteria can be evaluated based on case examples and its results can be examined.

REFERENCES

- Amini, Saba et al., (2012) *Comparative study of residents' satisfaction level between 2 samples in mid-rise and high-rise residential complexes, case examples: Shahid Mahalati and Soban residential complexes, Arman Shahr*, No. 11.
- Bahrapour, Atiyeh, (2014). *Studying the relationship between residents' satisfaction with the living environment and their sense of belonging in the high-rise residential complex of Shahrak Kausar, Tehran, Journal of Fine Arts, Architecture and Urban Development, Volume 20, Number 3.*
- Cohen, N., K. Reynolds, and R. Sanghvi. (2012). *Five borough farm: Seeding the future of urban agriculture in New York City. New York: Design Trust for Public Space.*
- Germer, J., J. Sauerborn, F. Asch, J. de Boer, J. Schreiber, G. Weber, and J. Müller. (2011). *Skyfarming an ecological innovation to enhance global food security. Journal of Consumer Protection and Food Safety* 6(2): 237–251.
- Hui, S.C.M. (2011). *Green roof urban farming for buildings in high density urban cities. In Paper presented at World green roof conference, 18–21 Mar, Hainan, China.*
- International Union for Conservation of Nature (IUCN). (2006). *The future of sustainability: Re-thinking environment and development in the twenty-first century. Report of the IUCN Renowned Thinkers Meeting, 29–31 Jan 2006.*
- Komisar, J., J. Nasr, and M. Gorgolewski. (2009). *Designing for food and agriculture: Recent explorations at Ryerson University. Open House International* 34(2): 61–70.
- Lee-Smith, D., and G. Prain. (2006). *Understanding the links between agriculture and health. Focus 13, Brief 13. Washington, D.C.: International Food Policy Research Institute.*
- Mohammadi Sangli, Khashayar, Qornesi, Sayeda Sediqeh, (2015), *sustainable urban development; Global approach with local solutions, case study: investigation of sustainability criteria in traditional architecture of Yazd city. Art and architecture studies of the second year, numbers 5 and 4.*
- Mohammadzadeh, Rahmat. (2013), *investigation of the quality of spatial and physical factors of open spaces in residential complexes of the new city of Sahand, Journal of Fine Arts - Architecture and Urban Development, No. 4*
- Mougeot, L.J.A. (2000). *Urban agriculture: Definition, presence, potentials and risks, and policy challenges. Cities Feeding People Series Report 31. Ottawa: International Development Research Centre.*
- Nelkin, J.B., and T. Caplow. (2008). *Sustainable controlled environment agriculture for urban areas. Acta Horticulturae* 801: 449–456.
- Nowak, M. (2004). *Urban agriculture on the rooftop. Senior Honors Thesis. Cornell University.*
- Pothukuchi, K., and J.L. Kaufman. (1999). *Placing the food system on the urban agenda: The role of municipal institutions in food systems planning. Agriculture and Human Values* 16(2): 213–224.
- Puri, V., and T. Caplow. (2009). *How to grow food in the 100% renewable city: Building-integrated agriculture. In 100% renewable: Energy autonomy in action, ed. P. Droege, 229–241. London: Earthscan.*
- Raja, S., C. Ma, and P. Yadav. (2008). *Beyond food deserts: Measuring and mapping racial disparities in neighborhood food environments. Journal of Planning Education and Research* 27: 469–482.

- Razzaghi Asl et al., (2008). *Suggesting a mechanism to resolve the ambiguity of landscape architects and urban design in common areas, Bagh Nazar, No. 12, year 6, fall and winter 2018.*
- Roman, H.T. (2010). *Rooftop garden design challenge. Technology and Engineering Teacher 70(1): 16–18.*
- Sadegh Saberi, Mohammad Javad and colleagues, (2015). *Designing the social action space of children in the open area of residential complexes with the approach of creativity and social interactions, second year art and architecture studies; Number 6.*
- Samadifar, Zahra, Mohed, Khosro, Jahanbakhsh, Haider, (2012), *Localization and sustainability of residential complex architecture with efficiency of public spaces to increase social interactions, 8th Science and Technology Advances Symposium, Iran, Mashhad*
- Shibani, Mehdi, Sadeghi, Zahra, (2013), *productive landscape, attention to the environment, the role of agriculture in the formation of urban landscape, Manzar No. 21.*
- Todd, N.J., and J. Todd. (1994). *From eco-cities to living machines: Principles of ecological design.* Berkeley, CA: North Atlantic Books.
- Vogel, G. (2008). *Upending the traditional farm. Science 319: 752–753.*
- Yazdanfar, Seyyed Abai, Hosseini, Seyed Baqer, Zoroudi, Mostafa, (2016), *The quality of public spaces and increasing social interactions (case study: Kotsar residential complex and phase two of Ekbatan residential complex), Urban Management Journal, Year 11, Number 32*

COPYRIGHTS

©2023 The author(s). This is an open access article distributed under the terms of the Creative Commons Attribution (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, as long as the original authors and source are cited. No permission is required from the authors or the publishers.



HOW TO CITE THIS ARTICLE

Koohi, M., Razzaghi Asl, S., & Monirifar, H. (2024). Explanation of evaluation indicators of public spaces in high-rise residential complexes in order to provide productive green spaces. *International Journal of Urban Management and Energy Sustainability, 4(3), 162-176.*

DOI: [10.22034/IJUMES.2024.711844](https://doi.org/10.22034/IJUMES.2024.711844)

