



# Strategic planning for cultivation of fruit trees and shrubs in urban landscapes using the SWOT method: A case study for the city of Mashhad, Iran



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## ABSTRACT

In urban landscape planning, using or not-using fruitful trees and shrubs as part of urban agriculture is a significant challenge. This study evaluated the important factors affecting cultivation of fruitful shrubs and trees in urban landscapes. It also utilized these factors in developing effective strategies for cultivation of these groups of plants in landscaping of the metropolitan city of Mashhad, Iran. It would be crucial for urban landscape managers and decision-makers to understand the relative importance of the affecting factors and to develop effective planning strategies for using these groups of plants in urban landscaping. To support their decision making process, a SWOT analysis approach was applied. Twelve factors and their relative weighting were examined through focus group interviews. This was followed by a semi-structured questionnaire survey with landscape decision makers in the city of Mashhad. The results suggested a range of SWOT strategies among which Strength-Threat (ST) strategies were the most important strategies. These ST strategies should be applied in productive cultivation of trees and shrubs in landscape development in the city of Mashhad. One of the main strategies which might be applicable for urban agriculture development in developing countries is using germplasm of native fruit trees with low water requirements. Using native species leads to sustainable use of local water and soil resources that are critical in these countries, such as the countries in the Middle East, on the benefit of employing more labors that are relatively cheap. This can also improve satisfaction of the society with reduction in unemployment rates.

## 1. Introduction

Today, the majority of people in the world live in urban environments, and it is estimated that future population growth will be concentrated in urban areas of less developed countries, while the global rural population is expected to decline after 2020 (UN, 2010). By 2020, developing countries of Africa, Asia, and Latin America will be home for 75% of urban dwellers in the world. Most cities in developing countries will have difficulties coping with this development and are unable to create sufficient formal employment opportunities or to provide food for the poor (Baudoin and Drescher, 2008; Drescher, 2000; De Zeeuw et al., 2011). In recent decades, urban agriculture has been powerfully advocated as a solution to particular types of urban challenges by contributing to the social, economic and environmental sustainability of cities (Deelstra and Nijwenning, 1997).

Urban agriculture throughout the world is transforming itself in

response to political, economic, environmental, and technological changes. Its emerging role in today's urbanizing world is just beginning to be understood (Zeza and Tasciotti, 2010). Urban agriculture can include community and private gardens, edible landscaping, fruit trees, food-producing green roofs, aquaculture, farmers markets, small-scale farming, hobby bee keeping, and food composting (Mendes et al., 2008). The definition of urban agriculture varies among scholars. However, it is difficult to find an appropriate definition for urban agriculture because some definitions are based on usage and the background or origin of the users. Based on the scope of this study, we discuss the concept as cultivation of fruit shrubs and trees in urban public landscapes.

Urban agriculture has various benefits. Its environmental benefits include the creation of active green spaces, revitalizing brownfield sites, improving air quality, providing food that travels a shorter distance from field to plate, preservation of cultivable lands, cooler buildings,

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and improving urban biodiversity (Irvine et al., 1999; Mougeot, 1994). At the same time, scholars suggest that urban agriculture provide a host of social benefits including active public spaces, community capacity building, participatory decision making, an enhanced sense of place, food security, community safety, physical activity, social inclusion and improved health and nutrition (Dubbeling, 2006; Holland, 2004; Mendes, 2007; Wakefield et al., 2007; Welsh and MacRae, 1998). This notion has its roots in Jane Jacobs's classic argument of "eyes on the street" as a mean to improve urban safety (Jacobs, 1961). A number of studies argue that urban agriculture contributes to foster 'community development' through the use of shared experiences, spaces, tools and skills (Armstrong, 2000; Smit et al., 2001; Jamison, 1985). Furthermore, some studies presented that urban agriculture can help to create a sense of place and stability for immigrant populations (Saldivar-Tanaka and Krasny, 2004). Other literature provides insight into the 'psychological benefits' of green spaces in urban areas, for stress levels, health and general well-being (Kaplan, 1973).

Gardening projects have been said to increase neighborhood pride and change the way people feel about their environment (Schmelzkopf, 1995). They can add a new and "uplifting aesthetic" and "sense of nature" to blighted areas. According to Schmelzkopf (1995), fruit gardens can help establish 'community engagement' and transform people's attitudes about their neighborhoods, often increasing commitment and involvement in neighborhood programs (Jamison, 1985). It has also been argued that gardening has the potential to decrease crime in an area (Armstrong, 2000). This is because gardens create 'defensible spaces' blocking criminals escape routes and increasing the public range of vision (Schukoske, 1999).

The reaction to urban agriculture has been varied. In some cases urban agriculture has faced strong opposition from city authorities, because of a range of negative health, environmental, economic and cultural aspects, comprising contamination of crops with pathogens, chemical residues and heavy metals (Lock and van Veenhuizen, 2001), soil degradation (Quansah et al., 1997), surface and groundwater pollution with agro-chemicals (Lock and van Veenhuizen, 2001; Van Veenhuizen, 2006), conflicting land and water issues (Lynch et al., 2001) and the perception that agriculture is not an appropriate activity for urban areas (Kalebbo, 1998). The problem is that because of such numerous health and environmental risks which have been perceived to be associated with the urban agriculture concept the authorities of developing countries prefer not to get involved in it.

Urban planners, especially in less-developed countries, need to find ways to capture the benefits and counter or prevent the potential problems of urban agricultural activities (Quon, 1999). Indeed, many city planners argue that urban agriculture is not compatible with modern urban forms (Girardet, 2004) because the sites used for urban agriculture as new green space developments may not provide monetary benefits (De Sousa, 2003).

The attitude of policy-makers towards urban agriculture in many countries ranges from repression, to tolerance and support. Generally, urban agriculture suffers from a combination of political restraints (Berg and Zeeuw, 1998) which includes restrictive urban policy, laws and regulations due to the legal status of urban agriculture, uncertainty about property rights of land, lack of supportive services, unfeasible implementation of environmental technologies, and lack of organizations and representation of urban farmers.

The key issue is how opportunities for urban agriculture can be translated into sustainable initiatives. In order to set the right conditions for city farming and urban agriculture to develop, a fundamental step is to recognize the interrelated nature of food, agriculture, health and ecology by forming a municipal working group that can deal with food issues from a total system perspective. This could involve the health department, planning department, engineering, local economic development, water management and waste management organizations. Municipalities are now more involved in urban agriculture because the concept has emerged as a strategy to achieve urban

sustainability and green space designs (De Sousa, 2003).

Some planners and municipal policymakers have proposed tools and strategies to achieve greener cities that are both ecologically and socially sustainable. In Iran, urban agriculture has had a great history (Hobhouse, 2003). However, in recent years, there are controversial ideas about the concept and there are challenges about the best strategies to apply the concept in urban planning, design and management. Therefore, this study used a SWOT analysis to assess the feasibility of cultivation of fruit bearing shrubs and trees in the city of Mashhad, Iran. The SWOT analysis approach has been previously used as a successful strategic planning method for open and green space development (The University of Manchester, 2010; Laghaei and Gilani, 2014). This research applied the SWOT approach for developing strategic plans regarding urban agriculture using fruit shrubs and trees in the city of Mashhad in Iran as a case study.

## 2. Methodology

This study used the SWOT analysis approach as a strategic planning approach to indicate strategies for developing urban agriculture in the city of Mashhad, Iran. This method is adapted to identify critical factors affecting the cultivation of fruit shrubs and to undertake preliminary decision making and planning (Arslan and Er, 2008) for developing urban agriculture in large cities. The main advantage of the SWOT approach is to indicate the current constraints and future possibilities of implementing the proposed policies (Johnson et al., 1989). The SWOT analysis approach is an effective technique in formulating strategies (Hill and Westbrook, 1997) since it categorizes factors as being internal (strengths, weaknesses) or external (opportunities, threats) in relation to a given decision (Shrestha et al., 2004). Hence, the approach can provide an insight into the means for converting threats into opportunities, and offsetting weaknesses towards strengths (Cheng-yong, 2010; Liu, 2013; Valipoor et al., 2013).

This method has been previously used in open space development scenarios (The University of Manchester, 2010; Laghaei and Gilani, 2014). The study findings can be helpful to achieve strategic objectives in order to develop fruit trees and shrubs in landscape of a city and its associated benefits including the use of multi-functional landscapes.

### 2.1. The study area

Mashhad as the capital of Razavi Khorasan province and is the second most populated cities in Iran. It is located in northeast of the country (Fig. 1).

It has a high population growth of 1.7 million people (Statistical Centre of Iran, 2011). It is a tourism city which hosts about 30 million people every year. The average area of green space per capita was 11.3 m<sup>2</sup> in 2016 (Mashhad parks and green spaces organization, 2016). This city is located in an arid climate region based on the Koppen Geiger climate classification (Rubel and Kottek, 2010) with relatively low quality water and soil resources. The high population and limited green space per capita in city of Mashhad with low green space per capita requires further development of its green spaces. In such a city with a high population and low natural resources, there is a need for sustainable multifunctional green spaces such as urban agriculture which can improve sustainable use of resources (Ebrahimpour et al., 2013) as well as opportunities for employment and food safety. Considering that there are native plant species of fruit trees and shrubs with low water consumption in the local region, urban agriculture has potential to improve urban landscapes while optimize the use of water resources (Kazemi and Abbassi, 2016).

The city administration is comprised of various organizations with a hierarchy as described in Fig. 2. Management of urban green spaces has been active since 1972, and the parks and green space organization, which works under supervision of the municipality of Mashhad, is the most responsible organization on green space development and



Fig. 1. Location of the city of Mashhad in Iran.

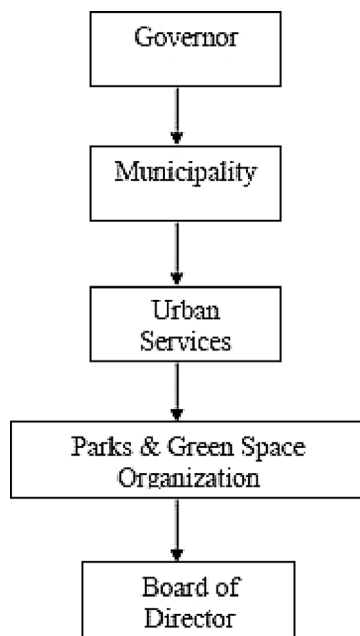


Fig. 2. The organizational structure related to the landscape development in the city of Mashhad.

maintenance of this city.

The local government intends to initiate implementing and maintaining urban agriculture. It should also be noted that due to the intense urban development and high pollution potential in the highly developed Mashhad Central Business District (CBD), if a suggestion for the development of urban agriculture could be made based on the results of this research, it might be more appropriate and less challenging if it occurs in suburban areas in this city.

## 2.2. The SWOT approach

The SWOT approach is designed at collecting information on two

groups of internal (strengths and weaknesses) and external factors (opportunities and threats). Based on the internal and external factors, the strategies to develop urban agriculture were extracted and the outcomes were compared and improved by the strategies suggested by the experts. The methodical stages are presented in Fig. 3.

To conduct the SWOT analysis method, face to face semi-structured interviews with different stakeholder groups were carried out. The stakeholders were representatives of various organizations involved in urban landscape development. They included landscape supervisors as employees of Mashhad municipality, the manager of the botanic garden of Mashhad, landscape contractors as representative of non-governmental organizations, and private sectors and university-academic members as representatives of the scientific research community. The total number of the respondents was 33 (Table 1).

In order to explore different aspects of the experts' views, experiences and perspectives on developing urban agriculture, the interview questionnaire mainly consisted of open-ended questions. To get to the final strategies, at the end of the questionnaire survey, the respondents were asked about possible strategies to develop urban agriculture.

The final dataset was made of 33 interviews which provided information on challenges and opportunities to develop urban agriculture in the city of Mashhad. To identify prominent and consistent themes across the large amount of data from the interviews, content analysis was used, on the basis that it has been shown to be an appropriate method to reduce and to generalize an interviewed based dataset (Babbie, 2001; Northey et al., 2002). Considering the conceptual framework and without imposing theories and prepared hypothesis in advance, the raw data was coded and emerged into categories of strengths, weaknesses, opportunities and threats (Creswell, 2003). Altogether 12 factors were identified within the four groups of strengths, weaknesses, opportunities and threats.

At the second round of the data collection, the stakeholders who were interviewed during the first round were asked to individually complete a structured questionnaire. The questions were about each identified factor, seeking to determine 1) how important the given factor is for the municipality; and, 2) how much the factors identified in the first stage of the survey could cause problems during the development of urban agriculture. In the first question, which was related to

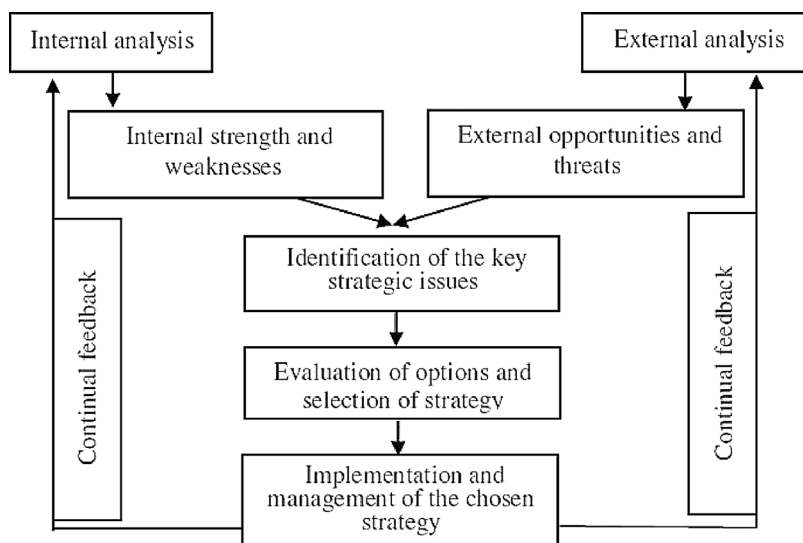


Fig. 3. The process of conducting the SWOT approach (Riston, 2008).

**Table 1**  
Frequency of the stakeholders attended in the SWOT analysis approach in this study.

Respondents category	Number of respondents
Landscape supervisors	17
The manager of the botanic garden of Mashhad	1
Landscape contractors	12
University-academic members	3
<b>Total</b>	<b>33</b>

factor weights, responses were given by a vector of integers ranging from zero for the least important to ten for the most important. The values were, then, converted to 0.01 (not important) to 1.0 (the most important). In the second question, which was related to the ranks, a rating from 1 (insignificant factor) to 4 (the most significant factor) were given to the respondents.

The weighted scores that were used for the judgments were calculated by multiplying the ranks and weights. The average of the weighted scores (2.5) was used as a judgment scale. If the weighted score increases up to 4, it indicates that the strengths (opportunities) overcome the weaknesses (threats) for the organization. If the scores were between 1–2.5, it indicated that the weaknesses (threats) overcome the strengths (opportunities). This method of calculation has been previously used. For example, Reihanian et al. (2012) used the SWOT approach to explore how the Boujagh National Park located in the north of Iran could be transformed to a sustainable tourism model.

After calculating the scores of external and internal factors and developing the strategic matrix, the strategic decision quadrangle in the SWOT analysis approach was constructed. Based on the calculated scores four strategies corresponding to different cross combinations of internal and external factors in the SWOT method were obtained (Fig. 1). All the calculations were conducted using the Excel software package (V. 2013).

This Matrix is one of the important tools by which the managers can compare the information and can provide four types of strategies: SO strategies, WO strategies, ST strategies, and WT strategies. The SO strategies – known as aggressive strategies- occurs when strengths can be used to maximize opportunities. This is the most favorable situation for any organization. The SWOT analysis leads to WO strategies – called conservative strategies- when weaknesses meet opportunities. This indicates that the situation brings risks, against which the organization should overcome its weaknesses. The SWOT analysis method may reveal a situation where strengths meet threats. In case of such situation, the organization can establish competitive (ST) strategies by

implementing its strengths to reduce its vulnerability to external threats. If weaknesses meet threats, the worst case is reached. This situation indicates that negative external factors reinforce negative internal factors. In such situation, the organization should establish defensive (WT) strategies to prevent the negative internal weaknesses from making it highly susceptible to external threats.

The SWOT approach does not require special software or tools to make the questionnaire or calculate the data collected from the respondents. The most important part of this approach is open interviews and focus groups to find the strengths, weaknesses, opportunities and threats.

### 3. Results and discussion

#### 3.1. Creating SWOT diagram of internal and external factors

The SWOT diagram of cultivation of fruit trees and shrubs in the city of Mashhad was constructed according to the focus group discussions and interviews with experts. The strengths and weaknesses were categorized as internal factors and the opportunities and threats were categorized as external factors (Table 2).

##### 3.1.1. Strengths

3.1.1.1. S1. More tendencies of the inspectors of organizations toward cultivation of fruit trees and shrubs at least in specific public landscape types. According to the respondents, cultivation of fruit trees and shrubs can be considered as a strength factor in developing some landscape types in the city of Mashhad because it creates multifunctional landscapes. Multi-functionality, usually defined as the multiple roles or objectives that society assigns to urban agriculture, includes economic, social and environmental roles (Duvernoy et al., 2005; Ali et al., 2006). Urban agriculture creates landscapes in which users cannot be excluded (Poulsen and Spiker, 2014). The advantage of urban agriculture compared to other created landscapes is that its function is supported by market forces, even if these markets are imperfect. Therefore, these landscapes are usually more sustainable than common non-productive public landscapes (De Bon et al., 2010). When fruit trees are used in appropriate landscapes in cities, the local government can get benefits from urban agriculture by selling the products to market and this can become an extra income sources for the organization. It perhaps can increase job’s satisfaction among organizational staffs as well (Rabinovitch and Schmetzer, 1997).

##### 3.1.1.2. S2. Access to variety of fruit trees and shrubs especially plant



Table 2

Diagram of the SWOT analysis approach for developing urban agriculture in the city of Mashhad, Iran.

	Strength	Weakness
Internal factors	S <sub>1</sub> More tendencies of the decision-makers toward cultivation of fruit trees and shrubs at least in specific public landscape types due to multifunctionality of these types of landscapes	W <sub>1</sub> Insufficient science and experience of personnel engaged in the relevant organization
	S <sub>2</sub> Access to variety of fruit trees and shrubs especially plant species with low water requirements	W <sub>2</sub> Lack of specialized and technical facilities in harvest and postharvest stages of fruit trees
	S <sub>3</sub> High diversity of native plant species	
External factors	Opportunity	Threat
	O <sub>1</sub> Presence of more accessible and cheaper labor force in the society	T <sub>1</sub> More dangers of biotic and abiotic stresses
	O <sub>2</sub> Creating beautiful landscapes using fruit trees and shrubs	T <sub>2</sub> Negative influence of chemical control of fruit trees on people's and plants' health
	O <sub>3</sub> Sustainable use of soil and water resources	T <sub>3</sub> The possibility of social vandalism
		T <sub>4</sub> Increasing organizational costs

*species with low water requirements.* The stakeholders in city of Mashhad believed that there is a variety of water-conserving fruit trees and shrubs that the urban landscape can get benefit from in the arid environment of Mashhad city under urban agricultural themes. Shortage of water resources is a strong limiting factor for landscape development in arid and semi-arid urban environments (Rabbani KheirKhah and Kazemi, 2015). Therefore, in such urban environments landscape managers should consider water conservation as one of their main priorities either through using non-productive plant species or by application of fruit trees and shrubs.

The industry for cultivating fruit trees and shrubs in Iran is relatively well-developed and adapted to arid and semi-arid climate of this country. A large variety of exotic fruit trees and shrubs which can survive in drought stress climate conditions of Iran are available in its market.

**3.1.1.3. S3. High diversity of native plant species.** Compared to many countries in the world, Iran is a rich country in terms of plant germplasm. Iran is origin of 6417 plant species. Such plant diversity is even higher than plant diversity recorded in Europe (Ghahreman and Attar, 1998; Mozaffarian, 1996). A large number of native fruit species such as almonds, grapes, pistachios, jujubes, olives, wild olives, pomegranate, figs and mulberries are naturally occurring in Iran – o-Turanian vegetation region in Iran and most of them are drought tolerant (Mozaffarian, 1996; Kazemi and Abbasi, 2016). Some of these plant species (such as Golab cultivar of apple) have already been domesticated and adapted to local urban conditions and are currently used for commercial fruit production in Iran, while some others still require adaptation (e.g. some native figs, crataegus hawthorn). Landscape development of this country can benefit from this variation of plants in its urban agricultural themes.

### 3.1.2. Weaknesses

**3.1.2.1. W1. Insufficient science and experience of personnel engaged in the relevant organization.** One of the features of urban agriculture is the agriculture personnel involved, who should have basic knowledge and skills about urban agriculture and horticulture. In Mashhad municipality, the personnel involved in green space development appear not to have sufficient experience or skills related to urban agriculture. Accordingly, improvement in the knowledge and skills of the landscape staff is a key factor for successful implementation of this concept. This can be easily overcome by holding short and long term courses depending on the requirements of the personnel through the strong Research, Education and Development Center available in Mashhad municipality.

**3.1.2.2. W2. Lack of specialized and technical facilities in harvest and postharvest stages of fruit trees.** According to the experts' idea in this research, there are little technological advancements in harvesting and post-harvesting stage of fruit trees and shrubs in the landscape organizations and this is a burden for development of this concept in

urban landscapes of Mashhad. This might be a true weakness for development of urban agriculture in Mashhad if only internal organizational facilities are considered as available resources for this organization. However, it should be noted that in current development practices using non-productive plants in landscaping, the organization is hiring experts and facilities from private sectors (Armat, 2004). Therefore, it is an achievable goal for Mashhad municipality to hire specialized technical facilities from external organizations and private sectors for any stage of growth, harvesting or post harvesting of fruit trees and shrubs in this city.

### 3.1.3. Opportunities

**3.1.3.1. O1. Presence of more accessible and cheaper labor force in the society.** A major feature and opportunity for the development of urban agriculture is the diversity of the socio-economic profiles of the actors involved, and their varying income and livelihood strategies which reflect a diversity of labor and their potential for partnership with producers and growers (De Bon et al., 2010; Mougeot, 2015).

In Iran, urban agriculture is a traditional activity and considered a significant part of Iranian culture and tradition of gardening. It can be used as a hobby to fill in people's spare time and connect people with nature in fully developed urban environments. Previous research has shown that Iranian people were more interested to work with fruit trees compared with common landscape plants when horticultural therapy treatments were presented (Hobhouse, 2003). The municipality of Mashhad can take this opportunity to develop the concept and to engage communities and reduce the labor costs, in particular in cultivation of the trees and in harvesting stage of fruits. Such opportunity has been recommended as a strategy in other urban farming programs for example in the US (Poulsen and Spiker, 2014). Using such opportunity not only can be beneficial for the development of the concept but also can assist society by improving social and cultural participation, increasing interactions and creating jobs and securing an alternative food supply especially for poor urban households in cities of Iran. This opportunity has been previously recognized in previous urban agricultural studies (Mougeot, 2015; Mohammadi et al., 2013).

**3.1.3.2. O2. Creating beautiful landscapes using fruit trees and shrubs.** Fruit trees and shrubs make beautiful landscapes. Fruit trees can showcase beautiful blooms, attract birds and pollinators, and can provide striking winter features, depending on their species. At present, these features are less seen in landscaping of the city of Mashhad (Kazemi and Abbasi, 2016).

Using flowering fruit trees in garden design ideas due to their distinguishing beauties has been previously developed. For example, in Japanese gardens, one of the significant features and visual aesthetics is cherry blossom which showcases flowering of varieties of species from the genus *Prunus* such as almonds, peaches, plums and apricots in the designed gardens (Conan, 2000).

**3.1.3.3. O3. Sustainable use of soil and water resources.** According to the

experts in this study, development of urban agriculture in the city of Mashhad can provide an opportunity for more sustainable use of resources such as soil and water in this city. Currently, the major water sources of Mashhad are supplied from groundwater sources which is not sustainable (Mashhad parks and green spaces organization, 2016). Therefore, creating landscapes with urban agricultural themes can reduce the need for creating traditional orchards for producing people’s food, therefore, can reduce water demand in horticulture and mitigate pressures on groundwater sources. Therefore, globally, there are tendencies towards developing multifunctional urban landscapes to justify using soil and water sources for these land uses (Brandt et al., 2000; Kazemi et al., 2010). One of the suggested strategies for sustainable use of these resources is urban agriculture by which policy makers can get important opportunities to better integrate agricultural activities into local municipal development and ensure that it helps to achieve sustainability (FAO, 2010). There are a variety of water efficient practices that have been incorporated into urban agricultural movements, including water harvesting, water reuse and improved irrigation. Using the same urban lands for fruit production and urban landscaping contribute to cities’ social, economic and environmental sustainability (FAO, 2010).

3.1.4. Threats

3.1.4.1. T1. More dangers of biotic and abiotic stresses. There was a perception among the experts in this survey that fruit trees and shrubs are more susceptible to pests and diseases and also to abiotic stresses such as drought and salinity. Residents’ fear that urban farming may bring pests to cities has been previously reported in other urban agricultural programs as well (Poulsen and Spiker, 2014).

It should be noted that while danger of biotic and abiotic stresses in cultivation of some common types of fruit trees and shrubs might be true, there are still a large number of fruit trees and shrubs which can well survive and tolerate in stress conditions of Iran (Mozaffarian, 2010).

3.1.4.2. T2. Negative influence of chemical control of fruit trees on people’s and other plants’ health. One of the major threats attributed to urban agriculture is that fruit trees require more chemicals than common urban landscapes in order to produce quality fruits. That is why some countries are opposed to the practice of urban agriculture as they perceive it is against public health (Maxwell, 1995). It appears experts’ ideas in Mashhad are also in agreement with Maxwell (1995) in that urban agriculture has negative influence on people’s and even plants’ health through using chemicals for its management.

3.1.4.3. T3. The possibility of social vandalism. There was a perception among the experts in this study that possibility of vandalism is higher in landscapes planted with fruit trees and shrubs. The perception of insecurity associated with vandalism has been previously reported in different urban landscapes such as urban parks and desert type landscapes (Bixler and Floyd, 1997; Chiesura, 2004; Yavuz and Kuloglu, 2011). While perception of vandalism has been previously reported for urban farms, in a study in Blatimore, residents and surrounding neighbors observed fewer incidents of theft and

vandalism in urban farms compared to the areas without urban farms. This was mainly because in some neighborhoods, residents were familiar with people who work at the farm (Poulsen and Spiker, 2014). Faizi et al. (2008) defined vandalism as ‘destruction of public places and properties in the city’ and believed vandalism from the social perspective can be because of the lack of belonging towards the spaces and their environment in people. They believed that there can be environmental design solutions to prevent vandalism in urban realm. Poulsen and Spiker (2014) also emphasized on integrating urban agriculture into urban landscapes of the cities by making stronger relationships between urban agriculture and local communities.

3.1.4.4. T4. Increasing organizational costs. Based on experts’ ideas, high costs have been a main issue of the development of urban agriculture in parks and green spaces of the city of Mashhad. However, as this concept has not been earlier developed in this city, this should initially be considered as experts’ perception which require further investigations. However, there are evidence in other countries that urban agriculture faces unique challenges including economic ones in the construction stage (Brown and Jameton, 2000) and also in maintenance phase. Experts in economics, the orchard industry and landscaping may need to gather together their ideas (Dubbeling and Merzthal, 2006) and strategies for more economic approaches for development of urban agriculture in Mashhad. Indeed, they should also consider economic costs as an investment in the less tangible benefits such as community well-being which is important for all types of urban green spaces (Kolbe and Wustemann, 2015; Saraev, 2012).

3.2. Designing external and internal factors evaluation matrix

At this phase of the research, external (opportunities and threats) and internal (strengths and weaknesses) factors that were perceived to affect cultivation of fruit trees and shrubs in the urban environment of Mashhad were evaluated separately. Based on the decision makers’ idea involved in the parks and green spaces organization of Mashhad, each factor was evaluated and ranked and the importance ratio coefficient was identified.

According to Table 3, the final weighted score of the matrix of internal factors in this study was 2.58. As the score was more than 2.5, it could be concluded that the strengths factors surpasses their weaknesses. However, it should be noted that as the score is very close to 2.5, it is very close to evenness of strength and weakness factors. The results also have some limitations due to relatively small pool of participants.

Table 4 demonstrates the result of the relative weight scores of the matrix of external factors. According to Table 4, the final score of the matrix of external factors was 2.25. As the score was less than 2.5, the threats were more than opportunities.

3.3. SWOT matrix and strategic position

To develop the SWOT matrix, internal and external factors and their associated weights and coefficients were compared together and appropriate and effective key strategies based on authors’ experiences, field data and documents were studied and recorded. The strategies

Table 3  
The matrix of internal factors for developing urban agriculture in the city of Mashhad.

Factor type	Internal factors	Code	Score	Weight	Weighted Score
Strength	More tendencies of the inspectors of organizations toward cultivation of fruit trees and shrubs at least in specific public landscape types	S <sub>1</sub>	3	0.15	0.45
	Access to variety of fruit trees and shrubs especially plant species with low water requirements	S <sub>2</sub>	4	0.24	0.95
	High diversity of native plant species	S <sub>3</sub>	3	0.18	0.54
Weakness	Insufficient science and experience of personnel engaged in the relevant organization	W <sub>1</sub>	2	0.21	0.42
	Lack of specialized and technical facilities in harvest and postharvest stages of fruit trees	W <sub>2</sub>	1	0.22	0.22
Sum		–	–	1	2.58

**Table 4**  
The matrix of external factors for developing urban agriculture in the city of Mashhad.

Factor type	External factors	Code	Score	Weight	Weighted Score
Opportunity	Presence of more accessible and cheaper labor force in the society	O <sub>1</sub>	3	0.126	0.38
	Creating beautiful landscapes using fruit trees and shrubs	O <sub>2</sub>	4	0.15	0.60
	Sustainable use of soil and water resources	O <sub>3</sub>	3	0.14	0.42
Threat	More dangers of biotic and abiotic stresses	T <sub>1</sub>	1	0.16	0.16
	Negative influence of chemical control of fruit trees on people's and other plants' health	T <sub>2</sub>	2	0.13	0.27
	The possibility of social vandalism	T <sub>3</sub>	1	0.15	0.15
	Increasing organizational costs	T <sub>4</sub>	2	0.14	0.28
	<b>Sum</b>	–	–	<b>1</b>	<b>2.25</b>

**Table 5**  
SWOT matrix of strategies for developing urban agriculture in the city of Mashhad, Iran.

	Strengths	Weaknesses
	S <sub>1</sub>	W <sub>1</sub>
	S <sub>2</sub>	W <sub>2</sub>
<b>Opportunities</b>	<b>SO Strategies</b>	<b>WO Strategies</b>
O <sub>1</sub>	SO1: Providing programs such as festivals and exhibitions to encourage people's cooperation in cultivation, maintenance and harvesting of fruit trees	WO1: Providing educational courses for landscape contractors, supervisors and others involved in landscaping to make them familiar with cultivation and maintenance of fruit trees and shrubs that are low input in using soil and water resources.
O <sub>2</sub>	SO2: Using germplasms of drought tolerant native fruit trees and shrubs of Iran for optimum use of soil and water resources	WO2: Increasing people and public participation and cooperation in maintenance of fruit trees and shrubs
O <sub>3</sub>	SO3: Increasing landscape aesthetics using extensive diversity among fruit tree species	WO3: Use of more experienced professionals to achieve desirable vision in urban agriculture of the city
<b>Threats</b>	<b>ST Strategies</b>	<b>WT Strategies</b>
T <sub>1</sub>	ST <sub>1</sub> : Decreasing influences of biotic and abiotic stresses by cultivation of resistant species	WT <sub>1</sub> : Establishment of productive landscapes near to municipality fruit shopping centers in order to decrease handling costs
T <sub>2</sub>	ST <sub>2</sub> : Use of science and experience of skillful employees in introducing plant species with long storage potentials with lowest requirements for postharvest equipment	WT <sub>2</sub> : Update information and science of the landscape contractors and supervisors regarding using effective materials and techniques in extending life span of fruits
T <sub>3</sub>	ST <sub>3</sub> : Propagating and selling fruit trees to cover organizational costs	
T <sub>4</sub>	ST <sub>4</sub> : Decreasing labor costs for tree cultivation, handling and fruit harvesting through encouraging people's participation	
	ST <sub>5</sub> : Paying special attention to sustainable landscape design approaches that increase safety and security in urban landscapes	

presented in Table 5 are the general guidelines to achieve the ultimate goals.

On the basis of the above analysis and its comparison with the results of the previous studies, the following countermeasures are essential to be considered for developing urban agriculture in Mashhad, Iran.

Production cost was a big challenge to develop urban agriculture (Poulsen and Spiker, 2014). Therefore, strategies to reduce it such as establishment of agricultural landscapes close to the shopping centers, decreasing labor costs for tree cultivation, handling and fruit harvesting through encouraging people's participation, and propagating and selling fruit trees as a source of income should be taken into consideration. One of the strengths in developing urban agriculture in Mashhad is presence of fruit shopping centers which belong to the municipality and this strength can be used not only for developing urban agriculture in this city, but also for promoting agricultural products with high standards of health. Furthermore, strategies associated with marketing and market improvement such as "pick your own" or "buy one get one for free" are realized as another important requirement in developing economical utilization of urban agriculture (Cheng-yong, 2010; Liu, 2013). Moreover, sustainable urban agriculture requires rich knowledge and skills on low-input products. The involvement of experts and professionals with high knowledge and experience contributes to promote knowledge of this field (Cheng-yong, 2010), and also can assist to industrialize agricultural production in the urban environment (Liu, 2013). In addition, providing training courses, workshops and facilities for employees who are involved in urban agriculture was recognized as another effective strategy in developing urban agriculture. This has been previously considered in such

programs in other countries (Cheng-yong, 2010; Liu, 2013) and appears to be easily achievable in Iran as well given the fact that there is a strong Research, Education and Development Center available in Mashhad municipality. It is worth noting that such facilities can be supportive of the initiative in developing urban agriculture in Iran.

In this study, the result showed that the scores of the internal and external factors were 2.58 and 2.25, respectively. These scores put the organization into the fourth quadrant in Fig. 1. Therefore, group IV strategies (ST) which are called competitive strategies should be adopted in the development of cultivation of fruit shrubs and trees in Mashhad. This indicates that the organization should seek strategies to consider improvement of the strength factors in order to avoid external threats.

As the score is more than 2.5, it could be concluded that the strengths factors surpasses their weaknesses. In this study.

According to Fig. 4 the most effective strategies for developing urban agriculture in Mashhad are ST strategies including:

ST1: Decreasing influences of biotic and abiotic stresses by cultivation of resistant species

ST2: Use of science and experience of skillful employees in introducing plant species with extended storage potentials with lowest requirements for postharvest equipment

ST3: Propagating and selling fruit trees to cover organizational costs

ST4: Decreasing labor costs for tree planting, handling and fruit harvesting through encouraging people's participation

ST5: Paying special attention to sustainable landscape design approaches that increase safety and security in urban landscapes, for which the municipality should take a special consideration.

To elaborate these strategies, it can be discussed that in relation to

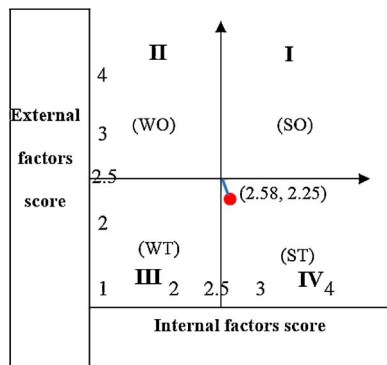


Fig. 4. Graphical interpretation of expert's decision preference towards development of cultivation of fruit shrubs and trees in the city of Mashhad, Iran.

the common limitations to develop urban agriculture, the city of Mashhad in Iran encompasses favorable strengths to overcome some of those limitations. The most favorable strength is that this country has great potentials in terms of germplasm and diversity of native productive plants (Mozaffarian, 1996), which can all assist in the development of urban agriculture in this country. Landscape planners and decision makers can take advantages from such opportunities and develop strategies to improve the aesthetics and multi-functionality of urban landscapes using native fruit trees and shrubs. Knowing the fact that a large portion of Iran is located in arid and semi-arid climatic conditions and that a large number of its native productive plant species are drought tolerant (Gahreman and Attar, 1999), such a landscape planning approach can better promote sustainable use of land, soil and water resources in the urban development of Iran. Native plant species are resistant to biotic and abiotic stresses of the region compared to using many exotic non-productive plant species. Therefore, using these species in urban agriculture can assist to produce organic products for urban dwellers. This can overcome public health concern which is one of the other concerns for the development of urban agriculture. Furthermore, the society's appreciation to have fruit trees and shrubs in their urban landscape in this country is high because this concept has its root in Persian gardens developed many centuries ago (Hobhouse, 2003). The presence of low-paid labor in the society is another great strength to sustain urban agriculture in Mashhad as it reduces production costs. It can also alleviate unemployment which is an issue of concern in the city of Mashhad (Shahrefarda, 2017).

Holding festivals and programs such as weekend farming and “pick your own” programs (Ernst and Woods, 2014; Leffew and Ernst, 2014) have been recommended. Through these programs, urban citizens are assigned some plots to have an experience of being a farmer or pick their own fruits. Such strategies can provide recreational opportunities for the community and can reduce construction and maintenance costs for the organization. Despite the above mentioned point it should be noted that some decision makers still believe by cultivation of fruit trees and shrubs in urban landscaping we may compromise the security and safety of the society. However, this can be resolved by limiting urban agriculture to specific types of landscapes such as theme parks and semi-public landscapes. Design and management strategies and options can also provide sustainable solutions for this apparent problem (Faizi et al., 2008).

It should be noted that all strategies discussed in this manuscript should be checked in accordance with the current world regulations and legal liabilities. For example, if people are concerned about their health due to potential high usage of chemicals in urban agricultural products, it might require further investigations by local experts into the required chemicals for cultivation and growth of each fruit tree types in accordance with world health standards and legal liabilities in order to suggest safer urban agriculture which can ensure health of people, flora and fauna of the region.

Further, it should also be noted that the SWOT analysis approach has limitations as well. For example, it may provide an incomplete list of internal and external factors with brief explanations for each factor. It might be appropriate to consider other potential risks or hazards except those suggested by the experts before suggesting any strategic planning program. In the current study, for example, it might be useful to assess potential risks of creating slip hazards for pedestrians as a result of fallen fruits, illness as a result of eating fruit contaminated with pollutants such as vehicle emissions, atmospheric pollutants or potential environmental or safety risks if undesirable animals and birds entered into urban areas to roost in the trees and consume the produce.

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