Original Article

Designing A Comprehensive Model Of Urban Agriculture Development System In Iran

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Abstract

This research tries to design a comprehensive urban agricultural development model. This study is applied and the statistical population in this investigation is 127 of the agricultural and green space experts of Karaj city. The data were collected using questionnaires and the smart PLS software was used to analyze the data. According to the results of this study, the KMO number (larger than 0.7) and a significant number of the Bartlett test (0.05 sig<) indicate that the data is suitable for factorial analysis. It was reported that the Cronbach's alpha coefficient (Alpha>0.7) was equal to 0.766 as well as the composite reliability coefficient (CR>0.7) was equal to 0.750 and coefficient R^2=0.720. The significant level in this study is between 2.075 and 3.318, so all research hypotheses are accepted. The results show the suitability of all questions in the factorial analysis process. The results of this study indicate that there is positive relationship between development of urban agriculture as independent variable with educational, cultural, economical, managerial, environmental, technological, infrastructural and social mechanisms.

Keywords: Urban Agriculture; Structural Equation Model; Farm System; Development; Extension; Karaj city; Iran

1. INTRODUCTION

Urban agriculture has the potential to contribute to urban food security in terms of availability, access and use, and the appropriate price and stability in the food system (Lang & Barling 2012). FAO estimates that more than 800 million people are involved in urban farming and the production of more than 15 % of the world's food **(**O'sullivan et al 2019). The rural agricultural supplement (RA), the urban agricultural concept (UA) has evolved as a food security solution over the centuries along with the rise of global population and urbanization (Armanda et al, 2019). Li et al (2013) presented General nexus between water and electricity use and it's implication for urban agricultural sustainability. This study was conducted on Shenzhen, South China. Orsini et al (2013) studied social, cultural, technical, economic, environmental and political factors that have been applied to urban farming with samples taken in East Asia, South America or east Africa. The results of the study showed that there are 100 - 200 million urban farmers in urban farming throughout the world. In another study, due to changing lifestyles from horizontal distribution into a vertical distribution style, the agricultural environment is expanding in a vertical light following the living space of citizens, as well as the results of a positive correlation between the willingness of individuals to have green roofs in their environment (Jafari et al, 2014). Qiu et al (2013) studied effects of evapotranspiration on mitigation of urban temperature by vegetation and urban agriculture. The results of the Taylor Lovell (2014) research in Chicago for measuring current level of food production in the city showed the evaluation of the ecosystem services provided by food production systems and the potential discovery for the development of production in the city's empty sections and other small spaces. Baloch and Thapa (2019) presented the external (policy, technical assistance, public institutions and the private sector) and internal (institutional structures, objectives/programmes) factors that impact on agriculture development in general in developing countries with special focus on Pakistan. O'Sullivan et al. (2019) improved the productivity, product diversity and profitability of urban agriculture by some strategies. This study discussed the technological research and innovations necessary for urban agriculture to meet the nutritional requirements of growing urban populations. In study by (Spataru et al 2019), a multi - purpose agriculture has been analyzed to protect agriculture in urban areas. It also, has been explored for a case study of the Melbourne metropolitan area in Australia. In study (Chandra and

Diehl, 2019) a case study of typical urban farming farms in Jakarta has been used as a starting point for systematic definition of different kinds of local urban farming. Another study has been used to evaluate the impact of urban smart transportation system, knowledge and business processes of farmers on the success of the green supply chain management system for urban distribution of agricultural products (Rajabion et al 2019). Tiraieyari et al, (2019) examined the relationship between different predictors of planned behavior theory and voluntary targets in urban farming with a sample of 890 postgraduate students from across the university in Malaysia. Figure 1 illustrates the conceptual model of the research..

Fig. 1. The conceptual model of the present study

So far, in the development of urban agriculture, a formalized strategic pattern was not designed in Karaj city, therefore, it is necessary to provide a comprehensive understanding of the physical and social status of Karaj city and the potential of urban agricultural development system for essential changes in its component in the form of internal and external environment, the general model of urban agricultural development for urban agricultural development in Karaj city in Alborz province. So, the main question of this study is to design a comprehensive model of urban agricultural development with economic, social, cultural and administrative mechanisms Karaj.
Alborz Province was formed by division of Tehran Province into two provinces, after the Parliamentary approval on June 23, 2010, and was introduced as 31st province of Iran. Situated northwest of Tehran, the Province of Alborz has 6 counties, Karaj, Savojbolagh, Taleqan, Eshtehard, Fardis and Nazarabad. Karaj is the capital of the province. Alborz Province is situated 35 km west of Tehran, at the foothills of the Alborz mountains, and is Iran's smallest province in area. According to the National Census, in 2016 population of Alborz was 2.712.400 million out of which 90,5% lived in urban areas. Figure 2 illustrates the map of Alborz provine

Fig. 2. Map of Alborz Province

Due to its close proximity of Tehran, a large number of its residents are migrants from small cities and rural areas across the country. Their familiarities with agricultural practices make this province very suitable for development of urban agriculture. Urban agricultural development is of great importance for Alborz province in terms of economical, educational, managerial, infrastructural, social, technological, environmental and cultural factors. The main question of this study is to design a comprehensive model of urban agricultural development in Karaj, Alborz provine.

2. Materials and methods

This research is applicable. This method is done in the field through questionnaire and interview with experts concerned in this regard and using library method and study of multiple books in this course as well as urban agricultural records in some selected countries.Table 1 exhibits a specific number of each statistical population.

Table1. Sample Size

Sample group	Number of people
Experts of Karaj municipality park organizations and green areas	44
Experts of Karaj flower and plant clinics	36
Persons who took part in the training courses in the field of flower and plant and vegetable production, cucurbits and some of local fruits	47
Toral	127

The Cochran formula is used to determine the sample size that essential sample carried up by simple random or unsystematic sampling method. In the formula of the Cochran, p and q are the ratio of success and failure that are considered 0.5. The formula of Cochran is written as Eq. (1).

$$n = \frac{Nz^2pq}{Nd^2 + z^2pq} \qquad (1)$$

The value of $Z_{a/2}$at error level of 0.5 is equal with 1.96.
Also error value of d is considered as 0.05.
The N - value defines the volume of the community.
In this study, variables of social, economical, environmental, managerial, educational, cultural, technological and infrastructural are considered and investigated as independent variables. Also, because of the purpose of research, prediction and characterization of urban agricultural development variable, the urban agricultural development variable has been studied as dependent variable. Considering the independent and dependent variables of the hypotheses, the research is as follows:

1. Economic mechanisms contribute to the development of urban agriculture.
2. Social mechanisms contribute to the development of urban agriculture.
3. Cultural mechanisms contribute to the development of urban agriculture.
4. Management mechanisms contribute to the development of urban agriculture.
5. Infrastructure mechanisms contribute to the development of urban agriculture.
6. Educational mechanisms contribute to the development of urban agriculture.
7. Environmental mechanisms contribute to the development of urban agriculture.
8. Technology mechanisms contribute to the development of urban agriculture.

In this study, smart - PLS software is used to analyze the data. in the introduction of the Smart - PLS software, it should be noted that the second generation of structural equations modeling, known as the trivial least squares approach or the variance - based approach to analyze the collected data, presented a similar but different process based on the constraints on the covariance - based approach. The ability of this approach to work with a few data, lack of sensitivity to normal data, the ability to predict and support very complex models as well as the capability of the combined measuring and reflection model was rapidly developed among researchers. Structural equation modeling is based on the partial least squares PLS - SEM method as opposed to the covariance. There are applications such as (AMOS, LISREL and EQS) in lack of fit indices; Kai-based mode is used to two investigation sides of the conformity in theoretical model with the data collected. This depends on the prediction nature of the PLS.

3. Research results

First, we examine the appropriateness of the data for factor analysis. There are many ways to do this that among them can mention about calculate the value of KMO which always fluctuates between 0 and 1. If the KMO value is less than 0.50, the data will not be suitable for factor analysis and if the amount is between 0.50 and 0.69, it can be more cautious with factor analysis. However, if the value is greater than 0.7, the correlations between the data for factor analysis will be appropriate. On the other hand, the Bartlett test was used to ensure the appropriateness of the correlation matrix data that is based on the analysis and it is not equal to zero in the community. In other words, the sampling adequacy can be ensured using the Bartlett test. The results shown in Table 2 indicate the appropriateness of the correlations between the data for factor analysis and sampling adequacy, hence the factor analysis can be applied.

Table2. KMO and Bartlett test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**.833**
	Approx. Chi-Square	4852.962
Bartlett's Test of Sphericity	df	990
	Sig.	.000

According to the KMO number (larger than 0.7) and a significant number of the Bartlett test (0.05 sig<) It can be said that the data is appropriate for conducting factor analysis and is faced with the required conditions. In order to evaluate the reliability of the measurement model and regarding to data analysis algorithm in PLS and after measuring the factor loadings, it is the time to compute and report the Cronbach alpha coefficients and the composite reliability, whose results are listed in Table 3

Table 3. Results of Cronbach alpha criteria and composite reliability of latent variables in the study

Latent variables	**Composite Reliability Coefficient (CR>0.7)**	**Cronbach's Alpha Coefficient (Alpha>0.7)**
Economical Mechanisms	0.713	**0.727**
Educational Mechanisms	0.870	**0.875**
Managerial Mechanisms	0.856	**0.823**
Infrastructural Mechanisms	0.703	**0.837**
Social Mechanisms	0.856	**0.806**
Technological Mechanisms	0.777	**0.879**
Environmental Mechanisms	0.742	**0.829**
Cultural Mechanisms	0.773	**0.787**
Urban Agriculture Development	0.750	**0.766**

As the appropriate amount for Cronbach alpha and combinatorial reliability is 0.7 and consistent with the findings of the above table, these criteria have been adopted in the case of latent variables, one can verify the suitability of reliability in the research. The second criterion of fitness study is convergence measurement models that this study investigates the correlation coefficient of each structure with the questions (indices). Table 4 shows the convergent validity of the latent variables of the research.

Table 4. Convergent validity results of the latent variables of the research

Latent variables	Mean extracted variance (AVE>0.5)
Economic Mechanisms	**0.516**
Educational Mechanisms	**0.534**
Management Mechanisms	**0.550**
Infrastructure Mechanisms	**0.506**
Social Mechanisms	**0.668**
Technology Mechanisms	**0.509**
Environmental Mechanisms	**0.518**
Cultural Mechanisms	**0.517**
Urban Agriculture Development	**0.520**

Considering that the right value for AVE [1]is equal with 0.5, and according to the findings of the above table, this criterion has been adopted in the case of latent Variable.so the suitability of the validity in this study is confirmed. The coefficients t for the relations of all research variables are more than 1.96, and it is supported by 95 % significance of confidence level. The second criterion for examining the fitness of structural model in a research is R^2 coefficients of the dependent latent variables in models. $R^2$is the measure showing the effect of an exogenous variable on endogenous variable and three sets of 0.19, 0.33 and 0.67 are considered a criterion for weak, medium, and strong values of R^2. The value is calculated for the endogenous constructs of the study. Due to the three values of the criterion, the suitability in fitting of the structural model can be confirmed. Table 5 shows the values of R^2

Table 5. Results of the parameter R^2 for the endogenous structure

Latent variables	R^2
Urban Agriculture Development	**0.720**

To examine the fit of the general model, the GOF criterion is used that were represented by three values of 0.01, 0.25 and 0.36 as weak, medium, and strong values for GOF. The measure is calculated by Eq. (2).

$$GOF = \sqrt{\overline{communalities} \times \overline{R^2}} \quad (2)$$

Communalities were obtained by the mean of the common values of the research's latent variables. Table 6 shows the Communality and R^2 of the research represents variables and table 7 shows the results of the overall fit of the model.

Table 6. Communality value and R^2research variables

Latent variables	R^2	Communality
Economic Mechanisms	0.000	**0.516**
Educational Mechanisms	0.000	**0.534**
Management Mechanisms	0.000	**0.550**
Infrastructure Mechanisms	0.000	**0.506**
Social Mechanisms	0.000	**0.668**
Technology Mechanisms	0.000	**0.509**
Environmental Mechanisms	0.000	**0.518**
Cultural Mechanisms	0.000	**0.517**
Urban Agriculture Development	0.720	**0.520**

Table 7. Overall model fit results

1.Average Variance extracted

GOF	R^2	Communality
0.621	0.720	**0.537**

According to the obtained value for GOF as 0.621, the proper fit of the overall model is confirmed. Table 8 shows the results of the direct relationship and significant coefficients of model hypotheses.

Table 8. The results of direct relationship and meaningful coefficients of model hypotheses

Sign	Path coefficient	significant	Test result
ECOM-- UAD	0.259	2.303	**Accept**
SOCM-- UAD	0.084	2.496	**Accept**
CULM-- UAD	0.043	2.215	**Accept**
MANM-- UAD	0.201	2.899	**Accept**
INFM-- UAD	0.389	2.490	**Accept**
EDUM-- UAD	0.523	2.303	**Accept**
ENVM-- UAD	0.348	3.118	**Accept**
TECM-- UAD	0.443	2.465	**Accept**

The fitted model shows that the amount of coefficient between economic mechanisms in agricultural development is 0.259 and the t value for this coefficient is 2.303. The value of it is higher than significance threshold of 1.96 which it indicates that among economic mechanisms in urban agricultural development, there is a positive relation at a significant level of 95 %, so the first hypothesis is confirmed.
The fitted model shows that the path coefficient between social mechanisms in agricultural development is 0.084 and t for this coefficient is 2.496. The value of it is higher than significance threshold of 1.96 that it indicates that among social mechanisms in urban agricultural development, there is a positive relation at a significant level of 95 %, so the second hypothesis is confirmed.
The fitted model shows that the path coefficient between cultural mechanisms in agricultural development is 0.043 and t for this coefficient is 2.215. The value of it is higher than significance threshold of 1.96 that it indicates that among cultural mechanisms in urban agricultural development, there is a positive relation at a significant level of 95 %, so the third hypothesis is confirmed.
The fitted model shows that the path coefficient between the management mechanisms in agricultural development is 0.201 and the value t for this coefficient is 2.899. The value of it is higher than significance threshold of 2.66 which it indicates that among management mechanisms in urban agricultural development, there is a positive relation at a significant level of 99 %, so the fourth hypothesis is confirmed.
The fitted model shows that the path coefficient between infrastructure mechanisms in agricultural development is 0.389 and the value t for this coefficient is 2.490. The value of it is higher than significance threshold of 1.96 that it indicates that among infrastructure mechanisms in urban agricultural development, there is a positive relation at a significant level of 95 %, so the fifth hypothesis is confirmed.
The fitted model shows the path coefficient between educational mechanisms in agricultural development and t for this coefficient is 3.118. The value of it is higher than significance threshold of 2.66 that it indicates that among educational mechanisms in urban agricultural development, there is a positive relation at a significant level of 99 %, so the sixth hypothesis is confirmed.
The fitted model shows the path coefficient between environmental mechanisms in the development of 0.348 and t for this coefficient is 2.891. The value of it is higher than significance threshold of 2.66 that it indicates that among environmental mechanisms in urban agricultural development, there is a positive relation at a significant level of 99 %, so the seventh hypothesis is confirmed.
The fitted model shows the path coefficient between technological mechanisms in the development of 0.443 and

t for this coefficient is 2.465. The value of it is higher than significance threshold of 1.96 that it indicates that among technological mechanisms in urban agricultural development, there is a positive relation at a significant level of 95 %, so the eighth hypothesis is confirmed. Figure 2 shows the structural model of the research with the path coefficients and also Figure 3 shows the structural model of the research with standard coefficients

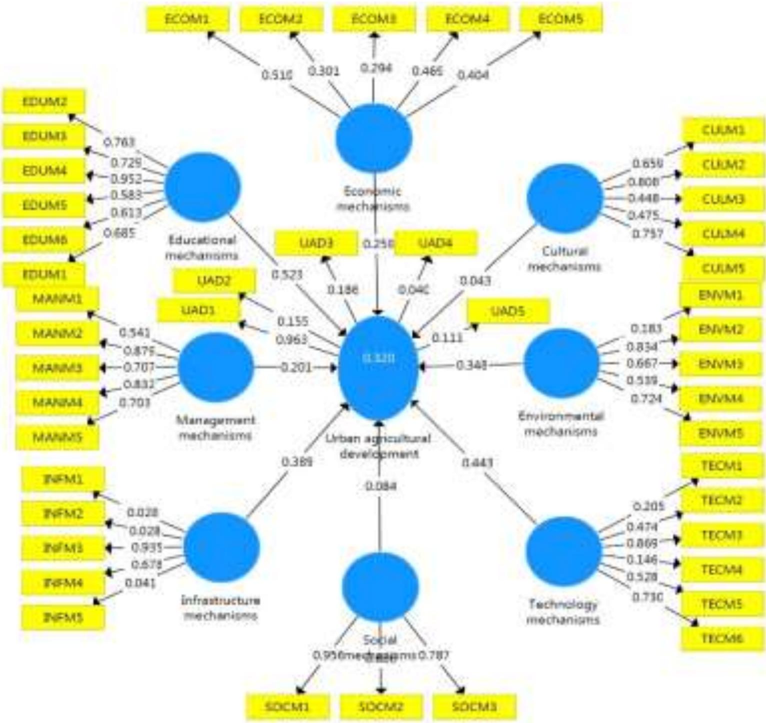

Fig. 2. Structural model of the research with path coefficients

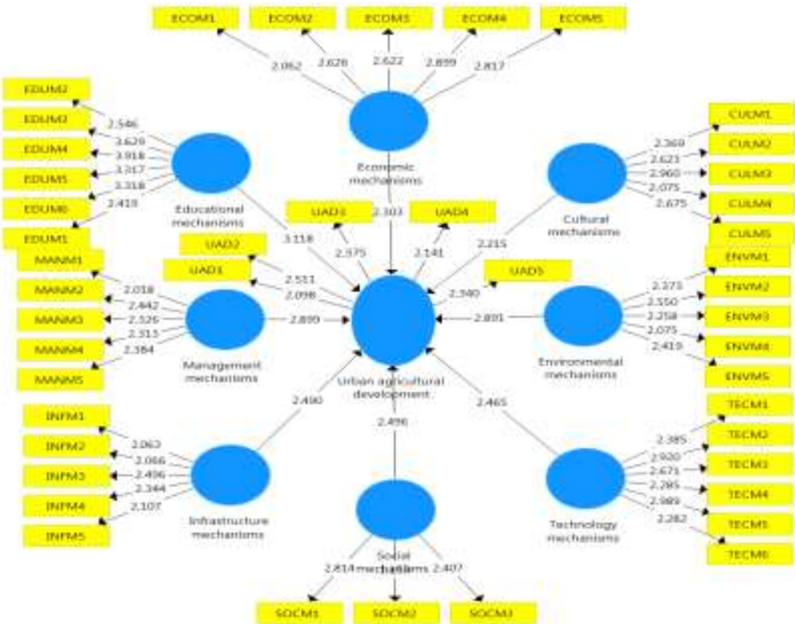

Fig. 3. Structural model of the research with standard coefficients. (t value)

4. Discussion and Conclusion

According to the results of this study, the KMO number (larger than 0.7) was a significant number of the Bartlett test (0.05 sig<) that the data is suitable for conducting factor analysis. The results indicate the appropriateness of all questions in the factor analysis process, because the shared number of questions is more than 0.5 and it represents the appropriate validity of the questions with regard to the results, all the research hypotheses are accepted. What makes the method of structural equation modeling a powerful technique used among researchers is that in addition to the graphic appearance that facilitates interpretation, this method can compute a set of relationships between variables simultaneously. None of the previous methods could simultaneously check the measurement model and calculate the causal relationships of the model (Hair et al, 2006). In general, the method of structural equation modeling through a set of equations similar to multiple regression reveals the structure of the internal relations of the variables. Therefore, to answer the main question of this study, structural equation modeling using PLS software has been used. According to the proposed model, the present study seeks to identify effective educational mechanisms on urban agricultural development. In this regard, it was also reported by Suvedi and others (2010) and Fox and others (2015) who have investigated the role of education in development of agriculture. Social mechanisms in Brussels were examined and in this regard, the social development section was examined in (Temerman, 2015). Zeunert (2018) is also presented a social life in cities and urban capabilities and a clearer view of urban services within urban areas, universities and communities. In the mentioned researches the infrastructures, social relations, customs, literacy conditions and the relationships between different groups have not been taken into consideration, but in the present research all the parameters and variables are mentioned. Also in King (2017) research, improved crop area, increased land use efficiency, reduced time needed for planting, harvesting and harvesting processes, as well as technology infrastructure use, were not addressed. But in the present study, in addition to the aspects of previous research, these aspects have also been of particular interest. Based on the results of this study, it is recommended to help citizen to organize the local entities for activities related to urban agriculture. Since infrastructure mechanisms have a positive and significant impact on urban agricultural development, it is recommended that arable land in urban areas should be equipped with modern irrigation equipment. Based on the results of this study, environmental mechanisms have a significant and positive impact on urban agricultural development, it is important to provide conditions for the use of clean and suitable agricultural water and to prevent the use of contaminated water (such as sewage and waste) in the urban agricultural sector.

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