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Validation of a model for gardeners' livelihood sustainability on the edge of Lake Urmia against late spring cold

Abstract

In this mixed methods research (qualitative-quantitative) in terms of paradigm, with an exploratory approach, the statistical population of the qualitative part included 22 experts and professionals in the field of horticulture, who were selected purposively. In the quantitative part, the population consisted of all the gardeners (n = 341) of the villages on the edge of Lake Urmia (LU), among whom 236 people were selected using stratified random sampling based on the village of activity with a proportional assignment. A sustainable livelihood model for small-scale gardeners on the edge of LU against late spring cold (LSC) was derived using the grounded theory. Theory extraction and coding process were performed by MAXqda18 software. Careful examination and linking between concepts and subcategories resulted in the identification of key subcategories, including six subcategories in the category of causal conditions, six subcategories in the category of background conditions, six subcategories in the category of intervening factors, four subcategories in the category of strategies, and five subcategories in the category of consequences. Finally, the validation status of the extracted model of the research was examined using $AMOS_{20}$ software, and the final model was confirmed based on the software's adjustment indices and the goodness of fit. The standardized regression coefficients determined that the livelihood of gardeners against LSC was mostly affected by the intervening conditions (β=0.47), followed by contextual factors (β=0.43) and causal factors (β=0.39), respectively. The results of the squared multiple correlations of dependent variables revealed that about 41% of the variance of the livelihood of small-scale gardeners on the edge of LU against LSC was explained by the involved predictor variables (causal conditions, contextual factors, and intervening factors).

Keywords: *sustainable livelihood, late spring cold, gardeners, Lake Urmia, grounded theory, structural equation modeling*

Parima Zamzami
Ph.D. Student Agricultural Extension and Education, Science and Research Branch
Director of Research, Islamic Azad University, Tehran
Alireza Poursaeed*
Department Head Agricultural Extension and Education, Science and Research Branch
Director of Research, Islamic Azad University
seyed jamal farajollah hosseini
Department Head Agricultural Extension and Education, Science and Research Branch
Director of Research, Islamic Azad University

Introduction

One of the new analytical approaches to achieving poverty reduction is the sustainable livelihood approach, which has been of interest in the field of rural development in recent years and tries to solve the problem of poverty and vulnerability of households, as a problem of the current era, based on human centrality (Najafi Ghareghani, & Hayati, 2012). Livelihood sustainability in rural areas has become very important and necessary following the development and evolution of rural development theories and the governance of the sustainable rural development model. This approach was introduced in the late 1990s as a new approach arising from the modern rural development theory with an emphasis on a comprehensive thought about rural development, which has been a framework and tool for understanding the complexity of people's livelihood and appropriate respective responses, aiming at reducing rural poverty (Horsley et al., 2015).

The sustainable livelihood approach helps those development activities that are people-centered (focusing on the priorities of poor people), responsive and participatory (responding to the livelihood priorities identified by poor people), multilevel (working at different levels to reduce poverty), directed (aided by public and private sectors), dynamic (flexible responses to people in various situations), and sustainable (creating an economic-institutional balance and social-environmental stability) (Motiei Langroudi et al., 2010). In rural areas, the identification of households' livelihood status and their access to livelihood capital is an essential and effective platform to advance development goals, especially in developing countries (Nowruzi & Hayati, 2016).

Many experts believe that paying attention to the rural community leads to the persistence of the productive population, especially the youth and teenagers, in these areas and draws off the society from the consequences of fake jobs, migration and marginalization, poverty, and social injury, besides increasing the gross national product (Ghanian et al., 2016). Socioeconomic researchers believe that paying less attention to the economic structure of villages and the empowerment of farmers, climate change consequences (e.g., late spring cold), and the slowness of programs in the balanced growth of farmers' economic centers are among the factors that reduce households' income levels among farmers and gardeners, leading to such consequences as the migration of villagers to cities, the spread of fake jobs, inflation, and visible and hidden damages (Shisany and Mafongoy, 2016).

The farmers' livelihood approach includes economic, social, environmental, and other aspects affecting people's well-being both directly and indirectly. Hence, it seems necessary to use such a framework as an analytical tool and a practical guide in the design and implementation of more appropriate social

policies for the sustainability of farmers' livelihoods (Pelletier et al., 2016). The sustainability of farmers' livelihoods is a system in which the food needs of the world can be supplied and environmental destruction can be prevented by applying proper management in the use of natural resources (Balezentis et al., 2020). As such, reduction of the pressures on underground resources, agricultural lands, no overuse of chemical poisons, and the health of human society are among the main issues in sustainability. The achievement of sustainability requires many steps, and first of all, a balance should be considered between crop production and environmental changes (Akbarian Ronizi, 2017). In the past few decades, farmers' livelihoods and incomes have been endangered by many factors, including the rise in living costs, the high cost of agricultural inputs, and extensive climate changes (Tulabi Nejad et al., 2017). Among these, climate changes have more effects on the livelihood of farmer households than the other components by affecting their food security. In the cold regions of Iran, climate changes annually alter climate patterns, including late spring cold (LSC), thereby affecting the production of farmers and gardeners in different regions of the country (Akbarian Ronizi, 2017), which directly influences agricultural development and sustainable livelihood (Tulabi Nejad et al., 2017; Thrän et al., 2020). Climate change is also currently regarded as one of the critical challenges for the sustainability of agricultural livelihoods in different regions of the world and dramatically influences the quantity and quality of agricultural and horticultural crops (Pelletier et al., 2016).

LSC is one of the climate hazards that annually causes damage to various activities, among which agriculture is the most important sector undergoing the most serious damage (Thrän et al., 2020). As one of the main climatic parameters in agricultural climate, LSC reduces the possibility of producing many agricultural and horticultural crops in vulnerable areas (Zolfaghari et al., 2012). Severe cold and frosts result in harmful and destructive consequences for many agricultural and horticultural plants, resulting in billions of riyals of damage to gardeners, farmers, and ultimately national interests in some years (Tulabi Nejad et al., 2017). The edge of Lake Urmia (LU) in northwest Iran is one of the significant and vital areas concerning both agriculture and animal husbandry and in terms of diverse natural habitats, which has faced serious challenges of spring cold and frost in recent years. This region has witnessed serious challenges, such as temperature changes, LSC, and negative water balance, in recent years (Pelletier et al., 2016). Severe cold and frosts lead to harmful and destructive consequences for many agricultural and horticultural plants so it damages billions of Rials to gardeners, farmers, and ultimately national benefits in some years (Tulabi Nejad et al., 2017). In Orumiyeh city and its subordinate cities, there are 112,000 hectares of gardens, 102,000 hectares of which are fertile, hence the incidence of frost will cause damage and challenge the livelihood of many gardeners in society. In the last few years, spring frosts and frostbite caused the highest damage to the edge of LU compared to other natural components (Zolfaghari et al., 2012). The mentioned challenges on the edge of LU on the one hand, and the existence of rich water and soil resources, fertile lands, and the location of this area on the route of Iran's transit road with neighboring countries to access crop markets outside of Iran, on the other hand, reveals the need for designing a model for the sustainability of farmers and gardeners' livelihood against LSC and validating the extracted model in these areas. This topic is analyzed in this research. Accordingly, the gap between the plans and policies should be filled to solve the existing problems because the problems caused by LSC in Orumiyeh have faced the local gardeners with a complex challenge. For example, existing evidence shows that about 22% and 52% of gardens in Orumiyeh were destroyed in 1992 and 1999, respectively, due to the effects of frostbite. These comparative statistics also reveal the need for an attempt to use different and effective methods to prevent frostbite (Nusrat, 2016). Accordingly, the main question of the present research is what model can be used for the sustainability of gardeners' livelihoods on the edge of LU against LSC? This is because researchers believe that natural factors, such as LSC and drought, are the main causes of economic and nutritional poverty, resulting in the instability and extrusion of farmers from the agricultural sector (Kenny, 2018).

A review of the literature indicates that studies are available on the sustainability of farmers' livelihoods. For instance, Fallah Alipour et al. (2012) and Darban Astane et al. (2018) report that farmers' livelihood sustainability index ranges at relatively stable and unstable levels.

One of the reviewed studies on the sustainability of farmers' livelihoods in the conditions of natural and environmental hazards is the study of Savari et al. (2017) who aimed to design a sustainability model for small-scale farmers' livelihoods in drought conditions. Their results indicate that more than 60 basic challenges exist in the sustainability of farmers' livelihoods. Finally, nine mechanisms (economic, the productivity of production factors, services and facilities, education and information seeking, management and capacity building, cultural, technology, organizations, and balance) were designed based on sustainability that challenges designing a model to overcome the aforementioned challenges of sustainability.

In an investigation by Bagheri Fahroji et al. (2018) on the analysis of resilience effects against climate change on food security, the results indicated the poor status of food security and the resilience of rural households against climate change.

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The results of the analysis also indicated significant positive relationships between the dimensions of resilience against climate change and the level of food security. Keshavarz & Karami (2012) investigated the effects of environmental hazards on rural livelihoods. They reported that the constructs of annual income, the number of received government facilities, the amount of compensation received from the agricultural crop insurance fund, the age of the household headman, the amount of beyond-social communication, and paying attention to the sensitivity of cultivated crops were the key factors explaining the sustainability of rural livelihoods.

Nowruzi & Hayati (2016) presented evidence that the sustainability of farmers' households was affected by human, social, economic, environmental, and physical constructs. In a study to choose an optimal strategy for sustainable rural livelihoods in the face of environmental hazards, Asghari Saraskanrud et al. (2018) identified the aggressive strategy as the best approach to achieve sustainable livelihoods in the studied villages. Savari et al. (2017) focused on strategies for the sustainability of small-scale farmers' livelihoods and their vulnerability in the conditions of environmental hazards (drought). They introduced "diversification of livelihood resources and non-agricultural activities along with the expansion of greenhouse crops using suitable infrastructures in the studied province" and "developing suitable plans for the capacity-building of agricultural communities in dealing with risks by forming rural knowledge clusters and developing infrastructures needed to maintain livelihood" as the key strategies to overcome environmental hazards.

The abovementioned issues suggest that research on the LSC management seems more necessary than ever in the studied area because the sustainability of gardeners' livelihoods in the studied area, who have a subsistence small-scale economy, will not be realized by the inattention and inconsideration of this issue in planning. In such a situation, small-scale gardeners adopt various solutions such as pre-selling their crops at a low price, seasonal and permanent migration, selling gardens and farmlands, and finally creating false jobs and more marginalization in suburbs. Therefore, it is clear that they should be empowered in different areas to achieve the indices of gardeners' livelihood sustainability. In the field of climate, for example, it is necessary to provide the conditions to reduce the damage to this producer class by extracting a suitable and validated model and providing a strategy to deal with sudden climate changes, including LSC (Ishaqi Milasi & Mahmoudi, 2018). In this regard, the vital role of agricultural extension in the agricultural progress of Iran makes it necessary to identify and examine different solutions in the region to manage and organize the challenge-induced damage. It is noteworthy that no comprehensive research has investigated this topic in the study area or no results have been published yet. Therefore, this research first tries to identify the main categories of gardeners' livelihood sustainability to deal with LSC in the region where the production of agricultural and horticultural crops is affected by this phenomenon by conducting semi-structured interviews with thematic experts and professionals. Then, the extracted model is validated to develop strategies tailored to regional potential and ecological power in the framework of a practical and executive program. The findings of this research can be used by policy-makers, planners, and relevant managers to pay more attention to the local gardeners to support decisions in achieving sustainable development.

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Methodology

Due to the nature, goals, and the "exploratory design" method of this research, model development tools and the Grounded Theory were used for an in-depth, systematic, and logical analysis of the data obtained from the research population. The exploratory design includes two stages, beginning with the qualitative method. In the first stage, the results of the qualitative method clarify the second (quantitative) method. In other words, these findings are used as a guide for developing the questions and scales of quantitative instruments. Therefore, a sustainability model of small-scale gardeners' livelihoods on the edge of LU against LSC is extracted using the Grounded Theory in the qualitative stage. In the next quantitative phase, the extracted model of the research (validation of small-scale gardeners' livelihood sustainability model on the edge of LU against LSC) is validated using the structural equation modeling (SEM) analysis by SPSS20 and AMOS20 software. The final model is confirmed based on the adjustment indices of the software and the goodness of fit (GoF).

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In the qualitative part, the participants of this research consisted of 22 horticulture experts and professionals, including faculty members, thematic experts of the Agricultural Jihad Organization in West Azarbaijan province, and environmental experts and activists. In the qualitative part, all individuals of the statistical population were selected using the purposive and snowball method, and sufficient information was obtained through semi-structured interviews. The interviews continued until theoretical saturation (until no more new information was received from the collected data). Data were collected by direct observation, semi-structured interviews, and note-taking, along with complementary methods of document review and library and internet documents.

The interviews lasted between 35 and 100 min (an average of about 45 min for each interview/person). A total of 1300 min interviews resulted in the extraction of 876 meaningful concepts and propositions. The theory was analyzed and developed using the systematic approach of Strauss and

Corbin, in which there are three stages of open, axial, and selective coding. In the open coding stage, a code was assigned to each of the issues raised by the participants, followed by extracting the basic concepts. The frequency of people who acknowledged each concept is also mentioned at this stage. In the next stage (axial coding), the mentioned concepts were classified in the form of categories, links were made between the categories obtained from open coding, and the most suitable codes were selected among the codes obtained from open coding. To name the categories, it is tried to select a title that has the most logical link to the data represented by the category based on common and similar concepts obtained from open coding. In the selective coding stage, which is accompanied by a detailed examination of the data and the coding of the previous two stages, the data are analyzed in depth and presented as a theoretical model (Creswell, 2007). According to the theory of Strauss and Corbin, this model possesses several dimensions of causal conditions, central phenomenon, background conditions, intervening conditions, strategies, and consequences (Strauss & Corbin, 2008).

In the present study, the results of the analyzed data are presented based on three coding stages. In the open coding stage, 1023 general meaningful concepts and propositions in the text of the interviews and 83 corresponding concepts were extracted from this number. In the axial coding stage, 27 subcategories were extracted from the corresponding concepts. After a more accurate examination, the links were obtained between the sub-categories and the six key categories of causal conditions, background conditions, intervening factors, core category (phenomenon), strategies, and consequences of gardeners' livelihood sustainability on the edge of LU against LSC (selective coding). Finally, the paradigm model of the research is depicted accordingly (Fig. 1). All stages of theory extraction and the coding process were performed by MAXQDA18 software. To ensure the validity and reliability of the research, the researcher was in contact with the research environment for a long time and continuously recorded all the details step by step by continuous observation, examining the subject from different aspects, and using different techniques of data collection to carefully and continuously question, examine, and analyze the research topic (open, axial, and selective coding). Moreover, the processes of data collection, data analysis, final model, and final report were examined, revised, and approved by the consensus of researchers (a review of results using several colleagues' and participants' opinions), and their opinions were also used in the model development.

In the next (quantitative) stage, the validation status of the extracted model of the research was investigated using AMOS20 software, and the final model was confirmed based on the software's adjustment and GoF indices. In the quantitative part of the research, the statistical population included 341 small-scale gardeners in the villages on the edge of LU, 236 of which were selected using the Krejcie and Morgan table by the stratified sampling method with an appropriate assignment. At this stage, data were collected by a questionnaire tool based on the qualitative findings of the first stage of the research. The external validity and content of the questionnaire were also verified by a group of experts in this field, and its reliability was confirmed using Cronbach's alpha.

Results

The results indicate that the age of the participants in the qualitative phase ranged between 46 and 55 years (90.9%). The studied experts and professionals were mostly male (86.36%), married (86.4%), and holding master's degrees (49.4%). They had on average 14.3 (± 2.13) years of experience in horticulture.

In the quantitative phase, the age ranged between 46 and 55 years (50.85%) in the studied gardeners who were mostly male (89.41%) and married (88.9%), with education levels less than a high school diploma (57.6%). On average, they had 11.7 (± 6.25) years of experience in horticulture.

Collected data and information from the studied community, interviews, and manuscripts were analyzed in the first (qualitative) phase of the research. To this end, the texts of the interviews and manuscripts were reviewed several times using the line-by-line analysis to extract appropriate codes, and the concepts related to the research topic were coded in three successive stages as described below.

The data from the collected participants, interviews, and manuscripts were first reviewed in the open coding phase. To do this, the texts of the interviews and manuscripts were reviewed several times using the line-by-line analysis to extract appropriate codes, ultimately leading to identifying 83 primary codes (key concepts).

In the second (axial) coding phase, the formed classes were developed by comparing the coded data with each other to arrange the subclasses in the form of clusters corresponding to the classes. In this phase, the concepts formed in the open coding phase were compared with each other, and those that were similar to each other were assigned to a shared axis. Finally, 27 comprehensive classes and barriers from the concepts related to the sustainability of gardeners' livelihood on the edge of LU against LSC were formed and named individually according to the conceptual load. Table 1 summarizes the main concepts obtained from the open coding process along with the development of the formed classes (axial coding).

Table 1. The results of open and axial coding processes

No.	Subcategories	Wide categories
1	Negligence of communication infrastructure	Lack of infrastructure development
2	Aging of gardeners' population	Social and demographic challenges
3	Determinism among gardeners	
4	Incidence of social shocks	
5	Incidence of unstable weather conditions and late frosts in recent years	Gardeners' inability to adapt to environmental changes and transformations
6	Gardeners' inability and lack of adaptation to changes in climatic conditions	
7	Instability of climatic conditions	
8	Lack of liquidity	Economic challenge
9	Non-participation of the young population in planning and implementing programs	Non-participation of human resources in making decisions
10	Non-participation of the target community in the design and implementation of programs	
11	No use of management patterns tailored to the region	Management challenges
12	Absence of comprehensive and integrated plans and policies	
13	No development of plans and programs according to the specifications of the region (in particular recent climate changes)	
14	No use of technology appropriate to the region	
15	Availability of required equipment and devices	Equipment and infrastructure factors
16	Development of plans to deal with a late spring cold	
17	Development of insurance infrastructure	
18	Adequate budget allocation in proportion to costs	Economic factors
19	The existence of scientific research centers for workforce training and research	Skilled human resources
20	Existence of efficient and skilled managers	
21	Using the capacity of specialized and young manpower	
22	Illiterate, less literate, and insufficiently knowledgeable local gardeners to manage their gardens against late spring cold	
23	Insufficient attention of executive organizations to the sustainability of gardeners' livelihoods	Lack of comprehensive and integrated policy-making
24	Inappropriate policies of banks in on-time credit allocation to implement the development of projects	
25	Different perceptions and scattered attitudes of organizations in charge, such as Agricultural Jihad and the Department of Environment, in the implementation of announced policies	No coordination in the implementation of affairs and planning
26	Coherence and coordination in various fields of designing, planning, organizing, and implementing activities for the sustainability of gardeners' livelihoods on the edge of Lake Urmia against late spring cold	
27	Paying attention to the regional culture and customs	Cultural factors
28	Paying attention to the local gardeners' identities and predicting the necessary strategies to deal with late spring cold in the development vision document	Using the regional capacities
29	Lack of educated youth's enthusiasm to cooperate with their fathers to manage late spring cold	
30	Preparing a road map of the resistance economy with an emphasis on domestically produced products to reduce the damage imposed by late spring cold	The need to pay attention to resistance economy programs
31	Development of supplementary agricultural conversion industries with an emphasis on industries with relative advantage to manage late spring cold	

No.	Subcategories	Wide categories
32	Garden division due to inheritance leads to land fragmentation and problems in managing horticultural activities and the increase in damages caused by late spring cold.	Land fragmentation and problems of inheritance law
33	Decreased quality of water in the region	Production challenges
34	Unstable weather in the region and no observance of meteorological recommendations by local gardeners	
35	Insufficient skills of gardeners to manage late spring cold	
36	A sudden rise in prices	Market management and its challenges
37	No on-time payment for the price of horticultural crops at the purchase time	
38	No determination of guaranteed prices for goods and horticultural crops	
39	Lack of comprehensive implementation of extensional-educational programs tailored to the needs of gardeners to manage late spring cold	Extensional-educational factors
40	Information and knowledge dissemination	Educational and research strategies
41	Using managers and skilled experts in the field of horticulture	
42	Support of applied research	
43	Improving local gardeners' knowledge, attitude, and skills to manage late spring cold	
44	Promotion of new production methods	
45	Teaching protection methods	
46	Use of fogging machines in gardens	Operational and implementation strategies
47	Use of plastic covers	
48	Management of foliar sprays	
49	Observance of meteorological recommendations by local gardeners to carry out horticultural activities	
50	Diversification of fruit trees in gardens	
51	Reinforcement of trees against cold	
52	Performing watershed affairs	
53	Irrigation management	
54	Promotion and development of late-flowering cultivars	
55	People's participation in managing frost challenges	Management strategies
56	Using the presence of young people and graduates	
57	Use of local capacities	
58	Developing a comprehensive plan for agriculture and horticulture risk management in the management and planning organization of Iran	
59	Diversification of horticultural, agricultural, and livestock activities	Economic and livelihood strategies
60	Reduction of poverty through granting loans	
61	Paying attention to the industrialization approach of villages by identifying central villages to provide livelihood in the conditions of damage imposed by late spring cold	
62	The existence of local credit funds to improve the resilience of gardener households in the conditions of damage caused by late spring cold	
63	Access to the buying and selling market	Sustainable market management
64	Development of local markets	
65	Support of exports	
66	Development of branding and product brands	
67	Continuity and relative income stability	Economic stability
68	Increasing the financial and purchasing power of gardeners	

No.	Subcategories	Wide categories
69	The feasibility of saving part of the income	
70	Gardeners' job stability	
71	Home business development	Livelihood stability
72	Livelihood promotion	
73	Empowerment of gardeners	
74	More effective management of environmental risks by local gardeners	
75	Prevention of the gardeners' migration in the region	Establishment of social justice
76	Increasing the social welfare of local gardeners	
77	Strengthening local institutions (councils, village councils, microcredit funds)	
78	Increasing gardeners' job satisfaction	
79	Paying attention to gardeners' needs at local, national, and international levels	
80	Development of conversion industries	Sustainable productivity
81	Efficient garden management	
82	Improvement of resilience and reduction of gardeners' vulnerability level in the region	
83	Sustainable management of natural resources	

As mentioned above, the analysis of collected data and the multiple reviews of textual interviews led to the identification of 83 concepts/primary codes. Then, the concepts with semantic and conceptual relations were categorized into 27 subcategories. These categories and subcategories are listed in Table 1. Finally, the identified subcategories were assigned to a more abstract level as the main category in the center of the axial coding process. At this phase, wider classes were linked to obtaining a model as presented in Figure 1.

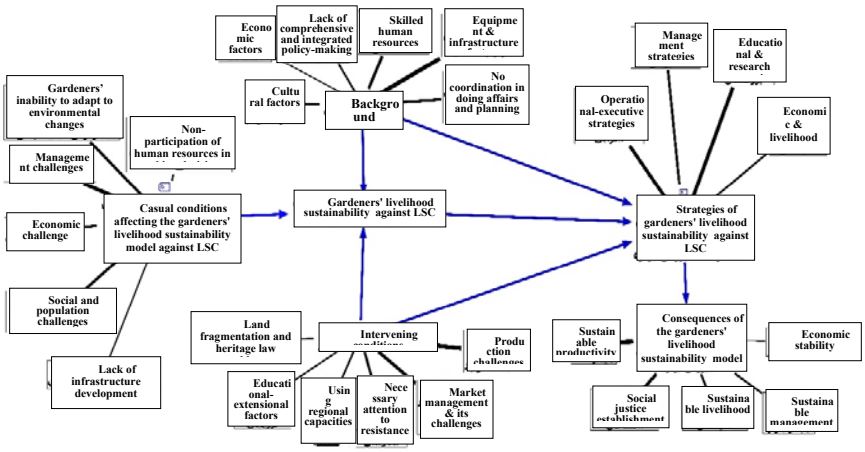

Figure 1. The gardeners' livelihood sustainability model on the edge of Lake Urmia against late spring cold using MAXQDA18 software

In the second (quantitative) phase of the research, the validation status of the extracted research model (validation of the model of small-scale gardeners' livelihood sustainability on the edge of LU against LSC) and relationships between independent and dependent variables of the research were examined by SEM using AMOS20 software.

In this research, the adequacy of the measurement model was determined using seven conventional GoF indices. The calculated values of these indicators for the research path model are listed in Table 2. Accordingly, the Chi-square statistic is equal to $\chi^2 = 19.32$ with a degree of freedom (df) of 17. The normal Chi-square value is calculated by dividing the Chi-square statistic by its df (χ^2/df), which is equal to 1.13 (<2 as the maximum possible value). This index indicates the suitability of the GoF of the self-sufficiency factor of the measurement model to the data. The obtained value of the RMSEA index (0.000) is smaller than 0.05 (the maximum acceptable value), which reveals a good fit for the model.

The obtained values of CFI, GFI, and NFI indices (0.92, 0.91, and 0.95, respectively) are greater than 0.90 (the minimum acceptable value), indicating the good fit of the model to the data based on this index. The calculated RMR index (0.016) is smaller than 0.1 (the maximum acceptable value), hence, it can be judged that the model has an acceptable fit as a whole. Altogether, the abovementioned GoF indices demonstrate a good fit for the designed measurement model of the research path.

Table 2. The GoF indices of the model for gardeners' livelihood sustainability on the edge of Lake Urmia against late spring cold

Index	Chi-square	P-value	X^2/ df	RMSEA	P-close	NFI	CFI	GFI	RMR
Value	19.32	0.11	1.13	0.000	0.21	0.95	0.92	0.91	0.016
Criterion	----	> 0.05	< 2	< 0.05	> 0.05	≈0.95	≈0.95	≈0.95	< 0.08

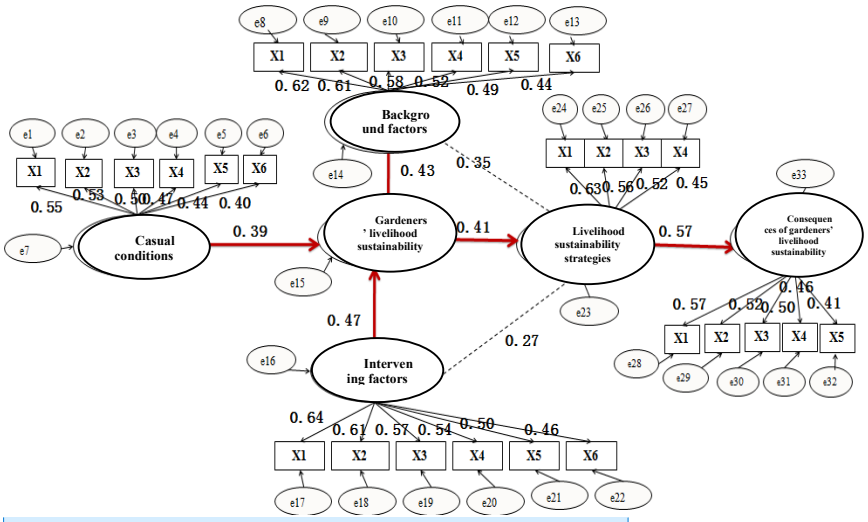

Figure 2. The SEM of the research conceptual model using the $AMOS_{20}$ software

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According to the standardized regression coefficients (Table 3), the small-scale gardeners' livelihoods on the edge of LU against LSC are mostly affected by the intervening conditions (β = 0.47), followed by background factors (β = 0.43) and causal factors (β = 0.39) respectively affecting the examined research topic. On the other hand, background factors (β = 0.35) and intervening factors (β = 0.27) also respectively influence the livelihood strategies of small-scale gardeners on the edge of LU against LSC.

Table 3. Parameters of the paths along with significance levels

Assumptions			**Estimated parameter**	**S.E.**	**C.R.**	**Sig. (P)**
Casual conditions	←		0.39	0.045	6.15	***

Background factors	←	Small-scale gardeners' livelihood sustainability on the edge of Lake Urmia against late spring cold	0.43	0.038	11.35	***
Intervening factors	←		0.47	0.043	11.27	***
Background factors	←	The sustainability strategies of small-scale gardeners' livelihoods against late spring cold on the edge of Lake Urmia	0.35	0.040	10.36	***
Intervening factors	←		0.27	0.038	10.27	***
The livelihood strategies of small-scale gardeners against late spring cold on the edge of Lake Urmia	←	The consequences of small-scale gardeners' livelihood sustainability against late spring cold on the edge of Lake Urmia	0.57	0.035	10.54	***

The results of the squared multiple correlations of the dependent variables (Table 4) show that about 41% of the variance of small-scale gardeners' livelihoods on the edge of LU against LSC is explained by the involved predictor variables (causal conditions, background factors, and intervening factors). Besides, about 53% of the variance of the livelihood strategies of small-scale gardeners on the edge of LU against LSC in the model is explained by the predictor variable (background factors and intervening factors affecting the livelihood of small-scale gardeners on the edge of LU against LSC).

Table 4. Squared multiple correlations of research variables

Variable	Test
The livelihood of small-scale gardeners against late spring cold	0.41
The livelihood strategies of small-scale gardeners against late spring cold on the edge of Lake Urmia	0.53

Discussion and conclusion

Most of the known accidents worldwide have occurred in Iran as an accident-prone country, where the major accidents are earthquakes, floods, droughts, and frosts. Among the types of natural hazards, the frost phenomenon accounts for one of the important challenges in the production of horticultural crops, causing significant losses to the horticulture sector every year (Nusrat, 2016). According to a report by the Bank Keshavarzi (Agribank) of Iran, the damage caused by cold and frost reached several thousand billion Rials, also called the green earthquake, in all parts of the country in the last few years (Sanjabi, 2016). According to the statistics of the Food and Agriculture Organization (FAO), 5-15% of crops are lost annually due to frost-induced damage; this number reaches more than 40% for some susceptible garden products, in particular almonds, pistachios, and apricots (Zolfaghari et al., 2012). Late frosts generally caused billions of tomans of damage to agricultural and horticultural crops in West Azarbaijan province in some years (JafarBagloo et al., 2019). LSC is considered one of the main and influential factors in the production of agricultural and horticultural crops in Orumiyeh city (Hesari et al., 2016).

Based on our findings, management challenges were identified as one of the causal conditions affecting the livelihood of gardeners in the region against LSC in this research, as was also reported previously by Ghanian et al. (2016). Therefore, significant attention is needed to carry out measures that can increase the productivity of gardeners by applying management patterns tailored to the region so that gardeners - as the main players - produce more and reach a more stable income.

Based on the results, the gardeners' inability to adapt to environmental changes was also identified as another causal condition affecting the local gardeners' livelihoods against

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LSC in this research. Accordingly, the environmental changes in recent years are among the major factors that make it necessary to design a model for the sustainability of gardeners' livelihoods on the edge of LU against LSC. Therefore, the ability of gardeners to adapt to environmental changes and transformations will be one of the factors influencing their productivity and reducing possible LSC-induced damages to their performance and production. In this regard, researchers believe that the ability to manage the challenge of LSC and pursue different livelihood strategies of villagers depends on the social, economic, physical, and ecological foundations owned within their domain (Li et al., 2020). Therefore, a comprehensive plan to adapt to such crises helps improve the sustainable livelihood of the local gardeners and increases their ability to deal with the destructive effects of LSC. This can be realized with high possibility given the very long history of farmers in managing and dealing with environmental crises. Therefore, this challenge can be overcome by taking advantage of local abilities and making use of effective methods and technologies.

Based on the findings, equipment and infrastructural factors were also identified as the other effective background factors in the sustainability of gardeners' livelihoods in the region against LSC, which is also known to be necessary to achieve any type of livelihood strategy (Abo et al. 2018). Likewise, Darban Astane et al. (2018) showed that structures and processes were the key factors affecting the sustainability of farmers' livelihood capital. Dehghanpour et al. (2020) claim that infrastructural factors are one of the major policies for adapting agriculture to climate change. However, traditional agriculture faces many challenges, such as poor communication and inappropriate agricultural and horticultural equipment, in addition to climate changes such as LSC (Savari et al., 2017). These challenges are more sensible in arable areas, such as West Azerbaijan province, where some more farmers and gardeners work traditionally, which reveals the need for more attention from the relevant officials and authorities to strengthen the mentioned factors.

The factor of skilled human resources was introduced as another factor affecting the model of gardeners' livelihood sustainability in the region against LSC, which was also proposed in previous studies (Ghadiri Masoom et al. 2015; Nowruzi & Hayati 2016; Liu et al., 2018). This finding shows that human capital in agriculture and rural development is the foremost factor in adopting new technologies, including weather forecasts and other natural disasters (Anita et al, 2010). This is because short-term tactical decisions, such as changing crop management or choosing the supply of raw materials, or long-term strategic decisions, including rotations or natural resource management, are made by skilled human resources during crises (Ghadiri Masoom et al., 2015), which will reduce the damages caused by enduring LSC and other crises. Decisions on the adoption of innovation in rural communities stem from the awareness, cost, benefit, and application of new technologies (Adjei et al., 2017). Consequently, human capital is the inherent and acquirable assets, including the skills, abilities, and capabilities, of people in society. Therefore, human capital can be achieved by training capable human resources, and this is dependent on the period spent by people in the society on the study and knowledge acquisition. As such, awareness, information about the process of doing work, and training in the work procedure have been shown to play a significant role in the adoption rate of new technologies, the progress of agriculture, and dealing with the crises and dangers ahead (Anita et al. 2010).

The lack of a comprehensive and integrated policy-making method is also proposed as another factor affecting the model of gardeners' livelihood sustainability against LSC (Foster & Ait-Kadi, 2012). Climate changes, in particular LSC, have become a crisis for the farmers in the northwestern regions of Iran in the last few years so the damage caused by this phenomenon has affected the production of many agricultural and horticultural crops in the region. To reduce the destructive and harmful effects of this phenomenon in spring, a suitable and comprehensive model should be defined for the region according to the specific climatic and geographical conditions of this area. In this regard, the gap between the implemented plans and the policies adopted by managers should be filled to solve the existing problems. Thus, the aforementioned challenge should be organized and managed considering the vital role of agricultural extension in the Iranian agricultural progress and the need to identify and investigate various solutions in every region to reduce possible losses to a feasible extent. This may be the reason for identifying and proposing the need for coordinated implementation of affairs and planning as another factor affecting the sustainability of gardeners' livelihoods in the region, which was also proposed earlier by Savari et al. (2017).

Overall, planning is necessary for the sustainability of gardeners' livelihoods depending on available resources to overcome the obstacles to achieving the goals of food security, poverty reduction, and environmental protection (Savari et al., 2017). This is highlighted in most studies that analyzed the sustainability situation by paying attention to the environmental sustainability situation, which guarantees the need for designing a comprehensive model for evaluating sustainability considering the complexity of agricultural activities (Mohammadi et al., 2014).

Experts believe that the realization of livelihood sustainability, particularly in rural areas, requires the use of a sustainable strategy that considers planning, implementation, and evaluation inside and outside the village in different periods.

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This is because the sustainability of farmers' livelihoods is a process that is feasible through the cooperation and mutual coordination of various stakeholders both inside and outside the village, as well as the establishment of coordinated communication between the departments involved in this field in the long-term sustainability of livelihoods. The realization of this goal requires strategic planning and determining the policies of interest (Sajasi Gheidari et al., 2013).

In this regard, paying attention to resistance economy programs to increase production efficiency and reduce environmental risks seems to be an ideal solution. This agrees with our findings on the need to concentrate on resistance economy programs in production efficiency and risk reduction as the intervening factors influencing the sustainability of gardeners' livelihoods against LSC and is also in line with the research of Kianpour & Mohammad Rezaei Azandariani (2017). Given that the main approach in the general policies of the resistance economy is to promote the resistance and resilience of the national economy in line with realizing the goals of the Vision Document, the related discussions about national resilience can be useful and effective in the explanation of these policies and their realization solutions (Bagheri Fahroji et al., 2018). Therefore, the creation of national resilience and resistance economy in the process of dealing with global and regional risks has been agreed upon by many researchers (Kianpour & Mohammad Rezaei Azandariani, 2017).

Educational and extensional factors are also proposed as the other intervening factors affecting the sustainability of gardeners' livelihoods in studies by Karami et al. (2014), Bijani et al. (2013), Arkawazi (2013), Zhang & Lu (2007), and Khanzode et al. (2012). This finding can be attributed to the effect of participation in training classes on the knowledge and awareness levels of gardeners and, consequently, on the management of environmental risks. In fact, a higher level of gardeners' knowledge and awareness amplifies their resilience in the process of dealing with global and regional risks. This is because more knowledgeable and informed people are more aware of environmental issues, understand the received training more effectively, better comprehend the instructions prepared for various activities, and implement them while performing horticulture activities.

The role of land fragmentation and the problems of inheritance law, as the other intervening conditions influencing the sustainability of gardeners' livelihoods against LSC, can be interpreted by the fact that the fragmentation of agricultural and horticultural lands hardens the power of planning for authorities. Since more farmers and owners with different perceptions are present with the fragmentation of agricultural and horticultural lands, it is not possible to make a single decision, which challenges the management of farms in the conditions of environmental crises.

The fragmentation of agricultural and horticultural lands causes water loss, problems in irrigation operations, harvesting crops, and using machines, generally resulting in low productivity. These issues are considered a threat to food security and create additional problems for the local gardeners in times of crises and climate change, including LSC.

Therefore, since climate change, soil, and water are three threats to food security at the international level, consolidation of land, prevention of land fragmentation, expansion of modern irrigation systems, reinforcement of production chains of horticultural crops, development of greenhouses, and improvement of gardens should be prioritized in programs for West Azarbaijan province aiming at ensuring food security of the province and the country.

To achieve this goal, measures such as the consolidation of agricultural lands with the creation of large agricultural and industrial companies and the establishment of cooperatives should be taken into account to prevent the fragmentation of agricultural and horticultural lands. With the establishment of cooperatives, small-scale owners operate in the form of a production firm, thereby increasing productivity per unit area while preventing land fragmentation. Consequently, the owners in the framework of cooperatives can utilize some facilities, such as pressurized irrigation, agricultural mechanization, and some low-interest and gratuitous facilities assigned to consolidated large lands, which cannot be used in the case of land fragmentation (Savari & Shokati Amghani 2019). Due to such problems as fragmentation and dispersion of agricultural lands, including the Islamic heritage, fundamental arrangements should be considered to organize the ownership and use of agricultural lands. These measures include the establishment of agricultural joint-stock firms in the region to consolidate fragmented and dispersed plots and prevent the fragmentation and division of agricultural lands into uneconomical small plots, increasing the area under cultivation in the country, improving the productivity of agricultural lands, providing the means for increasing production and per capita incomes of farmers, and familiarizing farmers with new technologies, which are considered appropriate solutions. Accordingly, the Central Organization of Rural Cooperatives is recommended to pave the development path of such firms by adopting appropriate strategies and resolving the existing challenges and bottlenecks.

In terms of operational and implementation strategies, the results of this research correspond to those of Davis (2009) concerning adaption to climatic and environmental changes toward LSC and the reduction of the vulnerability of gardeners as the main factors influencing the sustainability of their

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livelihoods. With respect to operational and implementation strategies, our findings are similar to those of Arkawazi (2013) and Khanzode et al. (2012) regarding the improvement of gardeners' ability to adapt to climatic and environmental changes against LSC and the reduction of the vulnerability of gardeners, suggesting the impact of the important role of agricultural extension and education in the implementation of the abovementioned strategies. According to Dolati Baneh (2019), although spring cold stress is one of the major factors threatening gardens in Iran in some years, there are also various operational and executive strategies to manage and deal with this factor, which should be presented to local gardeners through training and extension methods. Selection of the right site to build a garden, using late-blooming cultivars with secondary fertile sprouts, raising seedlings in an upright position with a tall trunk height, using garden methods (e.g., proper nutrition, double pruning, and delayed pruning), and protective methods (e.g., using heaters, wells Inverses, high and strong fans, rain irrigation), and other effective methods to reduce spring cold damage in the gardens of the region are some of the major operational and implementation strategies against LSC, which should be trained to local gardeners using extension methods (Dolati Baneh 2019).

References

Abo, T., rajian, S. & Geta, E. (2018). Nexus between household assets based and agrarian livelihood strategies diversification: using a multidimensional approach. Asian Journal of Agricultural Extension, Economics & Sociology. 22(4): 1-17.

Adjei, P. O. W., Kosoe, E. A., & Forkuor, D. (2016). Facts behind the myth of conservative rurality: major determinants of rural farmers' innovation adoption decisions for sustainable agriculture. GeoJournal, 1-16.

Akbarian Ronizi, S. (2017). Analysis of agricultural sustainability and factors affecting it in rural areas Case: Roniz rural district - Estahban city. Regional Planning Quarterly, 8, 31: 51-35. [in Persian]

Anita, W., Dominic, M., & Neil, A. (2010). Climate Change and Agriculture Impacts, Adaptation and Mitigation: Impacts, Adaptation and Mitigation. OECD publishing.

Arkawazi, K. (2013). Investigation of Work Injuries Among Farmers in Kermanshah: Achievements for Agricultural Promotion.M.Sc. Thesis in Rural Development, Razi University. [in Persian]

Asghari Saraskanrud S, Jalalian H, Azizpur F, Asghari Saraskanrud S. (2016). Choosing the Optimized Strategy of Sustainable Livelihood Faced with Drought by Using Integrated Model SWOT and TOPSIS Case study: Rural areas of the central district of Hashtrood, 16 (55): 313-339. [in Persian]

Azami, M. & Shanazi, K. (2018). Analysis of the effects of Zarivar Marivan wetland on the livelihood assets of its rural households. Journal of Geography and Development, 51, 25-42. [in Persian]

Balezentis, T., Ribasauskiene, E., Morkunas, M., Volkov, A., Streimikiene, D & Toma, P. (2020). Young farmers' support under the Common Agricultural Policy and sustainability of rural regions: Evidence from Lithuania. Land Use Policy, 94.

Bijani, M. & Hayati, D. (2015). Farmers' Perceptions Toward Agricultural Water Conflict: The Case of Doroodzan Dam Irrigation Network, Iran. J. Agricultural Science Technology, 17: 561-575.

Bijani, M., Salamat, A., & Karami, Gh. (2014). Promotion of Safety and Reduction of Work Injuries of Agricultural Users Social. Economic. Scientific and Cultural Monthly Magazine of Work and Society, 9: 173. [in Persian]

Creswell, W.j. (2007). Qualitative inquiry and research design, sage publications.

Darban Astane, A. Motiey Langroudi, H. & Ghasemi, F. (2018). Identification and analysis of factors affecting the sustainable livelihood of farmers (Case study: Shazand city). Journal of Rural Research, 9(2): 324-330. [in Persian]

Davis, I.Y. (2009). Izadkhah, "Building resilient urban communities. Article from OHI, 31:11-21, 2006.

Dolati Baneh, H. (2019). Methods of controlling late spring cold in grapes. Publications: Ministry of Agricultural Jihad, Agricultural Research, Education and Extension Organization, Agricultural Education and Extension Institute. [in Persian]

Fallah Alipour, S., Mehrabi Bashabadi, H., Zare Mehrjerdi, M.R. & Hayati, D. (2019). A model for measuring agricultural sustainability using fuzzy composite indices (Case study: Kerman province). Journal of Agricultural Knowledge and Sustainable Production, 29(2): 253-269. [in Persian]

Fathian, F., Murid, S. & senior, p. (2013). Evaluation of land use change trends using remote sensing technology and its relationship with river flow trends (Case study: East Urmia Lake sub-basins). Journal of Soil and Water (Agricultural Science and Technology), 27, 3: 655-642. [in Persian]

Foster, S., & Ait-Kadi, M. (2012). Integrated water resources management (IWRM): How does groundwater fit in? Hydrogeology Journal, 20(3), 415-418.

Ghadiri Masoom, M. Rezvani, M. Friday, M. & Horticulture, h. (2015). Leveling of livelihood capital in mountain tourism villages, studied in Bala Taleghan rural district in Taleghan city. Quarterly Journal of Space Economics and Rural Development, 12: 1-18. [in Persian]

Ghanian, M., Taqi Beigi, M., & Sharafi, l. (2016). Investigating Barriers to Improving the Business Environment in the Field of Rural Tourism in the Rijab Region Using Fundamental Theory. Journal of Agricultural Extension and Education Research, 9(1): 41-55. [in Persian]

GolShiri Isfahani, Z. Khademi, H., Sedighi, R., & Tazeh, M. (2019). The effect of social cohesion on the participation of villagers: A case study of the wheat sector. Borujen city. Journal of Rural and Development, 12(1): 167-147. [in Persian]

Hesari, B. Rezaei, R. Nikafar, R. & Taefeh Naskili, N. (2016). Investigation and preparation of frost maps of crops and orchards in West Azerbaijan province. Geography and Natural Hazards, 14, 135-117. [in Persian]

Horsley, J., Prout, S., Tonts, M., & Ali, S. H. (2015). Sustainable livelihoods and indicators for regional development in mining economies. The Extractive Industries and Society, 2(2): 368–380. https://doi.org/10.1016/j.exis.2014.12.001

Ishaqi Milasi, F. & Mahmoudi, B. (2018). Evaluation and prioritization of criteria and indicators of sustainable rural livelihood in Iran using the Delphi method. Quarterly Journal of Rural Development Strategies, 5 (2): 217-232. [in Persian]

Islami, L., Mohammadi Yeganeh, B. & Cheraghi, M. (2019). Analysis of Economic Factors Affecting Livelihood-Based Housing Developments in Rural Areas (Case Study: Miracles Village, Zanjan County). Journal of Rural Environment, 166: 34-44. [in Persian]

Karami, F. & Rezainejad, A. (2013). Effect of late spring cold on fruit yield and some physiological characteristics of apricot in Kurdistan province. Seed and Plant Breeding Magazine, 29(1): 15-1. [in Persian]

Keshavarz, M., Karami, E., and Vanclay, F. (2013). The social experience of drought in rural Iran. Land Use Policy, 30,120-129.

Kempster, S. & Parry, K. W. (2011). Grounded Theory and leadership research: A critical realist perspective. The Leadership Quarterly, 22(1): 106-120.

Kenny, A. (2018). Assessment of the Social Impacts of Drought. Journal of American Water Resources Association, 37(3): 678- 686.

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Khanzode, V. V., Maiti, J., & Ray, P. K. (2012). Occupational injury and accident research: A comprehensive review. Safety Science, 50(5), 1355-1367.
Kianpour, S. & Mohammad Rezaei Azandariani, H. (2017). General policies of a resistance economy or national resilience: a global risk-taking approach. International Conference on Management, Economics and Marketing, Tehran, https://civilica.com/doc/680388 [in Persian]
Lasco, R. D., Espaldon, M. L. O., & Habito, C. M. D. (2016). Smallholder farmers' perceptions of climate change and the roles of trees and agroforestry in climate risk adaptation: evidence from Bohol, Philippines. Agroforestry Systems, 90(3): 521-540.
Li, M., Xu, Y., Fu, Q., Vijay, P., Liu, D & Li, T. (2020). Efficient irrigation water allocation and its impact on agricultural sustainability and water scarcity under uncertainty. Journal of Hydrology, 586: 124.
Liu, Z., Chen, Q., & Xie, H. (2018). Influence of the farmer's livelihood assets on livelihood strategies in the western mountainous area. China. Sustainability, 10(3), 875.
Meemken, E.M. (2020). Do smallholder farmers benefit from sustainability standards? A systematic review and meta-analysis. Journal of Global Food Security, 26, 26,100373.
Motiei Langroudi, S., Rezvani, M., Faraji Sabokbar, H., Khajeh Shahkouhi, A. (2010). Analysis of Sustainability of Family and Rural Production Cooperative Farming Systems (Case Study: Agh-Ghala Township: Golestan Province). Iranian Journal of Agricultural Economics and Development Research, 2-41(3), 323-333. [in Persian]
Najafi Ghareghani, Z., Hayati, D. (2012). Performance Assessment of Water Users Associations as Perceived by Members: The Case of Ordibehesht Canal of Doroodzan in Fars Province. Iranian Agricultural Extension and Education Journal, 8(1), 73-86. [in Persian]
Nowruzi, M. & Hayati, d. (2016). Structures affecting sustainable rural livelihood from the perspective of farmers in Kermanshah province. Iranian Agricultural Extension and Education Sciences, 11(1): 127-144. [in Persian]
Nusrat, n. (2016). Effects of natural hazards (frost) on apple trees Case study: Urmia city. Sixth National Conference on Agriculture and Sustainable Natural Resources, Tehran. https://civilica.com/doc/573758. [in Persian]
Pelletier, B., Hickey, G. M., Bothi, K. L., & Mude, A. (2016). Linking rural livelihood resilience and food security: an international challenge. Food Security, 8(3), 469-476.
Roudgarmi, P. (2011). Qualitative research for environmental sciences: A review. Journal of Food, Agriculture & Environment, 9 (3&4): 871-879.
Sajasi Gheidari, H. Sadeghloo, I. & Paluj, M. (2013). Prioritizing Strategies for Sustainable Rural Livelihood Development with Swat Topsis-Fuzzy Combined Model: A Case Study of Khodabandeh County. Quarterly Journal of Rural and Development, 16(2): 85-110. [in Persian]
Savari, M., Shabanali Fami, H., Iravani, H., Asadi, A. (2018). Collecting the Strategies to Stabilize the Livelihood of Small-Scale Farmers and Training Common Strategies Considering Sustainability and Vulnerability in Drought Conditions. Environmental Education and Sustainable Development, 6(3), 137-156. [in Persian]
Savari, M., Shaban Ali Fami, H. Irvani, H. & Asadi, A. (2017). Designing a model for stabilizing the livelihood of small-scale farmers in drought conditions in Kurdistan province. Journal of Spatial Analysis of Environmental Hazards, 5(2): 1-18. [in Persian]
Savari, M., & Shokati Amghani, M. (2019). An Analysis of Agricultural Land Management in Iranian Agricultural Joint Stock Companies: Challenges and bottlenecks. Journal of Land Management, 1(1),69-86. [in Persian]
Shisany. S, & Mafongoy. P. (2016). Adaptation to climate change and the impacts on household food security among rural farmers in uMzinyathi District of Kwazulu-Natal, South Africa. Food Security, 8(1): 1- 12.
Statistics of horticultural products of the country. (2015). Ministry of Jihad Agriculture, organizational portal. Available at: https://www.maj.ir/Index.aspx?page. [in Persian]
Straus, A., & Corbin, J. (2008), Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory, Third Edition, Los Angeles: Sage Publications.
Thrän, D., Schaubach, K., Majer, S., & Horschig, T. (2020). Governance of sustainability in the German biogas sector—Adaptive management of the Renewable Energy Act between agriculture and the energy sector. Energy, Sustainability and Society, 10(1), 1- 18.
Tulabi Nejad, M. Tulabi Nejad, M. & Tabatabai, S. (2017). Farmers' adaptation to climate change and its role in food security of rural households in Poldakhtar city. Natural hazards, 6(13), 90-67. [in Persian]
Zarafshani, K., Sharafi, L., Azadi, H., and Van Passel, S. (2016). Vulnerability assessment models to drought: Toward a conceptual framework. Sustainability, 8 (6), 121.
Zhang, H., & Lu, Y. (2007). End-users' knowledge, attitude, and behavior towards safe use of pesticides: a case study in the Guanting Reservoir area, China. Environmental geochemistry and health, 29(6), 513-520.
Zolfaghari, H. Zahedi, Gh. & Sajjadifar, I. (2012). Predicting the history of the last spring glaciers in western and northwestern Iran. Geography and environmental sustainability, 4: 74-59. [in Persian]

Commented [//13]: Please enter this reference in the text