Why do farmers abandon agricultural lands? The case of Western Iran

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ABSTRACT

Agricultural land conversion (ALC) and agricultural land abandonment (ALA) have a direct relationship with different economic, social, and environmental issues. The change in land management and land use, in addition to economic and social effects, has a major impact on the physical, chemical, and biological properties of soil, quantity and quality of water resources, and air quality. Therefore, this study aimed to identify the drivers of abandoning agricultural lands in Sanandaj county in Iran using a structural equation modeling method. A systematic random sampling method was followed by a proportionate strategy for the selection of 351 samples from a total of 4500 farmers. Data were collected through a questionnaire developed during a comprehensive literature review. The results showed that the causes of ALA can be categorized into five drivers: economic, social, political, agro-technical, and managerial-legal ones. These drivers have a two-way relationship, both direct and indirect, with each other. According to the farmers' views, the most effective cause of ALA was managerial-legal with a factor loaded value of 0.79. The most important issues in the legal-managerial factor were lack of a strong and efficient land use management for lands around cities, inhibition of land fragmentation Act during the legacy after the culmination of Iran's revolution in 1978, purchasing agricultural lands around the city for housing construction purposes, the problem of segmented farms, and not paying enough attention to establish and enforce agricultural cooperatives. Therefore, better support of legal management issues about agricultural lands leads to better control of land use change (LUC).

1. Introduction

A very important condition for the life and growth of human beings and civilization, as well as a cornerstone for the welfare of a country, is the proper use of land as a limited resource. If, for a long time, farmland is not used for farming operations, it eventually becomes an abandoned field. In such an empty environment, there can be a variety of different issues, and transitions from rural to urban land use are especially troublesome due to the irreversible impacts of such changes (Barati et al., 2015; Bell et al., 2020; Liu et al., 2020; Slätmo, 2017).

Therefore, to a greater or lesser degree, the management of abandoned agricultural land and its successful use are important to every

region (Suziedelyte Visockiene et al., 2019). The subject of the land and how to use it in the social sphere has always been the source of conflict and legal or public problems (Mehrabi-Boshrabadi and Arjmandi, 2013). Agricultural land conversion (ALC) has now become a complex process that involves various variables and drivers at different levels of social and spatial development (Abolina and Luzadis, 2015). For many commercial, social, political, and environmental mechanisms, changes in land use are closely interrelated. In time and space, these mechanisms overlap and provide a diverse set of connections between human drivers and the environment (Ustaoglu et al., 2016). In land-use research, physical, political, and economic variables are well defined. Nevertheless, there were a few attempts to model all variables under land-use

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transition. The change in land management and land use, in addition to economic and social effects, has a major impact on the physical, chemical, and biological properties of the soil, the quantity and quality of water resources, and air quality. Studies (Dang et al., 2020; Deines et al., 2020; Nguyen and Warr, 2020; Sannigrahi et al., 2020; Song et al., 2020; Wojewodzic et al., 2021; Ying et al., 2020) on the economic and social impacts of land use have found that land use change has an impact on employment, income and expenditure, household participation's rate, and land prices. Studies in Iran have also shown that both the trend of agricultural and natural land use change and the various social, economic, and environmental impacts of these changes have been increased in recent years (Allahyari et al., 2013; Azadi et al., 2016; Barati et al., 2015; Eynali et al., 2013). Asimeh et al. (2020) studied the agricultural sustainability in two different regions (with and without land leveling and consolidation), and found that in unleveled and un-consolidated lands, the economic dimensions of sustainability were in a weak status. In a qualitative study on ALC, Tahmasebi et al. (2020) found that these changes can be driven by natural (climate change), institutional, economic, social, and psychological drivers. Jahanifar et al. (2020) studied that the economic and social drivers play an important role in shifting agricultural lands into residential areas in Hyrcanian forest Areas in the south of Iran. Therefore, it can be said that land use change (LUC) occurs for various causes, which in the research mentioned above, most of these reasons are rooted in economic, social, psychological, natural (climate change), and organizational drivers. However, reasons such as management and monitoring, especially legal drivers, have received less attention from researchers. Therefore, this study seeks to bridge the gap between the legal and managerial reasons of agricultural land conversion (ALC), as well as other reasons.

The dramatic effect of LUC and land cover on the physical and social environment is an incentive for research to understand the causes of this phenomenon and its main effects, including conservation and land abandonment. The core problem in this research is the conservation and abandonment of agricultural lands in Sanandaj, which can be addressed through ALC policies. In the Kurdistan province, and especially in the city of Sanandaj, agricultural lands abandonment is often due to geographical conditions (slope of land), problems associated with extensive land reform, and agricultural land transfer laws. Although there is insufficient evidence in this area (Ahmadpour and Alavi, 2014; Ghadermazi, 2012), the main purpose of this analysis is to figure out the reasons and causes of the abandonment of agricultural land (ALA) around Sanandaj. The key objective of the analysis is, therefore, to analyze both drivers influencing ALA in Sanandaj.

1.1. Drivers affecting agricultural land abandonment (ALA)

1.1.1. Economic drivers

Overseas researchers (Li et al., 2019; Rahman et al., 2016; Sallustio et al., 2018; Suziedelyte Visockiene et al., 2019; Ustaoglu et al., 2016) reported economic drivers such as residential and commercial uses, industrial developments, infrastructure, and real estate market as effective drivers in ALC. Some empirical evidence in Iran (Eynali et al., 2013; Ghadermazi, 2012; Rezaee-Moghadam et al., 2014) considered economic drivers as the most important effective reasons in ALC and abandonment of the lands. Furthermore, the results of Yazdani and Hashemibonab's (2014) study showed that land use changes were influenced by drivers such as high profits from land sales, rising land prices, and insufficient income from agriculture. Barati et al. (2015) believe that these reasons are attributed to the low-price level of agricultural products, price volatility, excessive increase in land prices, poverty, and unemployment in Iranian villages. The results of the study by Darban-Aastaneh et al. (2016) showed that the most important economic drivers of LUC are low prices of agricultural products, high cost of living and unprofitable agricultural income, high inflation in society, and higher income from land than agriculture. The findings of Kalali Moghaddam (2015) consider the drivers affecting LUC as expensive

agricultural inputs and low prices of crops, and the problem of ALC is more influenced by economic drivers than other drivers. In another similar research, Ahmadpour and Alavi (2014) identified the lack of initial conditions of cultivation, lack of access to production inputs, and high input prices as effective drivers in changing agricultural land use. Mehrabi-Boshrabadi and Arjmandi (2013) conclude that the most important cause of LUC in the villages is people's economic problems (low income and lack of financial supports).

Given the positive association of economic drivers with the land use reasons, the following hypothesis was established:

H_1. : Economic drivers will be positively associated with ALA.

1.1.2. Social drivers

The studies conducted by other researchers (Abolina and Luzadis, 2015; Barati et al., 2015; Handavu et al., 2019; Lipton and Saghai, 2017; Liu et al., 2016) emphasized the social and cultural causes of agricultural land use. According to Clements et al. (2020), landholders in South Africa are considered as major threats to sustainable land management. They have identified wider socio-economic challenges (e.g., community violence, national and political regulation, and global economic recessions) in this regard. As shown by Yan et al. (2020), the agro-pastoral transformation region in Kazakhstan was the region most influenced by changes in land use due to structural social changes. Demands for behavioral change and social learning affect farmers' motivation and ability to change their practices about land lease in the Netherlands (Westerink et al., 2020). The findings of Wayessa (2020) revealed that the land leases induced a significant decline in land-based social relations in both crop production and livestock husbandry systems. Maharjan et al. (2020) showed that in Nepal ALA is higher in mountain areas than in the plains (Terai). They also found out that the internal outmigration of women has a significant positive effect on ALA. This demonstrates that when males leave, women continue farming, resulting in the feminization of agriculture, but when women leave in large numbers, only aging parents are left, who are frequently unable to continue farming.

The results of a study by Mazzocchi et al. (2013) showed that the most important drivers that cause changes in agricultural land use are drivers related to urban pressure such as population density. In other words, the importance of drivers differs in areas, which are close to urban centers and have high population density, and in the remote areas with low population density. Therefore, in the first case, there are pull factors from urban centers that cause ALA, and in the latter case, there are push factors (rural poverty) that cause ALA. Karbasi et al. (2018) showed that variables of farmer family population, number of land parcels, farmer's income, and level of farmer's literacy have an influence on decision making in land use change. According to Barati et al. (2015), the most important social causes of ALA are the low interest of the new generation of rural people to work in the agricultural sector and the discrimination against the agricultural sector in comparison with the industrial and other sectors. Furthermore, according to a study by Darban-Aastaneh et al. (2016), the important LUC drivers are the increasing population of indigenous rural inhabitants, young people's unwillingness to farm, changing living standards, and inclination to urbanization.

Population expansion and urbanization growth have been considered as the most important social drivers of land use around cities (Abd-Elmabod et al., 2019; Abd EL-kawy et al., 2019; Ayambire et al., 2019; Feng et al., 2019; Peerzado et al., 2019; Tian et al., 2019). Accordingly, it can be found that social factor has a significant impact on agricultural land use. Therefore, the following hypothesis was addressed:

H_2. Social drivers have a positive effect on ALA.

1.1.3. Political drivers

ALA has a negative impact on the local economy and environment

because land, as a primary resource for agriculture, is underutilized (Yusoff et al., 2017). The conversion of agricultural land has been unhindered in recent years in order to implement comprehensive urban, industrial, and mineral development plans that are deemed necessary. To take necessary steps to rehabilitate ALA, government's policies must be identified and acknowledged (Suziedelyte Visockiene et al., 2019). To manage ALA, the Iranian government employs a variety of tools and policies, including: 1) comprehensive agricultural land registration system implementation; 2) approval of land reform regulations; 3) guaranteed purchase of some strategic crops such as wheat, and 4) improving farmers' livelihood by registering agricultural land tenure rights, which can strengthen institutions (rules of the game), reduce uncertainty and enable farmers to consider longer time horizon when making their plans and investments (Alijani et al., 2020; Mesgaran et al., 2017).

In the study by Ustaoglu and Williams (2017), it was found that the anticipated subsidies in public agricultural policies are effective in preventing urbanization and the destruction of agricultural lands. There are institutional barriers for ALA and LUC in Europe, and both the policy sphere and collaborative options for management need to be considered. The development of a dedicated allocation policy, mobilization of local government authorities, and establishment of strategic collaborations between governmental and non-governmental actors are the main recommendations provided by Pace Ricci and Conrad (2018). Furthermore, Primdahl (2014) states that agricultural, environmental, and spatial policies, when not considered together, are not capable to respond to the cross-dynamics of agricultural and urban developments. Azadi et al. (2016) identified the expansion of urbanization and non-intervention of governments in agricultural land policies as important drivers related to ALC. In his research, Shafiee-Sabet (2013) concluded that there was a relationship between variables related to rural environment capacity (number of services and infrastructure), decentralization policies (amount of loans distributed and number of rural development activities), and amount of agricultural land conservation. Some of the other political reasons and evidence of agricultural land use stated empirically by some researchers (Jürgenson, 2016; Urruty et al., 2016; Arvor et al., 2017; Mu et al., 2018; Paudel et al., 2019; Wang et al., 2018; Wästfelt and Zhang, 2018) are the implementation of agrarian reform, sale of lands around the city for industrial use, lack of public awareness and consequences of land use change, not implementing the existing laws and negligence by government officials, lack of strong and efficient management on land use around cities, and lack of coordination between organizations issuing land use permits.

As such, the next hypothesis we established was as follows:

H₃. ALA has a positive relationship with policy variables.

1.1.4. Legal-managerial drivers

The results of the studies conducted in Iran indicate that managerial and legal drivers are among the most important drivers affecting the LUC. In a study by Mehrabi-Boshrabadi and Arjmandi (2013), they identified the most important deterrents to land use change, the formulation of effective land use legislation, and government support for farmers and gardeners. The results of the study by Ahmadpour and Alavi (2014) showed that migration trends from Tehran to suburban areas are overshadowed by the lack of land use monitoring institutes and lack of land use planning in suburban areas. Shamseddini and Amir-Fahliani (2015) examined the drivers affecting rural land use management and stated that the problem of land use and management should be analyzed due to lack of land and its inaccessibility by a strategic method. Dadashpour and Mohsenzadeh (2012), in their study on the feasibility of using development rights transfer to protect agricultural lands, concluded that development rights transfer approach is one of the approaches to prevent agricultural land use (development rights ratio should be between 25 and 75). The following empirical studies highlight the weaknesses of legal and managerial changes in agricultural land use:

Petrescu-Mag et al. (2018), Pace Ricci and Conrad (2018), Ekpodessi and Nakamura (2018), Yucer et al. (2016), and Zhang et al. (2019).

Therefore, without paying attention to managerial and legal drivers, the ALC will not be solved. Thus, the following hypothesis was addressed:

H₄. Legal and managerial drivers will be positively associated with ALA.

1.1.5. Agro-technical drivers

In the research by Handavu et al. (2019), the most important drivers affecting forest land use are agricultural growth and population growth. Azadi et al. (2016) identified the most important technical causes of ALC as lack of a suitable cropping pattern, land fragmentation, depletion of water resources, low yields of current irrigation methods, and insufficient monitoring of land use change. Conventional farming systems or no ability to use modern farming practices (de Souza Medeiros et al., 2020) and sloping lands (Maharjan et al., 2020) are other reasons for ALA.

Westlund and Nilsson (2019) analyzed the number and scale of agricultural companies, and found that improvements in their key task and diversification patterns will preserve land use shifts across the larger cities and the capital area in particular. Some farming practices such as crop rotation, plugging, and the planting and logging of forestry disturb and change agricultural land covers of Great Britain (Tomlinson et al., 2018).

Piquer-Rodríguez et al. (2018) showed that the extension of cropland and pasture land into woodlands was much less susceptible than agricultural intensification to shifts in profit-related conditions, so intensification is likely to continue if agricultural demand remains high. Some other scientific documentation and evidence that emphasize the agro-technical causes of ALC are as follows: Barati et al. (2015), Baude et al. (2019), Degife et al. (2018), Fox et al. (2017), Pandey and Seto (2015), Smaliychuk et al. (2016), Stuart and Gillon (2013), Verburg et al.(2004) and Wang et al. (2019).

Furthermore, the association of agricultural-technical drivers with ALU is expected. Thus, the following hypothesis was developed:

H₅. Agro-technical drivers will be positively associated with ALA.

Therefore, the main issue addressed in this study is to find out the drivers that lead to inappropriate use of agricultural land in rural areas of central districts of Sanandaj. Identifying the drivers in this regard can not only benefit the authorities but also help farmers and even local people both technically and environmentally learn how to use the existing and abandoned land properly and efficiently. Accordingly, it is imperative to investigate and identify suitable scientific solutions and mechanisms to solve the problems of ALA in the region so that in the future, no more adverse effects will occur, including the degradation of agricultural land. Based on the background of the research, the proposed conceptual model of this research is drawn as Fig. 1.

2. Methodology

2.1. Study area

Kurdistan province is a wide geographic region (29,137 km2) located in Western Iran. The provincial capital of the province is Sanandaj. The province is a mountainous territory scattered over high plains and throughout the region's large valleys. This province is composed of 10 major cities, 30 towns, 31 districts, 86 rural districts, and 1654 villages, according to the new state divisions in 2019. Its beautiful nature, the unusual topography of this province, and its climatic variety have made this region an enticing location for visitors. The average daily temperature in this province ranges from 22 to 28 °C between mid-May and mid-October. Sanandaj town is located on the geographical coordinates of 35° 20 'north latitude and 47° 18' east longitude of the prime
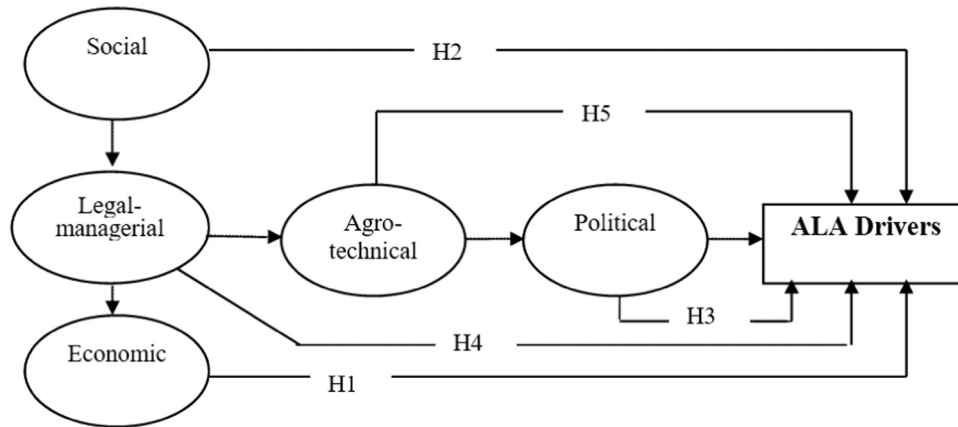
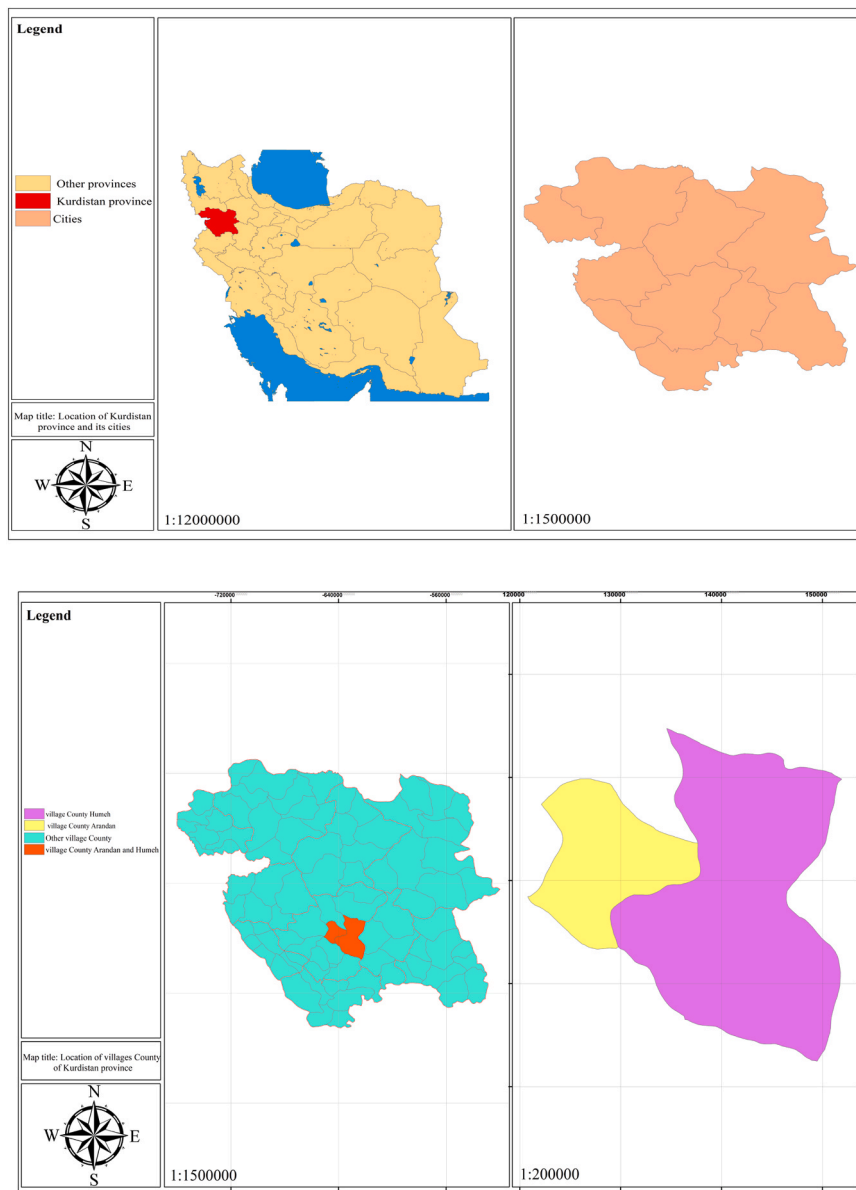**Fig. 1.** Conceptual model of the research.

Fig. 2. Map and geographic location of the study.

meridian (Fig. 1). The average height of Sanandaj is 1535 m above the sea level (600 and 2550 m are the lowest and highest points, respectively). The region has a Mediterranean climate that is semi-arid. Sanandaj city consists of two parts: central and Clatterzan. The Clatterzan section has three districts named West Javrood, Negel, and Clatterzan, and the central section has seven districts named Abidar, Arandan, Humeh, South Hossein Abad, East Javrood, Sarab Ghamish, and Naran. In this research, the villages of Arandan and Humeh districts were studied. Arandan includes seven villages and Humeh consists of 17 villages. Fig. 2 shows the geographical map of Kurdistan province and Sanandaj city. The satellite images and field measurements showed changes in agricultural land in Sanandaj from 1998 to 2017 (Amini and Hesami, 2017). Statistical data in Sanandaj city suggests that the land use reform in the villages surrounding the city has occurred as a result of the transition part of the village system and agricultural space. In this city, in total 3334 (ha) of arable land, gardens and pastures have changed to other uses. Today, increasing the value of land in rural areas and the formation of new uses, including tourism development, the creation of second homes, and industrial development have doubled the importance of attention to the issue of land use and land conservation in Sanandaj city. For this reason, in this city, various plans have been developed and implemented, such as land plot planning, urban development, rural land plot planning, and land consolidation to have proper land use management. As a result of urban sprawl, ALC and ALA have become important challenges facing agriculture and rural areas in this city. Recently, these changes have resulted in different social, economic, and environmental consequences (Mohammad Nejad et al., 2020). Furthermore, with a total crop production of 2130869 tons, wheat and legumes play an important role in the region's farmers' economy. As a result, studying the effective drivers of the ALA in this city is critical (Fooladi et al., 2020).

2.2. Data collection and analysis

This paper, is an empirical study in terms of intent and in terms of nature, it is a quantitative one, in which a descriptive surveying method has been used. The statistical population of this study was farmers in the central part of Sanandaj city in two districts of the Humeh and Arandan (N = 4500) in 2016. The sample size was 351 using the Krejcie-Morgan table. In this study, the sampling protocol proceeded in two phases. In the first phases, a systematic random sampling method was used, and a proportional allocation method was applied, in which 9 out of 26 villages in these two districts were selected systematically. Then, by a proportional method, according to the household population of each village, the samples were selected and questionnaires were completed by the farmers in each village.

The main research tool was a researcher-made questionnaire in the surveying stage. The questionnaire consisted of two parts: the individual and demographic characteristics of farmers and the causes of abandoning agricultural lands.

The questionnaire consisted of seven main questions about demographic and professional characteristics of farmers, as well as 35 items on the main drivers of ALA (including economic, social, political, institutional, legal-managerial, and technical-agricultural reasons). Likert scale with five-point items from (1) very low to (5) very high was used to measure respondents' views.

To guarantee the questionnaire's material validity, some experts and managers of agricultural Jihad organizations, as well as faculty members of the universities, expressed their opinions after a careful study of the items and necessary corrections were made based on their comments. In order to estimate the reliability of the questionnaire, a preliminary study was used. For this purpose, 30 copies of the questionnaire were completed by a section outside the research population. After data processing, the ordinal alpha coefficient was calculated for the questions ($\alpha = 0.86$).

In the next step, the data extracted from 351 questionnaires were analyzed. In the beginning of the study, the reliability of the indices was tested to have an accurate basis for Cronbach's alpha. Next, we applied Confirmatory Factor Analysis (CFA) and "removed the objects with poor accuracy" to increase the reliability to maximize the value of the Cronbach's alpha. The exploratory factor analysis (EFA) summarizes many variables into a small number of factors (Kalantari, 2003; Saadi and Movahedi, 2014), whereas CFA focuses on modeling the relationship between the observed indicators and underlying latent variables (factors). CFA is frequently used as a preliminary step in evaluating a proposed measurement model in a structural equation model (Schmitt, 2011). Therefore, CFA was used in this study to measure the effect of each latent variable (social, managerial, economic, political, and technical).

At the end, 351 questionnaires after data processing and descriptive and analytical statistical methods (comparing mean, factor analysis, and correlation test) were applied using SPSS 19 and smartPLS.

3. Results

3.1. Descriptive data

The farmers' mean age in this study was 44.66 years with a standard deviation of 8.03, the youngest was 26 and the oldest was 58 years old. The distribution of farmers' literacy level shows that 38 people (14.9%) were illiterate, 71 (27.8%) had elementary school education, 70 (27.5%) had around 5–10 years of school-based education, 52 (20.4%) had a high school diploma, and 96 farmers had not answered the question. The cultivated area per average was 2.8 ha, with a standard deviation of 1.6; the lowest cultivated area was 0.2 ha and the highest cultivated area was 8 ha. The average monthly income of the studied farmers was 125 USD, with a standard deviation of 1.45, and the variance was 2.09; the lowest income was 90 USD, and the highest income was 750 USD. The results showed that the main crops of farmers were wheat by the highest percentage (68%), strawberries (18%), grapes, and almonds (2%), respectively. About farmers' participation in cooperatives, the results showed that 15.1% took part in cooperatives and 84.9% did not.

The results of the prioritization of the reasons for non-use or abuse of the agricultural land in Sanandaj County showed that the first five priorities are respectively: 1) purchasing the agricultural lands around the city by dealers and middlemen (M = 4.63, SD = 0.57), 2) better price of agricultural lands around the city (M = 4.58, SD = 0.52), 3) sale of lands around the town for the construction of bungalows (M = 4.38, SD = 0.89), 4) consequent droughts in the region (M = 4.35, SD = 0.73), and 5) lack of support for slope agricultural lands (M = 4.30, SD = 0.72) (see also Table 1).

3.2. Structural equations modeling

In order to fit the theoretical or proposed model of research on the reasons for abandoning agricultural lands by the farmers of Sanandaj and to realize the most influential drivers of this phenomenon and their relations, a confirmatory factor analysis method was used with the help of SmartPLS software. With attention to the value of RMSEA reported for the initial model that is more than 0.08, some changes to the model are required. The structural equation modeling approach uses the **Δ**Kai-Square test to improve the performance and fitness of the instruments. Based on Table 2, it is observed that the initial model has reached a suitable form for use in the structural model after modification.

To test the fit of this model, various measures of fit goodness were used. Non-normalized fit index (NNFI), normalized fit index (NFI), goodness fit index (GFI), comparative fit index (CFI), and modified goodness fit index (AGFI) are among the various indexes in this region and all should be between 0.90 and 1. In this analysis, except for the non-normalized fit index (NNFI), all cases were above 0.9. In addition, if the RMSEA (Root Mean Square Error of Approximation) is less than 0.8, it will show a good model fit. The RSMEA value in this study was 0.63,

Table 1
Priority of the reasons for the abandonment of agricultural lands in the vicinity of Sanandaj.

Nr.	Item	Mean	SD
1	Purchasing the agricultural lands around the city by dealers and middlemen	4.630	0.574
2	Good price of agricultural lands around the city	4.584	0.527
3	Selling the agricultural lands around the city to construct bungalows	4.384	0.896
4	Consequent droughts in the region	4.353	0.738
5	Lack of enough support for slope agricultural lands	4.307	0.727
6	Lack of enough attention to the establishment and enforcement of agricultural cooperatives	4.276	0.894
7	Farmers' willingness to land use for more benefit	4.215	0.717
8	The inhibition of land fragmentation Act during the legacy after the culmination of Iran's revolution in 1978	4.214	0.649
9	Purchasing agricultural lands around the city for housing construction purposes	4.200	0.754
10	Lack of strong and efficient land use management for lands around cities	4.184	0.788
11	Small size or low farmlands belonging to some farmers around cities	4.123	0.696
12	The problem of some slopping lands in Sanandaj region	4.092	0.842
13	The problem of segmented farmers' lands	4.046	0.799
14	Paying no attention to land consolidation policies	4.045	0.873
15	Easy access to small sized land deed	3.969	0.660
16	Lack of specialization among some authorities of agricultural land conservation	3.890	0.737
17	The abandonment and easy release of agricultural lands due to migration	3.861	0.881
18	Lack of coordination among organizations related to land use	3.846	0.814
19	Lack of a data bank from agricultural lands around cities	3.830	1.097
20	No mechanization of agriculture in the region	3.812	0.663
21	Not enough personnel of land use offices	3.784	1.096
22	Increasing the cities' boundary and occupation of agricultural lands	3.783	0.819
23	Ignoring agricultural land abuse by some authorities	3.781	1.015
24	Lack of enough control on agricultural lands around cities	3.769	1.100
25	The enforcement of agrarian reform programs	3.753	0.901
26	Lack of bank credits and facilities to cultivate agricultural lands	3.722	1.053
27	Purchasing lands around the cities for industrial purposes	3.661	1.004
28	Lack of agricultural cooperatives	3.615	1.330
29	Lack of local organizations and NGOs	3.600	0.965
30	No awareness and knowledge of authorities to abound agricultural lands	3.569	0.749
31	Organizations' working in parallel on land use	3.553	0.884
32	Ignoring or reluctance to obey the current laws by some officials	3.476	1.532
33	No need for farming income because of the second job	3.430	0.809
34	Lack of farmers' awareness of abounding agricultural lands	3.415	0.899
35	Migration of farmers to big cities like Tehran	3.261	1.302

Very low = 1, low = 2, moderate = 3, high = 4, very high = 5

Table 2
The values of RSMEA and Kai-square in two models (initial and modification models).

Latent variables	X2	ΔX2	RMSEA	Sig.
Initial model	509.92	0.000	0.091	0.000
Modification model	387.83	187.34	0.063	0.1

indicating a good match for the model in this study (Table 3).

3.3. Confirmatory Factor Analysis (CFA)

For social, economic, technological, administrative, and political influences, Table 4 shows the factor loadings in CFA models. The T value is determined for each factor and the significance amount is also shown in Table 4 (an appropriate value is indicated by a t value greater than 1.96). "Y" in 'Removal' means that for "factor loading" we have removed

Table 3
Fit model indices.

Index	Acceptable level	Reported value
Goodness of fit index (GFI)	> 0.90	0.91
Normalized fit index (NFI)	> 0.90	0.92
Non-normalized fit index (NNFI)	> 0.90	0.89
Increased fit index	> 0.90	0.95
Comparative fit index (CFI)	> 0.90	0.97
Root Mean Square Error of Approximation (RMSEA)	< 0.8	0.63

a given object with no better value and "N" is inversely interpreted, i.e., only drivers with "N" are used in further tests." All the objects were assessed on a 5-point Likert scale.

Fig. 3 also shows CFA modification model with factor loading, and beta values. In order to investigate the two-way correlation between the causes of agricultural land use, the significance of coefficients was first tested and the results showed that all correlation coefficients were significant; then the correlation matrix was used (Table 5). The findings show that the most related economic drivers were socioeconomic (r = 0.63, p = 0.000) and managerial (r = 0.59, p = 0.000) ones, respectively. There was the highest association between technological causes of administrative causes (r = 0.52, p = 0.000) and political causes (r = 0.47, p = 0.000). It has the greatest association with economic (r = 0.53, p = 0.000) and scientific (r = 0.47, p = 0.000) drivers for political reasons. There was a high association between managerial causes and economic causes (r = 0.59, p = 0.000) and scientific causes (r = 0.52, p = 0.000). Overall, it is observed that among the five causes, technical causes with the highest correlation coefficient of 0.53 had the highest association with other causes, indicating a systematic relationship of this reason with other drivers in agricultural land use (Table 5).
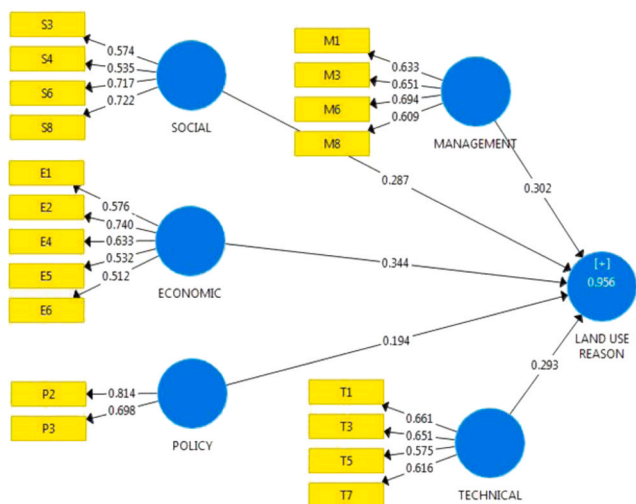
4. Discussion

Abandoning agricultural lands and LUC are among the most important challenges the agricultural and rural sectors are faced with. These changes in recent decades have had various social, economic, and environmental effects, and their management has always been one of the main challenges that policymakers and decision-makers are faced with. The findings of this research indicate that the structure reviewed for the reasons of abandonment and non-using of agricultural lands can be classified into five drivers including economic, social, political, technical, and legal-managerial ones. It is also possible to apply these five considerations to planners and decision-makers in the field of conserving agricultural land use in the area. Based on the results, the legal-managerial item was the most important factor in ALA. The most important issues in the legal-managerial factor are the implementation of the agrarian reform law and the fragmentation of agricultural lands, the cancellation of the prohibiting land plots' law during the inheritance after the Islamic Revolution, and the sale of lands around the city for the construction of residential houses. Because these causes have a high correlation with other causes, especially economic and technical ones, much of the process of LUC management and the depletion of agricultural land depend on planning and policymaking in this area. Undoubtedly, managing these causes will have a significant role in managing other causes and controlling their effects. The findings of other researchers (Dadashpour and Mohsenzadeh, 2012; Shamseddini and Amir-Fahliani, 2015; Yucer et al., 2016) emphasized the weaknesses of legal management issues regarding ALC.

Economic causes are the second most important factor in the causes of ALA. Among these causes were good price of agricultural lands around the city, lack of bank credits and facilities to cultivate agricultural lands, and farmers' willingness to land use for more benefit. Our findings are consistent with the results of Eynali et al. (2013), Rahman et al. (2016), Rezaee-Moghadam et al. (2014), and Ustaoglu et al.

Table 4
Reliability indices using confirmatory factor analysis.

Factor	Symbol	Item	Factor loading	T value	Sig.	Removal
SOCIAL	S1	Lack of peoples' awareness about the consequences of abounding agricultural lands	0.637	8.194	0.000	N
	S2	Easy releasing of agricultural lands due to migration	0.412	4.965	0.000	Y
	S3	Lack of local organizations and NGOs	0.597	8.180	0.000	N
	S4	No need for farming income because of the second job	0.506	6.113	0.000	N
	S5	Purchasing the agricultural lands around the city by dealers and middlemen	0.451	4.904	0.000	Y
	S6	Migration of farmers to big cities like Tehran	0.611	7.206	0.000	N
	S7	Ignoring agricultural land abuse by some authorities	0.492	5.531	0.000	Y
	S8	Lack of farmers' awareness of abounding agricultural lands	0.369	3.790	0.000	Y
ECONOMIC	E1	Good price of agricultural lands around the city	0.603	11.359	0.000	N
	E2	Lack of bank credits and facilities to cultivate agricultural lands	0.690	15.111	0.000	N
	E3	Lack of agricultural cooperatives	0.445	5.278	0.000	Y
	E4	Farmers' willingness to land use for more benefit	0.585	7.439		N
	E5	Easy access to small sized land deed	0.546	5.714	0.000	N
	E6	Lack of enough support for slope agricultural lands	0.504	6.662	0.000	N
TECHNICAL	T1	Lack of enough control on agricultural lands around the cities	0.584	9.158	0.000	N
	T2	Frequent droughts in the region	0.429	5.296	0.000	Y
	T3	Increasing the cities' boundary and occupation of the agricultural lands	0.605	8.594	0.000	N
	T4	Lack of specialization among some authorities of agricultural land conservation	0.055	0.594	0.583	N
	T5	Paying no attention to land consolidation policies	0.569	5.355	0.000	Y
	T6	No mechanization of agriculture in the region	0.333	4.934	0.000	N
	T7	Small size or low farmlands belonging to some farmers around the cities	0.537	9.720	0.000	Y
	T8	The problem of some slopping lands in Sanandaj region	0.434	4.566	0.000	N
MANAGERIAL	M1	The enforcement of agrarian reform programs	0.519	7.712	0.000	N
	M2	Lack of enough attention to the establishment and enforcement of agricultural cooperatives	0.417	4.951	0.000	Y
	M3	During the legacy after Iran's revolution in 1978, it was illegal to exclude land fragmentation from the law	0.424	8.814	0.000	Y
	M4	Purchasing lands around cities for industrial purposes	0.524	4.887	0.000	N
	M5	Selling the agricultural lands around the city to construct bungalows	0.390	7.993	0.000	Y
	M6	Purchasing agricultural lands around the city for housing construction purposes	0.497	6.754	0.000	Y
	M7	Ignoring agricultural land abuse by some authorities	0.592	3.774	0.000	N
	M8	Lack of a strong and efficient land use management for lands around the cities	0.455	5.118	0.000	Y
	M9	No awareness and knowledge of authorities to abound agricultural lands	0.560	2.674	0.008	N
	M10	Lack of coordination among the organizations related to land use	0.473	6.778	0.000	Y
POLITICAL	P1	Organizations' working in parallel on land use	0.457	1.650	0.100	Y
	P2	Not enough personnel of land use offices	0.787	9.713	0.000	N
	P3	Lack of a data bank from agricultural lands around the cities	0.660	7.013	0.000	N

Fig. 3. CFA modification model, factor loading, and beta values.

(2016). They also believed that agricultural lands located near the city are more desirable for economic benefit and more profit.

The third group of causes includes agro-technical drivers such as lack of enough control on agricultural lands around the cities, increasing the cities' boundary and occupation of the agricultural lands, paying no attention to land consolidation policies, and small size or low farmlands belonging to some farmers around cities. Some of the scientific proofs that are compatible with this result and emphasize the technical causes of agricultural land use are as follows: Barati et al. (2015), Mehrabi--Boshrabadi and Arjmandi (2013), Pandey and Seto (2015), Rezaee--Moghadam et al. (2014), Shafiee-Sabet (2013), Smaliychuk et al. (2016), Stuart and Gillon (2013), Verburg et al. (2004). Given that agro-technical causes are highly correlated with managerial-legal and political causes, measures such as reforming and adopting new laws to protect and optimize agricultural land use, the unity and integration of management and legislation in the area of agricultural and natural lands, especially abandoned lands, and the implementation of land use planning, in order to avoid the incidence of this element, may play an essential role in discouraging further land abandonment. Undoubtedly, strategies such as encouraging farmers to improve agricultural productivity, equipping and modernization plantation machines to apply

Table 5
Correlation matrix between agricultural land use causes.

Causes	Managerial	Technical	Political	Social	Economic	Mean correlation
Managerial	1	0.52	0.35	0.28	0.59	0.44
Technical	0.52	1	0.47	0.36	0.45	0.53
Political	0.35	0.47	1	0.38	0.53	0.41
Social	0.28	0.36	0.38	1	0.63	0.39
Economic	0.59	0.45	0.38	0.38	1	0.49

sloping lands policies about encouraging land consolidation, and using new agricultural land monitoring techniques are efficient in this regard.

Social drivers such as building culture regarding the negative consequences and the effects of changing the agricultural land use on the environment and food security of the people, including the occurrence of floods and desertification, are also among the reasons that according to this study have been effective in farmers' views on ALA (Abolina and Luzadis, 2015; Barati et al., 2015; Shafiee-Sabet, 2013; Smaliychuk et al., 2016; Stuart and Gillon, 2013). In this regard, the results of researchers like Abolina and Luzadis (2015), Smaliychuk et al. (2016), Barati et al. (2015), and Rezaee-Moghadam et al. (2014), which were mentioned in the research background section, had similar results about social drivers.

Based on the results of the fifth hypothesis, it was found that the existing policies are such that they have caused problems in ALC in the study area. Therefore, a combination of policies and strategies should be used to prevent ALC and the sustainable management of agricultural lands. Some of these policies are preventing the excessive increase in land prices and receiving less tolls from suburban farmers, new policies for the protection and optimal use of suburban agricultural lands, integrated management and legislation in the field of agricultural lands and natural resources, especially abandoned lands, and the implementation of land use management programs. Furthermore, due to the fact that agricultural development policies in rural areas, such as land consolidation, water supply network, extension education activities, and participatory projects, face many obstacles and problems, the need for more careful and serious planning, monitoring, and management is inevitable in this area, especially the abandoned lands.

5. Conclusion

The general objective of this study was to identify the main drivers affecting the ALA in Sanandaj city in Iran. According to the results, the five drivers analyzed in this study (legal-managerial, economical, agrotechnical, social, and political drivers) had a positive and significant impact on the ALA. Therefore, the hypotheses (H1, H2, H3, H4 and H5) are confirmed. According to the results, the most important ways to prevent ALC and LUC include: a) management; b) control; and c) proper implementation of policies and regulations. From the farmers' point of view, this issue was more important than other drivers. Therefore, managerial-legal supports should be given more attention to prevent ALC and help farmers around the cities. Implementing land consolidation plans, and organizing abandoned lands is felt more and more in the region. This requires more interaction between farmers and other organizations. It is also necessary to address educational and extension programs, especially in the field of agricultural land use protection, and the issues and problems of agricultural abandoned lands around the cities through media and information and communication technologies.

The findings of this study suggest preventing ALC by a sound management in the implementation of land use laws. If the lands around the city have been abandoned and destroyed, they could be used to create health, cultural, educational and green recreational spaces. Furthermore, for the better management of agricultural lands around the cities, the following suggestions could be considered: providing a platform for public and private sector participation in the reuse and optimal use of rural land abandoned around the cities, allocating low-interest and long-term credits, encouraging villagers and farmers to use the maximum capacity of their abandoned and fragmented properties and lands, and providing special banking facilities for villagers who want to reuse their properties with maximum profits.

The study also suggests that policymakers should focus on ALA control and rapid ALC, which have a negative impact on the environment and food security. Due to the fact that research on this topic in Iran is still very rare, further studies should be applied to gain a deeper understanding of ALA challenges. Farmers should be trained for the negative effects of ALA and ALC. Specific measures should be taken to address the economic drivers of ALA. The low rate of return in agricultural sector is one of the primary reasons for the abandonment of agricultural activities. As a result, the advantages for the new farming community in the research region should be provided with the potential to boost agricultural output. High-value crops, drought-resistant types, and high-yielding types should all be promoted in the research region to boost agricultural productivity. It's vital to have access to high-quality agricultural inputs like certified seeds, fertilizers, and herbicides at market-competitive pricing. Furthermore, the government should intervene to restore/reclaim the abandoned land that has been abandoned by farmers who have quit farming due to low agricultural production. Land tenancy regulations should also be made more market-oriented, with tenant farmers being encouraged to utilize agricultural lands that have been abandoned by proprietors. ALA prevention policies, on the other hand, do not demand substantial cultivation in degraded and marginal soils. Land abandonment, rather than being discouraged, should be promoted in these regions through early efforts to restore biodiversity and forestation. Partnerships between the public and private sectors are also vital to increase agricultural efficiency. Controlling the unjustifiable and illegal establishment of housing colonies and commercial marketplaces in inappropriate areas should be a priority.

Also, rural development plans do not receive sufficient economic support. So, in order to increase farm mechanization and improve the situation of rural and agricultural communities, economic support along with technical and managerial support should be considered. Finally, there is a need for more studies on the management and organization of abandoned lands, which require greater engagement of farmers, executive agencies, and change agents. Due to low level of literacy of the villagers and consequently their lack of the necessary technical-ecological knowledge, this issue requires the existence of change agents to overcome the problems of abandoned lands by conducting training classes and using specialized agricultural programs.

CRediT authorship contribution statement

Reza Movahedi, Sina Jawanmardi and Hossein Azadi: Conceptualization, Methodology; **Reza Movahedi:** Data collection, Analyses, Writing - original draft; **Reza Movahedi, Sina Jawanmardi, Hossein Azadi, Imaneh Goli, Ants-Hannes Viira and Frank Witlox:** Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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