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Presenting a Framework for Assessing Agricultural Enterprises' Sustainability in Rural Areas (Case Study: Kurdistan Province, Iran)

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Abstract

Nowadays, the concept of sustainability assessment in agricultural entrepreneurship is one of the most prominent research subjects among researchers and policymakers. Although there are numerous sustainability assessment frameworks for agricultural enterprises, the selection of sufficient indicators is still a matter of debate. This study aimed to fill this gap with an emphasis on applicability by adopting a descriptive-analytical survey using the Delphi method. To this end, a conceptual framework for the identification of components, criteria, and indicators of sustainable agricultural entrepreneurship was first developed. Then, a set of indices capable of signifying the status of sustainability in agricultural entrepreneurship activities in rural areas of the Kurdistan Province, Iran, were extracted using the opinions of a panel of experts, consisting of 30 local entrepreneurs, university instructors, and experts on agriculture. Data collected from the panel was analyzed by fuzzy TOPSIS, as a multi-criteria decision-making method. The results revealed the indicators of the sustainability assessment framework for agricultural enterprises in the study area. The ultimate objective of this study was to discuss and test the proposed framework to broaden its applicability to similar regions.

Keywords:
Agricultural sustainability, agricultural entrepreneurship, sustainability assessment, rural development, Kurdistan

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INTRODUCTION

In recent years, sustainable development and sustainability paradigms have been among major matters of debate in many scientific domains including rural development (Badri and Eftekhari, 2003; Guta et al., 2017; Pourtaheri and Hemmati, 2017; Whitehead, 2017). The subject of sustainable development revolves around the exhaustibility of natural resources and the responsibilities of humans in exploiting these resources for welfare. Natural resources must be utilized and managed so that the next generations inherit a stock of environmental assets no less than the stock inherited by the previous generations (EC, 2001; OECD, 2001; WCED, 1987). The concept of intergenerational equity in sustainable development envelopes a broad range of economic, social and environmental goals, which are difficult to pursue in the structure of business enterprises and entrepreneurial units (Jeremy et al., 2010). The concept of sustainable development requires the business owners and commodity producers to act in line with goals and principles of sustainable development and to pay as much attention to social and environmental objectives as economic goals (Shepherd & Patzelt, 2011). In other words, innovations are needed to meet the needs of the current generation of natural resources for welfare without limiting the share of future generations. Therefore, the notion of sustainable development is the link between the capacity of natural systems and the social challenges resulting from human activities. The core idea behind the integration of sustainable development with entrepreneurship is that business activities should not only contribute to human welfare and economic development by reasonable use of resources but also preserve social and ecological processes in their own setting and environment (Jeremy et al., 2010).

The objective of this paper was to conceptualize, identify and assess the criteria of sustainable agricultural entrepreneurship in Kurdistan, Iran. This objective was pursued by reviewing the research background and literature, followed by semi-structured interviews and data analysis using multi-criteria decision-making methods. The results of this paper can be used to enhance the efficacy of agricultural and entrepreneurial planning and policymaking in the study area.

To achieve the research objective from the perspective of sustainable development, we concentrated on the following questions: What are the features of a sustainable agricultural entrepreneurial unit? What is sustainable entrepreneurship? how can we evaluate sustainability in entrepreneurial activities?

Research objectives

Our objective was to define a set of criteria for the sustainability assessment of agricultural entrepreneurial activities in Kurdistan from the viewpoint of local experts. More specifically, we aimed to define specific criteria for:

- Assessment of environmental sustainability
- Assessment of social sustainability
- Assessment of economic sustainability
- Analyze and prioritize agricultural entrepreneurship sustainability criteria set in the study area

Sustainable entrepreneurship

In the 1990s, the growing attention to environmental effects of entrepreneurial activities and community-based entrepreneurship highlighted the necessity of integration between entrepreneurship and sustainable development, which gave birth to the notion of sustainable entrepreneurship. This notion was based on the idea that without sustainability, entrepreneurship may result in even more environmental issues, thereby threatening its survivability in social and economic arenas. Essentially, the notion of sustainable entrepreneurship grew popular because of a deluge of issues resulting from worldwide industrialization and its environmental impacts, and the advocates supporting the idea that the environment can be protected only

through constant innovation in all industrial domains. In the literature, this process is referred to as the future industrial revolution because it is believed that entrepreneurship is capable of solving the world's environmental problems (Cohen & Winn, 2007; Crals & Vereeck, 2004; Choi & Gray, 2008; Dean & McMullen, 2007; Bachev, 2016; Parrish, 2010; Schlange, 2006).

In sustainable entrepreneurial activities, social responsibilities are recognized and environmental impacts are minimized by adopting environmentally-friendly production methods. The main challenge of sustainable entrepreneurship is how economic, environmental, social, and cultural responsibilities can be incorporated into an innovative, creative, and profitable entrepreneurial framework.

therefore, despite the importance of sustainable entrepreneurship for all businesses, it is especially vital for businesses directly linked with the environment. The majority of businesses in rural areas are a wide range of agricultural activities, which are closely connected with nature and natural resources. To further discuss this subject, we must first define the notion of sustainable entrepreneurship in the context of agriculture.

Sustainable entrepreneurship in agriculture

Although some scholars analyze sustainable agriculture from a purely ecological perspective, there are scholars who argue that this notion transcends the ecological aspects and encompasses other dimensions, such as ethics, sustainable growth, institutional sustainability, and preservation of rural communities. For example, Chopin et al. (2017), D'Silva et al. (2011), Whitehead (2017) and Schimmenti et al. (2016) believe that sustainable agricultural entrepreneurship guarantees the economic, social and ecological sustainability of rural communities based on an equity paradigm (D'Silva et al., 2011). FAO defines sustainable agriculture as "the management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations" (FAO, 2013). In the long run, such a form of agriculture can provide sustainable food and clothing, improve the quality of the environment and natural resources, and increase the quality of life for both farmers and society as a whole (Hatfield & Carlen, 1997). Thus, it can be argued that sustainable agriculture revolves around the notion of equilibrium between economy, ecology and rural culture (Tzanopoulos et al., 2011).

In the context of agriculture, the aim of sustainable entrepreneurship in its three-dimensional form (environmental, economic and social objectives) is to find a way to infuse the business with sustainability values, such as economic welfare, improved environmental performance, and social justice (Bachev et al., 2017; Chik, 2009; Elkington, 2007; Gaviglio et al., 2016; Mark-Herbert et al., 2010). These three dimensions of sustainability are illustrated in Figure 1 and are described as follows:

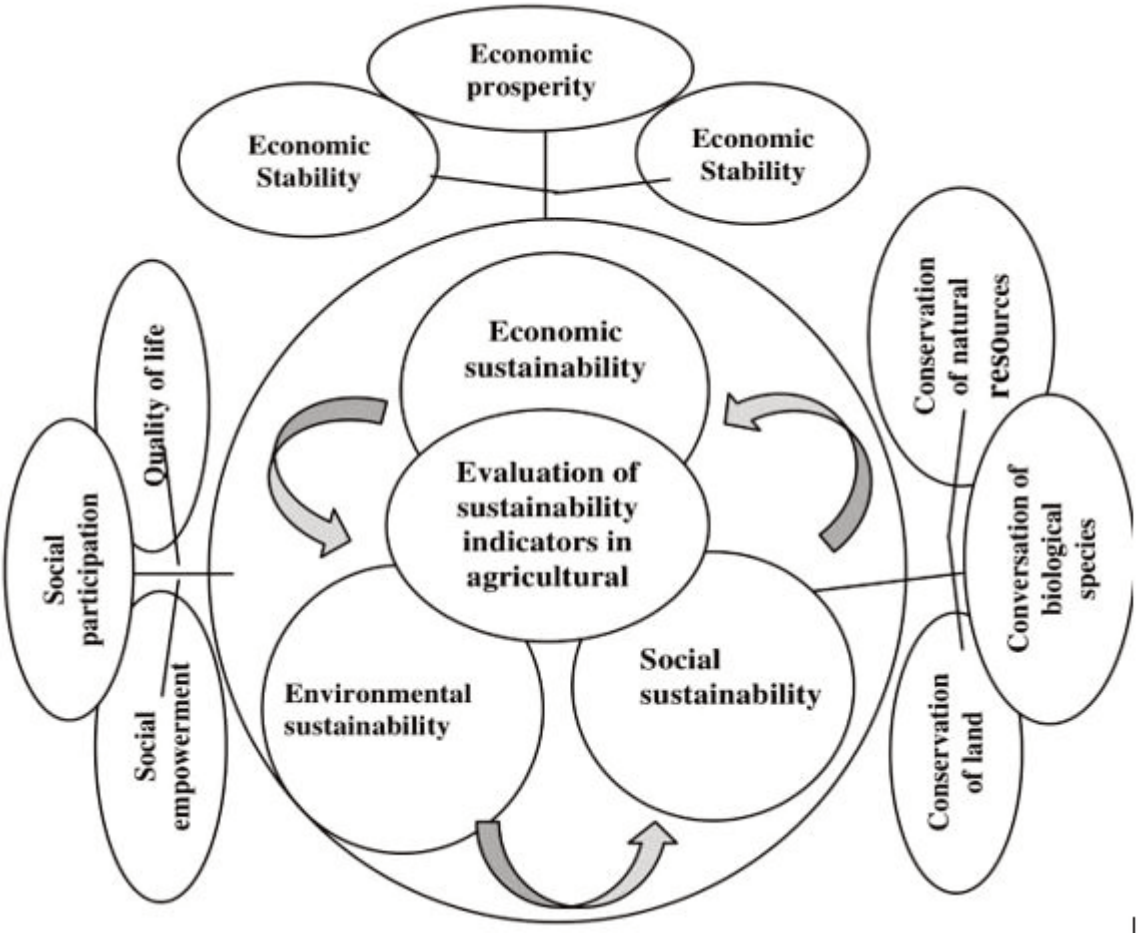

Figure 1. Conceptual model of the research theoretical framework
Source: research literature, 2018

Environmental sustainability

From this perspective, an environmentally sustainable system preserves the natural resource base, stops the over-utilization of renewable resources and environmentally destructive practices, prevents the depletion of non-renewable resources for the sake of development, and invests in the preservation of resources (EC, 2001). In the context of sustainable agricultural entrepreneurship, these objectives are translated into the conservation of biodiversity, atmospheric sustainability, and other ecosystem functions, and usually exclude economic resources.

Economic sustainability

From this viewpoint, a sustainable system should be able to produce goods and provide services in a consistent and sustainable way. Such a system also avoids the sectorial disequilibrium, which adversely affects agriculture and traditional production (OECD, 2001).

Social sustainability

Social sustainability reflects the human aspect of development. In other words, it allows people in a community to meet their essential needs. Social sustainability means allowing people to achieve a reasonable level of peace, have a meaningful and purposeful life, and gain access to equal and fair opportunities in health and education (OECD, 2001).

As was mentioned in connection with the concepts of agricultural entrepreneurship, sustainable entrepreneurship, and sustainable development, it is expected that their integration, i.e. the concept of sustainable farm

entrepreneurship, can help us in developing sustainability assessment criteria in this field.

Sustainable agricultural entrepreneurship is an integrated perspective aimed at the facilitation of food security, income growth, environmental protection, job creation, wealth distribution, creativity, and ultimately public participation (Adhikari et al., 2017). Therefore, broad attention to all dimensions of entrepreneurial development effectively guarantees the life quality improvement in rural areas through sustainable utilization of natural environment and engagement in entrepreneurial agricultural activities (Guta al., 2017).

METHODOLOGY

The study's objectives were pursued with an emphasis on applicability by adopting a descriptive-analytical survey approach using the Delphi method. To this end, a conceptual framework for the identification of components, criteria, and indicators of sustainable agricultural entrepreneurship was first developed, and then a set of indices were extracted to signify the status of sustainability in agricultural entrepreneurship activities in rural areas of Kurdistan Province, Iran, with the help of a panel of experts consisting of 30 local entrepreneurs, university instructors, and experts on agriculture in 2018. Collected data from the panel was analyzed using fuzzy TOPSIS.

Given the main objective, which was to establish a set of localized criteria for the sustainability assessment of agricultural entrepreneurial activities in Kurdistan, the authors adopted a descriptive-analytical Delphi-based approach to survey the experts.

Based on theoretical foundations and literature, the concepts with a significant relationship with agricultural entrepreneurship sustainability in its social, economic and environmental dimensions were listed. The total of 127 concepts, extracted in this step, were inserted into a questionnaire and given to the expert panel to filter the most important relevant criteria.

The panel of experts consisted of 30 experts in agriculture in the region, who were selected using convenience sampling (a non-probability sampling method). This sampling method is used when the results are not needed to be extended to the entire population and to increase the accuracy and reliability of data when there are limited data collection instruments, particularly in quasi-empirical research.

Based on the body of literature on entrepreneurial sustainability indicators, there are few processes for the identification and assessment of these indicators. Accordingly, the systematic process in Figure 2 was devised based on the common features of observed processes.

The process in Figure 2 shows the stages for the identification and measurement of the sustainability indicators. The studies on the sustainable entrepreneurial development methodology were then carefully reviewed with a focus on the mentioned components. Further, a detailed description of each step of the process is presented.

Identification of agricultural entrepreneurship sustainability indicators

The stages of identification and description of agricultural entrepreneurship sustainability indicators (framework and process):

Step 1: Identifying the principles and criteria of agricultural entrepreneurship sustainability indicators

Step 2: describing the criteria for the selection of sustainability indicators

One of the main challenges in the process of identification of indicators is the mechanism of the selection of indicators and references. In other words, it is to establish how to decide which indicators are really relevant to the objectives and principles of sustainable agricultural entrepreneurship development and consistent with the realities of the society under the investigation.

Step 3: identifying the basic components of sustainable agricultural entrepreneurship development

Recognition of the sustainability requires

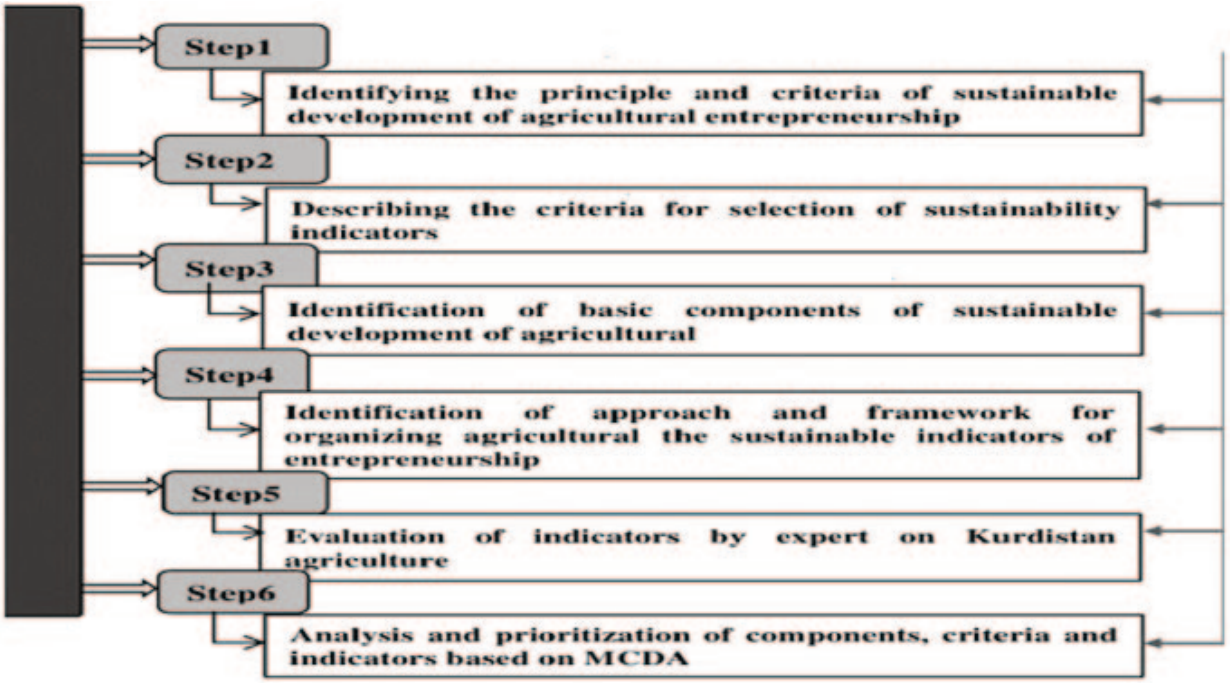

Figure 2. The process of identification of agricultural entrepreneurship sustainability indicators

attention to human-environment components of the study area at local, regional and trans-regional scales. The fundamental components of sustainable agricultural entrepreneurship development cannot exist without the use of sustainable development approaches, goals, and principles. Thus, for the principles of comprehensiveness, simultaneity and synergy between the subsystems of sustainable entrepreneurial development (or its dimensions: environmental, social and economic) to be achieved, the components of sustainability of agricultural entrepreneurship should also be defined based on characteristics of main dimensions or subsystems of sustainable development.

Step 4: Developing an approach and framework for organizing the indicators of agricultural entrepreneurship sustainability

Given the broad scope of sustainability in its social, economic, environmental dimensions, the determination of sustainability indicators requires a systematic and comprehensive approach. In this context, the use of a broad-spectrum approach for analysis of sustainability indicators can yield more applicable and reliable results.

Step 5: Assessing indicators by experts on Kurdistan agriculture

At this step, a checklist with 127 items was prepared and assessed by a panel of experts using the Delphi method. Experts were asked to rate each item based on its importance for the assessment of the agricultural entrepreneurship sustainability using a score between 0 (no importance) and 3 (highest importance). To facilitate the assessment, dependency and hierarchical relationships of indicators, criteria, components, and sustainability dimensions were described in the questionnaires. At this step, 30 out of 46 questionnaires were delivered to the experts and their feedback was received. Overall, 62 social, 23 environmental, and 22 economic indicators out of 127 indicators were recognized as significant indicators by the experts.

Step 6: Analysis and prioritization of components, criteria, and indicators based on fuzzy TOPSIS (a multi-criteria decision analysis)

In this study, we used TOPSIS to analyze fuzzy multiple-criteria group decision-mak-

ing (FMCGDM) in a fuzzy environment. TOPSIS is one of the most common for multiple-criteria decision-making (MCDM) methods. Most of the TOPSIS steps can be easily generalized to a fuzzy environment.

RESULTS AND DISCUSSION

Assessment of sociocultural indicators

Social sustainability plays a central role in achieving sustainable development goals. Sustainability of the social system refers to the improvement of human resources and life quality, and ultimately to the empowerment of local communities to overcome internal issues and respond to external challenges while preserving their positive values (Assefa & Frostell, 2007). In this sense, social objectives of sustainable development heavily emphasize such notions as equal opportunities (inter and intergenerational), empowerment, quality of life, dignity and human rights, poverty alleviation, cultural diversity, social solidarity, social participation, institutional capacity building, social security, accountability, social welfare, and place attachment (O'Neill et al., 2009).

The analysis of social sustainability indicators in agricultural entrepreneurship in rural areas of Kurdistan showed that "decrease in rural-urban migration" with the score of 0.75, and "increase in social security and welfare" with the score of 0.73, "decrease in seasonal and permanent unemployment" with the score of 0.61, "decrease in sense of deprivation and poverty" with the score of 0.55 and "public access to modern information resources" with the score of 0.50 are the most important indicators (Table 1).

In the following tables, D^+ represents the distance between the target alternative and the worst condition; D^- stands for the distance between each alternative and the best condition, and Cci represents the closest coefficient of each alternative, calculated by the distances to fuzzy positive ideal solution (A+) and the fuzzy negative ideal solutions (A-), simultaneously.

Assessment of environmental indicators

Since any activity to improve human development and life quality deals directly or indirectly with the environment, the sustainability of the environment and environmental resources significantly influence the development process. Accordingly, any discussion about entrepreneurship without considering the concept of environmental sustainability is incomplete. In the environmental dimension, the potential for achieving environmental sustainability through sustainable agricultural entrepreneurship has been strongly emphasized. Some researchers argue that the essence of this discussion is ecosystem elements such as air, water, and energy, which are not renewable and must be exploited sustainably (Shepard & Patzlet, 2011); therefore, the ecosystem sustainability plays a key role in the entrepreneurial activities (Shepard Patzlet, 2011). The analysis of environmental sustainability indicators of agricultural entrepreneurship in Table 2 showed that the "use of green and biological fertilizers to increase production" with the score of 0.75, the "use of biological methods for pest management" with the score of 0.62, and "stabilization of soil carbon" and "use of clean fuels" with the score of 0.65 are the most important indicators of environmental sustainability in agricultural entrepreneurship.

Evaluation of economic indicators

Many determinants of life quality in both rural and urban communities are governed by economic factors. An economically sustainable system should be able to produce and supply goods and services indefinitely. Both social and environmental sustainability require a compatible economic system capable of producing goods and services without undermining ecological and social structures (Dizdaroglu, 2017; Hancock & Windridge, 2001). According to Hall et al. (2010), any type of entrepreneurship, including its sustainable variant, in any sector, such as agriculture, is impossible without access to adequate financial and economic capital and

Table 1

Ranking of Social Indicators and Components of Agricultural Entrepreneurship Sustainability

Components	Criteria	Indicators	ID	D^+	D^-	CC	Rank
Participation	Social participation	Participation of local people in entrepreneurial activities	E1	6.108	2.208	0.265	13
		Support for positive rural culture and traditions	E2	5.579	2.659	0.323	10
	Social cohesion	Trust in and interaction with partners or other manufacturers	E3	6.003	2.228	0.271	12
		Establishment of self-governing associations, cooperatives, and groups	E4	5.548	2.745	0.331	9
Quality of Life	Quality of Life	Reduction of the class gap in the rural areas and business environment	E5	6.223	1.995	0.243	14
		Increase in social security and welfare	E6	2.185	5.969	0.732	2
		Reduction of seasonal and permanent unemployment	E7	3.134	4.938	0.612	3
		Reduction of rural-urban migration	E8	1.987	6.177	0.757	1
		Reduction of the sense of deprivation and poverty	E9	3.669	4.565	0.554	4
	Social satisfaction	Sense of satisfaction with work	E10	4.805	3.376	0.413	6
		Sense of social belonging	E11	5.502	2.732	0.332	8
		Satisfaction with income	E12	5.788	2.445	0.297	11
Capability	knowledge-based development	Use of local knowledge	E13	4.941	3.270	0.398	7
		Use of entrepreneurism consultants	E14	7.592	0.803	0.096	17
		Public access to modern information resources	E15	4.093	4.133	0.502	5
	Social empowerment	Empowerment and employment of women	E16	6.638	1.543	0.189	15
		Creation of direct and indirect youth employment	E17	7.047	1.226	0.148	16

facilities. Economic profit is not the only objective of sustainable entrepreneurship. This is because there is an emphasis on the profits, which are more sustainable and have the lowest impact on ecosystems and natural resources, in the economic dimension of discussion.

The analysis of economic indicators shown in Table 3 indicated that economic features of agricultural entrepreneurship are directly and indirectly influenced by economic processes and procedures in this area. In addition, it was found that "investment in production activities" with the score of 0.75, "use of agricultural innovations and new equipment" with the score of 0.65, and "diversity of agricultural products" with the score of 0.67 are the most important indicators in its economic dimension.

Table 2

Ranking Indicators of the Environmental Dimension of Agricultural Entrepreneurship Sustainability

Components	Criteria	Indicators	ID	D^+	D^-	CC	Rank
Sustainability of natural resources, ecosystem, and landscape	Protection of natural resources	Conservation or increase of vegetation	E1	5.672	2.552	0.310	11
		Reasonable use of natural resources	E2	6.152	2.115	0.256	14
		Contribution to human-nature bondage	E3	5.591	2.652	0.322	12
	Protection of soil	soil enrichment	E4	6.229	1.861	0.230	15
		Use of Crop Improvement	E5	7.047	1.226	0.148	18
		Use of crop rotation and multi-crop cultivation	E6	4.815	3.326	0.409	7
		use of biological methods for pest management	E7	2.572	5.545	0.683	2
		use of green and biological fertilizers to increase production	E8	1.987	6.177	0.757	1
		stabilization of soil carbon	E9	2.790	5.175	0.650	3
	Protection of atmosphere	use of clean fuels	E10	4.381	3.807	0.465	5
		Reduction of air pollutants	E11	6.471	1.878	0.225	16
	Protection of water resources	Use of modern irrigation systems	E12	5.197	2.855	0.355	8
		Water conservation in production units	E13	5.243	2.736	0.343	10
		Use of water conservation and storage methods	E14	4.815	3.326	0.409	7
		withdrawals from groundwater resources	E15	3.762	4.308	0.534	4
		water recycling	E16	4.821	3.404	0.414	6
Sustainability of energy	Protection of energy resources	Use of renewable energy sources	E17	6.638	1.543	0.189	18
		waste recycling in production units	E18	6.229	1.861	0.230	15
		recovery of farm wastes as energy resources	E19	6.002	2.085	0.258	13
		Reduced consumption of non-renewable energy	E20	5.345	2.874	0.350	9
Sustainability of biological species	Protection against environmental hazards	Protection of bio reserves and biodiversity	E21	6.911	1.332	0.162	18
		Fighting desertification	E22	6.638	1.543	0.189	17
		Flood prevention	E23	6.229	1.861	0.230	15

Table 3
Ranking Indicators of the Economic Dimension of Agricultural Entrepreneurship Sustainability

Components	Criteria	Indicators	ID	D^+	D^-	CC	Rank
Social justice	Distribution of opportunity and income	Distribution of income	E1	5.382	2.725	0.337	12
		Diversity of job opportunities	E2	5.805	2.292	0.283	14
		Job opportunities in non-agricultural activities	E3	4.933	3.053	0.382	10
Economic welfare	Income and profit	Increase in economic efficiency	E4	5.805	2.292	0.283	13
		Real savings rate	E5	5.381	2.724	0.336	11
		Return on capital	E6	4.730	3.379	0.417	7
		Income - expense ratio	E7	3.684	4.450	0.547	4
	Capital and economic power	Diversity of agricultural products	E8	2.790	5.860	0.677	2
		use of agricultural innovations and new equipment	E9	3.067	5.728	0.651	3
		investment in production activities	E10	1.987	6.864	0.775	1
		Use of bank loans and facilities	E11	3.959	4.767	0.546	5
		Number of agricultural land lots	E12	5.035	3.474	0.408	8
		Diversity of agricultural land	E13	6.844	1.753	0.204	14
		Use of agricultural insurance	E14	6.843	1.752	0.203	16
		value of agricultural lands	E15	4.168	4.458	0.517	6
		value of production unit	E16	4.168	2.588	0.383	9
Economic stability	Dependence on local capital	dependence of production on local resources	E17	5.381	2.724	0.336	11
		involvement of brokers in the sale purchase of products	E18	7.036	1.082	0.132	19
		Dependence of demand (buyers) on goods or services	E19	7.034	1.080	0.130	20
	Quality and sustainability	Production of new or green products	E20	7.024	1.076	0.125	21
		Provision of new and green services	E21	5.382	2.725	0.337	12
		Improvement in the quality of products	E22	5.805	2.292	0.283	14

Assessment of overall sustainability

To prioritize agricultural entrepreneurship sustainability criteria in Kurdistan, their degree of importance was assessed with the help of entrepreneurs and experts through the fuzzy TOPSIS method. The assessment results showed that "quality of life," "capital and economic power," "income and profit (from entrepreneurship)," and "protection of soil" had the highest score or the highest degree of importance for the assessment of agricultural entrepreneurship sustainability in Kurdistan (Figure 3).

Figure 3 and Table 4 present the results of the overall assessment of three dimensions of sustainability according to the experts' opinions. It is clear that for increasing the overall sustainability, it is necessary to improve the environmental protection activities of rural enterprises, followed by the social indicators.

Table 4

Ranking Agricultural Entrepreneurship Sustainability Criteria

Dimensions of sustainability	criteria	Criteria ID	D^+	D^-	CC	Rank
Environmental criteria	Protection of natural resources	**Cen1**	6.229	1.861	0.230	9
	Protection of soil	**Cen2**	4.108	4.019	0.494	5
	Protection of atmosphere	**Cen3**	5.775	2.309	0.286	8
	Protection of water resources	**Cen4**	5.381	2.724	0.336	7
	Protection of energy resources	**Cen5**	6.305	1.837	0.226	10
	Protection against environmental hazards	**Cen6**	6.465	1.636	0.202	11
Economic criteria	Distribution of opportunity and income	**Cec1**	4.532	3.587	0.442	6
	Income and profit (from entrepreneurship)	**Cec2**	3.067	5.092	0.624	3
	Capital and economic power	**Cec3**	2.068	6.076	0.746	2
	Dependence on local capital	**Cec4**	6.699	1.421	0.175	12
	Quality and sustainability	**Cec5**	7.384	0.752	0.092	14
Social criteria	social participation	**Cs1**	6.460	1.639	0.202	11
	Social cohesion	**Cs2**	6.922	1.195	0.147	13
	Quality of life	**Cs3**	1.987	6.177	0.757	1
	Social satisfaction	**Cs4**	3.792	4.292	0.531	4

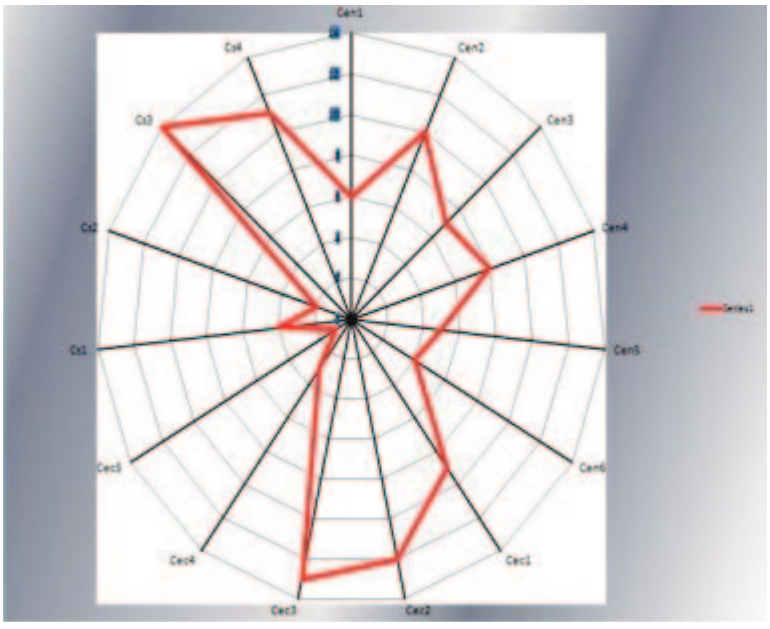

Figure 3. Ranking agricultural entrepreneurship sustainability criteria (in economic, social, and environmental dimensions)

Figures 4 presents the results from the overall assessment of three dimensions of sustainability according to the experts' opinions. The indices of Cen, Cec, Cs indicate environmental, economic, and social criteria, which are used to rank the alternatives sorted by the values. It is clear that for increasing the overall sustainability, it is necessary to improve the environmental protection activities of rural enterprises. At the next level, social indicators are important to increase the overall sustainability of rural agri-businesses.

CONCLUSION

This paper aimed to design an assessment framework for agriculture enterprises for assessing the level of sustainability and its impact on the environment. The results also showed that it is not possible to propose a comprehensively effective framework for all types of agriculture enterprises in every region or local area.

To achieve the study's objectives, the literature on sustainable development and sustainable entrepreneurship was first reviewed and then the sustainability criteria of agricultural entrepreneurship were identified through interviewing entrepreneurs and experts on agricultural activities. The obtained criteria were divided into three groups, each dedicated to one aspect of sustainability, namely environment, society, and economy. The results showed that the most important indicators of social sustainability of agricultural entrepreneurship in rural areas of Kurdistan were "decrease in rural-urban migration," "increase in social security and welfare," "decrease in seasonal and permanent unemployment," "decrease in sense of deprivation and poverty," and "public access to modern information resources." This is in line with the findings of Badri et al., (2011), Gaviglio et al. (2016), and Guta et al. (2017). In recent decades, Iran's unproductive oil-dependent economy has intensified the phenomenon of rural-urban migration, and this trend cannot be stopped without providing active support to laborers in rural agriculture and improving the agricultural sustainability indicators, such as entrepreneurship.

Environmentally, "the use of green and biological fertilizers to increase production," "the use of biological methods for pest management," "stabilization of soil carbon," and "use of clean fuels" were the most important indi-

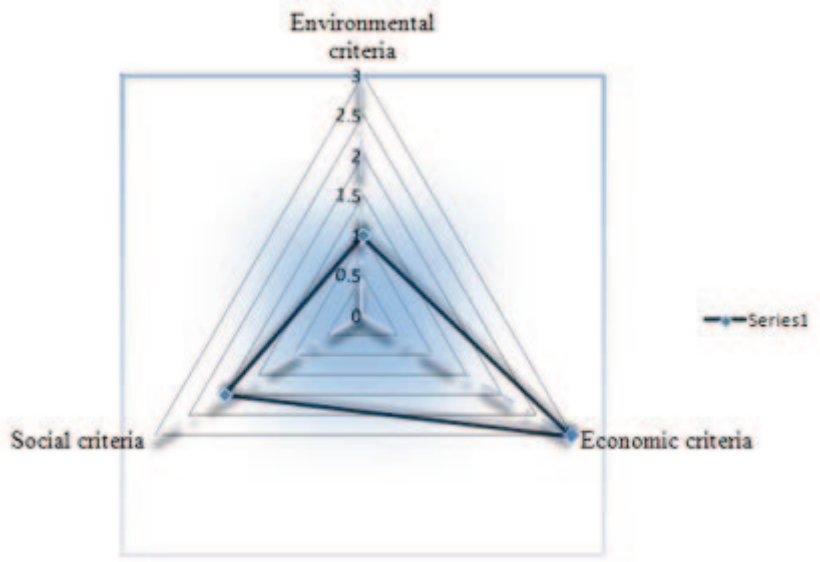

Figure 4. Overall sustainability in economic, social, and environmental dimensions

cators of environmental sustainability of agricultural entrepreneurship in the study area. This is in line with the results of Chick (2009) and D'Silva et al. (2011) and, and also with theoretical foundations. Given the growing use of agricultural fertilizers to increase the yield and pest management performance in line with the principles of competitive agriculture, the support of green and biological fertilizers and resulting products can significantly contribute to sustainable agricultural entrepreneurship.

Lastly, the results showed that "investment in production activities," "use of agricultural innovations and new equipment," and "diversity of agricultural products" were the most important economic sustainability indicators of agricultural entrepreneurship in the study area. This is consistent with the findings of Pourtaheri and Hemmati (2017). Considering the seasonal nature of agriculture business in Kurdistan, active support of investments in parallel manufacturing businesses, support of the use of agricultural innovations and new equipment, and support of those industries that complement agricultural production are of great importance for sustainable development in this area.

In conclusion, this paper showed that the assessment of status and identification of bottlenecks of entrepreneurial sustainability development can considerably contribute to any planning and policy-making in entrepreneurial activities. Identification of indicators and measures for determining the level of sustainability of entrepreneurial activities from economic, social and environmental viewpoints can be a strong step toward the encouragement of sustainable entrepreneurship and to address sustainability-related issues of entrepreneurial activities before they turn into crisis and result in bankruptcy. Recognizing a sustainable activity from an ordinary business requires access to a set of indicators and criteria capable of standardizing the assessment results so as to make them comparable and generalizable (Opricovic, 2004). This ability can play a vital role in the adoption of plans and policies to push entrepreneurial activities towards sustainability and sustainable development.

Assessment of the sustainability factor in agricultural enterprises is extremely important both in theoretical and practical terms. In Kurdistan Province and other regions in Iran, such an assessment framework is far behind the modern theoretical development and the needs and development of agriculture.

The proposed framework in this paper for assessing the level of sustainability in agri-enterprises is to be further discussed and improved since the ultimate goal of this research is to improve research methods in that important area. However, for achieving those objectives, it is necessary to assess the proposed framework in diverse locations and local areas.

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REFERENCES

Adhikari, R.P., Bonney, L., & Miles, M.P. (2017). When can a farmer be an entrepreneur? Taking entrepreneurship back to the future. *International Journal of the Nepalese Academy of Management, 5*, 117-129.

Assefa, G., & Frostell, B. (2007). Social sustainability and social acceptance in technology assessment: A case study of energy technologies. *Technology in Society, 29*(1), 63-78.

Badri, A., & Roknodin Eftekhari, A. (2003). Sustainability evaluation: concept and methods. *Journal of Geographical Research, Ashoora Publishment, 4*(3), 14-29 (In Persian)

Badri, S.B., Eftekhari, A.R., Salmani, M., & Behmand, D. (2011). The role of family farming system on sustainable rural development (Case study: Ghir & Karzin County-Fars Province). *Human Geography*

Research, *43*(2), 33-48.

Bachev, H.I. (2016). About governance and evaluation of the sustainability of farming enterprise. *Journal of Social and Administrative Sciences*, 3(2), 161-183.

Bachev, H., Ivanov, B., Toteva, D., & Sokolova, E. (2017). Framework for analyzing and assessing the system of governance and the level of agrarian sustainability in Bulgaria and China. *Available at SSRN 2950123*.

Crals, E., & Vereeck, L. (2004, February). Sustainable entrepreneurship in SMEs: theory and practice. In *3rd Global Conference in Environmental Justice and Global Citizenship, Copenhagen, Denmark*. 12(14),1–16.

Choi, D.Y., & Gray, E. R. (2008). The venture development processes of "sustainable" entrepreneurs. *Management Research News*.

Chopin, P., Blazy, J. M., Guindé, L., Tournebize, R., & Doré, T. (2017). A novel approach for assessing the contribution of agricultural systems to the sustainable development of regions with multi-scale indicators: Application to Guadeloupe. *Land Use Policy, 62*, 132-142.

Cohen, B., & Winn, M.I. (2007). Market imperfections, opportunity, and sustainable entrepreneurship. *Journal of Business Venturing, 22*(1), 29–49.

Chick, A. (2009). Green Entrepreneurship: *A Sustainable Development Challenge. Entrepreneurship for Everyone: A Student Textbook.* London: SAGE Publications, 139-150

Dean, T. J., & McMullen, J. S. (2007). Toward a theory of sustainable entrepreneurship: Reducing environmental degradation through entrepreneurial action. *Journal of Business Venturing*, *22*(1), 50-76.

Dizdaroglu, D. (2017). The Role of Indicator-Based Sustainability Assessment in Policy and the Decision-Making Process: A Review and Outlook. *Sustainability*, 9(6), p. 1018

D'Silva, J.L., Samah, B. A., Uli, J., & Shaffril, H. A.M. (2011). Towards developing a framework on acceptance of sustainable agriculture among contract farming entrepreneurs. *African Journal of Business Management, 5*(20), 81-110.

Eoroupian Comission. (2001). A Framework for Indicators for the Economic and Social Dimensions of Sustainable Agriculture and Rural Development. *European Commission*, 27-64.

Elkington, J. (1997). *Cannibals with Forks: The triple bottom line of 21st Century Business*. Capstone, Oxford, p407.

FAO (2013). SAFA. Sustainability Assessment of Food and Agriculture systems indicators. FAO report series, 47-62. https://agris.fao.org/agris-search/search.do?recordID=US201300075816

Gaviglio, A., Bertocchi, M., Marescotti, M. E., Demartini, E., & Pirani, A. (2016). The social pillar of sustainability: a quantitative approach at the farm level. *Agricultural and Food Economics, 4*(1), 15-32.

Gibbs, G. (2006). Why assessment is changing. *Innovative assessment in higher education*, *11*.

Guta, G., Vhudzi, G., & Chazovachii, B. (2017). Sustainability of Rural Entrepreneurship as a Livelihood Strategy in Zaka District, Zimbabwe. *Bangladesh Sociological Society, 14*(1), 70-87.

Hall J. K., Daneke G., & Lenox M. J. (2010). Sustainable development and entrepreneurship: Past contributions and future directions. *Journal of Business Venture*, 25, (5), 439–448

Hatfield, J. N., & D. L. Carlen., (1997). *Sustainable agriculture systems*. Trans. by E. Koochaki; M. Hosseini & H. Khazaee, Mashhad University Publications, Mashhad, Iran. (In Persian).

Hancock, B., Ockleford, E., & Windridge, K. (2001). *An introduction to qualitative research*. Trent focus group.

Jeremy K. Hall, A., Gregory A. Daneke, B., & Michael J. Lenox, (2010). Sustainable development and entrepreneurship: Past contributions and future directions. *Journal of Business Venturing, 25* (1), 439–448.

Eftekhari, A. R., Moosavi, S. M., Poortaheri, M., & Asl, M. F. (2014). Analysis of the role of livelihood diversity to rural household resilience in drought condition: case study of the drought exposed areas of Isfahan province. *Rural Research*, *5*(3), 639-662.

Mark-Herbert, C., Rotter, J., & Pakseresht, A. (2010). A triple bottom line to ensure corporate responsibility. In Berg, P. (Eds.), *Timeless Cityland: An interdisciplinary approach to building the sustainable human habitat*. Uppsala: Sveriges Lantbruks Universitet.1-7.

O'Neill, J., Hershauer, R., & Golden, J., (2009). The cultural context of sustainability entrepreneurship. *Greener Management International, 55*(2), 67-85.

Organisation for Economc Cooperation and Development, (2001). *Environmental indicators for agriculture*. Volume 3: Methods and Results. OECD, Paris, 117-140. https://www.oecd.org/greengrowth/sustainable-agriculture/40680869.pdf

Opricovic, S., & Tzeng, G.H. (2004). Compromise solution by MCDM methods: A comparative analysis of VIKOR and TOPSIS. *European Journal of Operational Research*, *156*(2), 445-455.

Parrish, B.D. (2010). Sustainability-driven entrepreneurship: Principles of organization design. *Journal of Business Venturing*, *25*(5), 510-523.

Pourtaheri, M., & Hemmati, S. (2017). Comparative assessment of the sustainability of rural housing in the old and new textures of rural areas: A case study in villages of central area of kabudarahang county. *Journal of Sustainable Rural Development, 1*(1), 69-82. (In Persian)

Schlange, L.E. (2006). What drives sustainable entrepreneurs? In: Proceedings of the Applied Business and Entrepreneurship Association International Conference. Kona, HI, USA,16–20, Nov 16-21(2006).

Schimmenti, E., Migliore, G., Di Franco, C. P., & Borsellino, V. (2016). Is there sustainable entrepreneurship in the wine industry? Exploring Sicilian wineries participating in the SOStain program. *Wine Economics and Policy, 5*(1), 14-23.

Shepherd, D. A., & Patzelt, H. (2011). The new field of sustainable entrepreneurship: Studying entrepreneurial action linking "What is to be sustained" With "What is to be developed". *Entrepreneurship Theory and Practice, 35*(1) 137–163.

Tzanopoulos, J., Kallimanis, A. S., Bella, I., Labrianidis, L., Sgardelis, S., & Pantis, J. D. (2011). Agricultural decline and sustainable development on mountain areas in Greece: Sustainability assessment of future scenarios. *Land Use Policy*, *28*(3), 585-593.

Whitehead, J. (2017). Prioritizing sustainability indicators: Using materiality analysis to guide sustainability assessment and strategy. *Business Strategy and the Environment, 26*(3), 399-412.

World Commission on Environment and Development (WCED) (1987). *Our common future*. Oxford University Press: Oxford, 76-138.

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