



Assessing and Measuring the Sustainability of Rural Settlements Active in the Field of Medicinal Plants (Case Study- Kohgiluyeh & Boyerahmad Province)

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Abstract

Purpose- Medicinal plants have a special value and significance in providing hygiene, health and food resources. Although the human attitude towards the products of medicinal plants has a long history, the issue of increasing the production of these products at the level of fields and gardens has taken on a new scientific form since the second half of the 20th century. The purpose of this research is to assess and measure economic, social, environmental sustainability of expanding the activities of medicinal plants in the rural development in Kohgiluyeh and Boyer Ahmad province.

Design/methodology/approach- It is an applied descriptive research based on field data collection (questionnaire). The statistical population of this research included 13 villages in cold region of Kohgiluyeh and Boyer Ahmad province. According to a report by Natural Resources of the Province in 2022, 383 medicinal plant producers were determined and among all of whom the questionnaires were distributed. Descriptive statistics (mean, standard deviation and variance) and inferential (one-sample t-test and VIKOR model) were used for data analysis.

Findings- The findings showed that the mean score of the social and environmental indicators is over the theoretical average value (3), while the mean score was 2.80 in terms of economic indicators. The results of VIKOR model revealed that Sepidar village with a VIKOR index of (0.157) has the highest rank and Sadat Mahmoudi village with a VIKOR index of (0.993) has the lowest rank in terms of the sustainability of the activities of medicinal plants among the villages in the study area.

Original/value- This study is promising the activities of rural areas in the production of medicinal plants, which is considered as a strategy for diversification in rural settlements. Therefore, the results of this research can be given special consideration in recognizing the effects of medicinal plants in different geographical areas and have an effective role in the development of rural areas.

Keywords- Economic sustainability, Social sustainability, Environmental sustainability, The activities of medicinal plants, Kohgiluyeh & Boyerahmad province.

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1. Introduction

Nowadays, considering the role and sustainability status of the villages in the processes of economic, social and political development on a local, regional, national and international scale and the consequences of the underdevelopment of rural areas such as widespread poverty, growing inequality, rapid population growth, unemployment, migration, urban marginalization, etc. has led attention to villages and rural communities and even its precedence over urban communities (Roumiani, 2021). On the other hand, having environmental potential, rural areas are rich in natural resources and agricultural products, which require attention and prioritizing them in line with sustainable rural development (Omisore, 2018).

Since the villages have been the place of producing agricultural products, a high percentage of the villagers' livelihood is associated with the use of land which is in a traditional and subsistence way in the rural settlements. Such economic and occupational structure in rural areas has led to specific issues (Matiei Langroudi, et al., 2019). Accordingly, a dynamic and sustainable movement towards the optimal use of available resources, increasing the quality and quantity of agricultural production and diversifying it in rural areas is known as one of the key strategies in the development of rural areas (Tohidyanfar & Rezaei-Moghaddam, 2019). The diversity of agricultural activities, while strengthening this sector, not only facilitates the diversity of agricultural jobs and the strengthening the incomes and rural development process, but also improves job opportunities in rural areas and has a significant impact on rural households' welfare (Riahi & Nouri, 2015). Hence, it can be said that the diversity of the rural household economy is in the direction of rural development as this diversity raises the villagers' living standards, makes it possible to build a new place, and makes their economic participation in the development of the villages practical (Safi, 2009: 21).

One of the diverse activities in rural areas is the cultivation of medicinal plants and its related economic activities, which can pave the way for the economic development of rural areas. The diversity of medicinal species, climatic diversity, human force and available energy resources are

important potentials for the development of cultivation and industries related to medicinal plants (Jafari et al., 2017). Medicinal plants have been and are of special value and significance in providing health and wellness to communities, both in terms of treatment and prevention of diseases. This part of natural resources is as old as humans and has been one of the most important sources of human food and medicine supply for generations. Although the human attitude towards the medicinal products of plants has a deep history, the issue of increasing the production of these products in fields and gardens have taken a new scientific form since the second half of the 20th century (Noorhosseini et al., 2018). Therefore, the activities of medicinal plants can have effects in terms of economic dimensions (Employment diversification, employment creation, income generation and savings), social dimensions (improving the quality of life, reducing inequalities, health and treatment) and environmental dimensions (reducing water consumption, environment preservation, and environmental awareness) in rural development (Riva et al., 2018; Shalizi, 2003; Elachouri, 2018). Iran has more than 8000 species of valuable plants in the world with diverse weather and climate conditions (Jafari et al., 2017). One of these areas is the Zagros region in the cold region of Kohgiluyeh and Boyer Ahmad province, which has been the focus of local rural people and private companies in the last three decades. In this region, based on the information received from the Province's Natural Resources, 127 medicinal plant projects have been implemented or developed in the province from 2017 to 2020 whose administrators were introduced to Omid Entrepreneurship Fund and Agricultural bank by Agriculture Jihad Organization, 52 ones (40%) of which were in the study area, namely Dena and Boyer Ahmad counties, which were worth approximately 87 billion Tomans. Approximately 300 people directly and 1000 ones indirectly benefit seasonally from its benefits and incomes. In addition, in Zardband company¹, approximately

¹ Zardband Pharmaceuticals is a knowledge-based company that started its activity in 1993 with the aim of producing and processing medicinal plants. At the beginning, this company procured the seeds of different and special species of medicinal plants

2000 people directly and indirectly and about 517 households, i.e. roughly 1100 people are working seasonally in the villages of Tange Sorkh region as a pilot area for medicinal plants in the province.

They make a living receiving an income or selling medicinal plants. However, it is worth noting that most administrators of the medicinal plants project do not settle in villages; rather they are villagers settling in the city, and the stages of cultivating, protecting, and harvesting are kept with the help of the villagers. Although passing years, the diversity of medicinal plants in the villages of Iran is increasing, it should be noted that the participation of the local people is still at a very limited and unacceptable level, which needs studying and recognizing the obstacles in the way of the activities of medicinal plants in rural development and planning in order to overcome them. Thus, this research aims to answer this question: What is the degree of economic, social, and environmental sustainability of the development of medicinal plants in the villages of Kohgiluyeh and Boyer Ahmad province?

2. Research Theoretical Literature

Sustainability, as a descriptive aspect of development, is a situation in which the desirability of available facilities does not decrease over time. Derived from Latin word "sustinere" with the meaning of keeping alive, it implies long-term support or durability. In its broadest meaning, sustainability refers to the ability of society, ecosystem or any ongoing system to continue functioning in the indefinite future, without being weakened by force due to the depletion of the resources that the system depends on or imposing an excessive burden on them. Furthermore, the system ability for endurance and reliability is inevitably dependent on the success of the system in establishing a relationship with the external environment (Asadi & Naderi, 2009). Therefore, it can be deduced that sustainability is a form of distributive justice: The fair distribution of development opportunities

through reliable international sources and focused its efforts on their reproduction and adaptation to the climatic conditions of the country. In parallel with these activities, research was also conducted in the field of optimal extraction and processing methods of plant products.

between current and future generations on the one hand and its inclusiveness on the other hand, which means empowering people and supporting and paying attention to all human rights, including political, economic, social rights and etc. (Zahedi & Najafi, 2006). According to the existing literature, rural sustainability has three dimensions: 1- ecological or environmental sustainability, 2- social sustainability and 3- economic sustainability, which are explained in details in the following:

2.1. Ecological/ environmental sustainability

This dimension refers to the total components and elements existing in the ecosystem and paving the way for activity and production. Ecological sustainability means "maintaining basic resources at levels which do not negate future options or maintain and improve the capacity, quality and resilience of the ecosystem." Environmental experts focus more on this aspect of development and are concerned about the limitations caused by human activities on the environment. They are anxious about preserving what is named natural capital by economists and are well aware that the viability condition of every living being on earth depends on the primary production of plants. According to them, nature is the most enormous and wonderful treasure (Kalantari & Shabanali Fami, 2008). Undoubtedly, no matter how profitable or socially acceptable the economic and social system of rural areas is, if not environmentally sustainable, it cannot maintain its productivity over time and will inevitably move towards instability.

2.2. Social sustainability

In defining social sustainability, a group of researchers have mentioned four main and determining elements: 1- Social justice, 2- Social cohesion, 3- Participation, 4- Security. In this meaning, components such as equal opportunities along with progress for all human beings, life with cooperation and cooperation, equal opportunities for all people to play social roles along with security of livelihood and safety in human settlements against natural hazards, are the basis of assessing social sustainability. In terms of social sustainability, resources should be exploited in such a way that future generations also have the ability to make decisions in order to meet their needs at the best level of satisfaction. In this definition, win-win policy is emphasized by decision makers and aims to achieve

economic, social and environmental improvements (Martin, 2001). In this regard, social sustainability in rural areas is defined as "a healthy life through meeting the basic needs of the rural community members, taking into account the quality of life and simultaneously maintaining the environmental quality and related to the economic systems in order to achieve the highest level of life satisfaction." (Badri & Taher Khani, 2008). In general, it can be said that social sustainability is measured and assessed with its main indicator, which is the quality of life, which "means providing better living conditions in which balance, harmony, desirability and fair equality for life are along with health, security, comfort, vitality, creativity and beauty (Cheraghi, 2011).

2.3. Economic dimension

Economic sustainability means the systems are competitive and sustainable in interaction with the economic environment. Any system that is not appropriate in terms of economic point, no matter how much it is accepted by the society, in harmony with the ecological requirements and politically supported, cannot sustain" (Zahedi, 2009).

The sustainability of economic activities can be explained from different points of view as follows: 1- A situation is called sustainable in which the desirability of the society does not decrease over time; 2- A situation is said to be sustainable in which natural resources are managed in such a way that production opportunities and economic growth remain sustainable for the future; 3- A situation is called sustainable in which natural capital reserves do not decrease during economic growth and development; 4- A situation is named sustainable in which natural resources are managed in such a way that the performance of the used resources does not decline (Cheraghi, 2011). Meanwhile, economic sustainability in rural areas means strengthening the foundations of the economy and achieving economic security in terms of access to sustainable livelihoods, in continuous and stable affairs, profitable employment and reliable financial resources, and finally, appropriate technology compatible with the environment by exploiting human resources" (Planning Committee of Processing and Complementary Industries and Rural Development, 2013).

Although the concept of rural sustainability and its strategies have not been considered in relation

to the activities of medicinal plants, it has had a significant impact on the medicinal plants sector. The goal of rural sustainability is to ensure a stable and secure livelihood that reduces resource depletion, environmental destruction, cultural disruption and social instability (Bodeker, 2007). Therefore, the concept of rural sustainability has been considered as a potential solution to prevent environmental and social industrial destruction, and medicinal plants are an industrial resource dependent on the natural endowment and heritage of the society (Karunamoorthi et al., 2013).

Since ancient times, people have collected plant and animal resources for their needs. For example, it can be pointed out to edible nuts, mushrooms, fruits, plants, spices, gum, fodder, fibers used to make shelter and housing, clothes or utensils, and plant or animal products for medicinal and cosmetic or cultural purposes. Nowadays, hundreds of millions of people, mainly in developing countries, obtain a significant part of their subsistence needs and income by the collection of plant and animal products (Agelet et al., 2000). Collection of high-value products such as mushrooms (morels, matsutake, truffles), medicinal plants (ginseng, goldenseal, black cohosh) also continues in developed countries for cultural and economic reasons (Jones et al., 2002). Among these uses, medicinal plants play an essential role not only as traditional medicines used in many cultures, but also in the trade of goods that meet the demand of often distant markets (Anon, 2002).

The diversity and availability of native plants helps to use them by different people and communities such as rural (non-traditional) communities, traditional communities, native populations and riverside communities. Rural communities are able to identify many plant species that produce numerous products such as food, firewood, medicine, fodder and tools for their daily needs (Miguéis et al., 2019). For example, in India, the cultivation of medicinal plants is considered important for two reasons: a) Cultivation provides an alternative source of supply and thus reduces the need to collect these plants from nature. This decreases the pressure on endangered species and promotes their protection. b) Cultivation provides an additional source of income to the poor rural population of the states. Therefore, in this country, the cultivation of medicinal plants is known as an important source

of income owing to several advantages namely high price, low transportation cost due to higher value per volume unit and long shelf life compared to traditional products (Alam & Belt, 2009). Egamberdieva et al. (2017) reported that a large number of medicinal plants have been studied according to their phytochemical compounds, including plants that are usually used in the treatment or prevention of specific diseases and economic marketing. In general, they have a useful role in health care. Their use in the treatment of humans and animals for various diseases is well documented as the local plants used for medicinal purposes have biological and socio-cultural heritage (Mbuni et al., 2020). Cultivating, harvesting, processing, using and marketing of medicinal plants provide valuable contributions to the economic well-being of local communities (Bareetseng, 2015). Therefore, it can be deduced that medicinal plant fields are considered as pioneers for the future supply of rare plant species with commercial and medicinal value in southern Africa. Furthermore, they are effective on the livelihood of many local people (Rathore and Mathur, 2018).

Noorhosseini et al. (2018) found out in their research that providing training through visual, audio, and written media, credit financial facilities with low interest for cultivating medicinal plants in the fields and holding educational-extension classes are known as the most important economic and extension activities effective on the development of medicinal plants. Mohammadzadeh et al. (2019) pointed out that the two strategies of following global processing and packaging standards and supporting the establishment of production, marketing and export management companies have the highest priority. Therefore, they suggested that considering the important role of medicinal plants in Razavi Khorasan Province, the government, as the executive of the National Medicinal Plants Plan, should pave the way for the development of medicinal plants production in accordance with global standards by supporting the establishment of production and export companies. Shahi et al. (2017) indicated that the villages of Iran have a great comparative advantage and potential in terms of medicinal plants. Although the numerous challenges are big obstacles for the villagers, the results reveal that familiarizing the users with the correct methods of cultivation and exploitation,

the use of mechanization and explaining the results of research on medicinal plants will increase the share of medicinal plants in the gross national product. In addition to the stability of the rural economy, it will play a significant role in rural development. Sojasi Qhidari & Azizi (2019) found out that most people prefer to use medicinal plants obtained from the nature for treatment which they experienced better compared to chemical medicine at least once in their lifetime. The source of people's knowledge in the use of medicinal plants has been from previous generations. Among the effective factors on the villagers' tendency to use medicinal plants, the indicators including cultural adaptability and medicinal plants adaptability with the body are considered to be the most effective factors, respectively. Alipour Khesht et al. (2022) reached to the conclusion that the production of medicinal plants constitutes 1.50% of the total income of the agricultural sector in the study area. Moreover, cultivating each hectare of medicinal plants generates 6.53% more income rather than other crops on average.

Smith-Hall et al. (2012) pointed out that a large number of people rely on herbal medicinal products to maintain health or treat diseases, and it is unlikely that this number may decrease in the foreseeable future. They proposed a framework based on the typology of the main groups of users of medicinal plants (hunters, farmers and ranchers, urban and suburban dwellers and entrepreneurs) and three major types of benefits (producer, consumer and society-wide). In the proposed framework, the factors and links vary from international to domestic levels and, although necessarily broad, can therefore be a facilitator to construct internationally comparable knowledge. Nonetheless, the proof of success is whether this framework stimulates empirically and theoretically richer research than before and whether the obtained results more effectively contribute towards improving human health and better managing of medicinal plant resources. Sen & Chakraborty (2017) found out that traditional Indian medicine or medicinal plants are also considered as a vital source of new medicine. It is important to make such medicine available for people. Several initiatives have been taken in India to promote such medicine and integrate them into clinical practice. Evidence-based integration of traditional Indian medicine into

clinical practice helps provide high-quality health care for all. [Tnah et al. \(2019\)](#) pointed out that 30 herbal products from the local market were tested for their authenticity. The recovery of DNA barcodes from plant products was 73.4%, 56.7% of the tested products were valid, while 10% of the plant products were replaced by other plant species and 6.7% were contaminated. The research by [Yadav & Misra \(2010\)](#) revealed that the use of information and communication technology systems solves problems in development and helps suppliers, producers and consumers. They also stated that the production of medicinal plants has increased the quality of plants and helped consumers and suppliers to recognize medicinal plants. [Kalauni & Josh \(2018\)](#) in their research on medicinal plants and the economy of Nepal, found that more than 75% of the Nepali community (and 60% of the global community) depend on local medicinal plants. Although these medicinal and aromatic plants have a large share in the cash of Nepalese villagers, approximately 90% of them are exported to India in the form of raw materials due to the lack of a wholesale collection system, the lack of processing industries, and the lack of investment by the government. Hence, it is necessary to increase the share of medicinal and aromatic plants in the national economy of Nepal through commercializing and turning them into large commercial crops.

[Astutik et al. \(2019\)](#) in their research titled "Asian medicinal plants' production and utilization potentials: A review" emphasize on the essential role of medicinal plants and their impact on reducing rural poverty and improving the level of community health in Asian countries. Reviewing 247 journal articles in the field of medicinal plants, they have reached the conclusion that studies in this field have been carried out in a scattered and non-systematic manner without an overall view to achieve a certain purpose. They pointed out that most of the studies have been conducted on the role of medicinal plants on livelihood and health and very few studies on the commercialization of medicinal plants, especially with regard to the role of middlemen, boom–bust

cycle, raw material readiness, and product quality. [Mbuni et al. \(2020\)](#) found out that rural communities in the Cherangani Hills are rich sources of plants with medicinal properties, and the therapeutic uses of the collected plants provide basic information which can contribute to further research by scientists for species conservation and pharmacological studies of the most important species. [Da Costa Ferreira et al. \(2021\)](#) reported that diverse knowledge of local pharmacology and in-depth studies are needed to confirm the effectiveness of medicinal plants and understand the dynamics of local knowledge. In a research by [Ssenku et al. \(2022\)](#) the plant species used to treat human diseases in Butalja District of Eastern Uganda and their associated TMK were documented.

Reviewing the background of the studies, it is deduced that most of the studies conducted so far in the field of the activities of medicinal plants in rural areas have focused on the aspects of health and treatment benefits and less have addressed to the issue of economic, social and environmental effects, and this study is focused on its effects as investigating the effects of the activities of medicinal plant can pave the way for improving the quality of rural development for villagers.

3. Research Methodology

It is an applied research and descriptive analytical one in terms of nature. The data has been collected using the library method (in order to review the theoretical literature) and the field method.

The statistical population of this research included medicinal plant producers in 13 villages in Kohgiluyeh and Boyer Ahmad province including 383 medicinal plant producers based on a report by Natural Resources of the Province, among all of whom the questionnaires were distributed.

In addition, the questions in the research questionnaire were designed based on a Likert scale (very little, little, medium, much and very much). According to the review of the studies conducted in the theoretical literature, related indicators were extracted ([Table 1](#)).

Table 1. Research indicators

Indicators	Items	Resources
Economic sustainability	The demand for medicinal products, The stability of appropriate marketing systems for selling medicinal plants, Purchasing medicinal products by the government, Creating income and employment obtained due to the activities of medicinal plants, Distributing income due to activities of medicinal plants, Strengthening the local economy due to the activities of medicinal plants, Economic diversification due to the activities of medicinal plants, Economic added value of medicinal plants, Investing of non-local people in the production of medicinal plants, Government investment in the production of medicinal plants, Benefiting from the activities of medicinal plants, Investing of local people in the production of medicinal plants	Safi (2009), Matiei Langroudi et al. (2019), Mohammadzadeh et al. (2019), Omisore (2018), Tohidyan Far & Rezaei-Moghaddam (2019)
Social sustainability	Access of local community to processing and complementary facilities, Booming the activities of medicinal plants and reducing migration, Supporting the progress of promoting and exporting products produced in the village, The effects of medicinal plants on quality of life and making a living, The cooperation and participation of the village council and manager in paving the way for the activities of medicinal plants in order to encourage people and producers, People's awareness of the benefits of products and creating motivation in the activities of medicinal plants, Holding appropriate educational-extension classes on how to cultivate and harvest medicinal plants, Improving non-governmental and local institutions (cooperatives, associations) in the field of medicinal plants, The cooperation of local institutions associated with medicinal plants, Supporting sample models (flower and plant festivals), The cooperation and contributions of local people in medicinal plants, The local community's satisfaction with the booming of medicinal plants	Riahi & Nouri (2015), Sojasi Qhidari & Azizi (2019), Alipour Khesht et al (2022), Shahi et al. (2017), Noorhosseini et al. (2018), Tnah et al. (2019), Smith-Hall et al. (2012).
Environmental sustainability	The optimum use of water, Reducing the extinction of plant species, The effects of climate and booming the activities of medicinal plants, Supporting medicinal plant and species, Increasing environmental vulnerability in the village, The activity and advertisement of village residents to preserve medicinal plant species, Learning opportunities to use better plant species, Raising environmental awareness	Sojasi Qhidari & Azizi (2019), Alipour Khesht et al (2022), Shahi et al. (2017), Jones et al. (2002), Anon (2002).

13 villages in cold regions of Kohgiluyeh and Boyer Ahmad province were used to conduct the study. On the one hand, the selection of the villages was due to the fact that the activities of medicinal plants was more than other villages. On the other hand, they were selected based on the job creation as the local people were engaged in the activities of medicinal plants. This province has 46 types of native plants and three rare medicinal plants in the world, including *Ferula golbaniflua*, *Ferula assa-foetida*, and *Astragalus brachycalyx Fischer*. *Dorema aucheri Prangos*

ferulacea, *Allium ampeloprasum*, *Kelussia odoratissima Mozaff*, *Allium Jesdianum*, *Arum detrunctum*, *Thymus vulgaris*, *Fritillaria imperialis*, *Astragalus brachycalyx Fischer*, *Carthamus tinctorius*, *Artemisia annua*, *Artemisia vulgaris*, *Cichorium intybus* and *Nigella sativa* are among the medicinal and edible plants in Kohgiluyeh and Boyer Ahmad. The document for the development of medicinal plants in this province has been compiled and so far, more than 50 thousand hectares have been restored using the cultivation of medicinal plants (Table 2).

Table 2. Examples of local medicinal plants

County	Region	Popular medicinal plant
Boyer Ahmad	Yasouj	<i>Ferula assa-foetida, Melissa officinalis, Crocus sativus, Apium graveolens, Rosa damascene, Cuminum cyminum, Glycyrrhiza glabra, Astragalus brachycalyx Fischer, Allium iranicum, Allium Jesdianum, Arum detruncatum</i>
	Margoon	<i>Ferula assa-foetida, Descurainia sophia, Matricaria chamomilla, Cuminum cyminum, Mentha piperita, Allium iranicum, Allium Jesdianum, Arum detruncatum</i>
	Ludab	<i>Dorema aucheri, Rheum ribes, Apium graveolens, Rosa damascene, Lavandula angustifolia, Mentha piperita</i>
	Kabgian	<i>Rheum ribes, Aloysia citrodora, Allium stipitatum, Artemisia vulgaris, Cichorium intybus</i>
Dena	Sisakht	<i>Ferula assa-foetida, Cuminum cyminum, Crocus sativus, Rosa damascene, Lavandula angustifolia, Glycyrrhiza glabra, Mentha piperita, Astragalus brachycalyx Fischer, Allium iranicum, Allium Jesdianum, Arum detruncatum</i>
	Pataveh	<i>Matricaria chamomilla, Echium amoenum, Ferula golbaniflua, Astragalus brachycalyx Fischer</i>

The validity of the questionnaire was confirmed by 18 academic experts. Using SPSS software, Cronbach's alpha was calculated and obtained 0.85 for the producers of medicinal plant which confirmed its reliability. Finally, descriptive statistics (mean, standard deviation and variance) and inferential (one-sample t-test and VIKOR model) were used for data analysis.

4. Research findings

The descriptive findings of the 383 questionnaires distributed among the producers of medicinal plants showed that most respondents (38.5%) were in the age group of 31-40 years old, at high school (23.5%) level of education. In addition, most respondents were male (56.9%), married (66.6%), with a history of activities in medicinal plants, more than 5 years (15.2%). (Table 3)

Table 3. Respondents' descriptive characteristics

Respondents' Characteristics	Mode	Frequency	Percentage
Age	31-40	149	38.5
Education	High school	123	23.5
Gender	Male	218	56.9
Marital status	Married	236	66.6
History of activities in medicinal plants	More than 5 years	61	15.5

Economic, social and environmental indicators are a combination of components and therefore the research scale is changed to an interval scale. To check the normality of the distribution of the research indicators, the standard error of the Skewness and Kurtosis has been used. If the value of the standard error of the Skewness and Kurtosis is more than +2 or less than -2, then the

assumption of normality of the distribution is rejected (Habibpour & Safari, 2009). At the same time, if the numerical value of the Skewness and Kurtosis is between +1.5 and -1.5, the distribution of research indicators and variables is normal. The results of the normality test for economic, social and environmental indicators can be seen in Table 4.

Table 4. Normality test results for the studied indicators

Source: Research findings, 2022

Indicators	N	Skewness		Kurtosis		Test results
	Statistic	Statistic	Standard Error	Statistic	Standard Error	Skewness & Kurtosis
Economic sustainability	383	-0.389	0.206	-0.583	0.410	Confirmed normality
Social sustainability	383	-0.198	0.251	0.363	0.412	Confirmed normality
Environmental sustainability	383	0.582	0.325	0.456	0.325	Confirmed normality

4.1. Assessing and measuring the economic, social, and environmental sustainability of expanding the activities of medicinal plants

In order to find out which items of the activities of medicinal plants have had the greatest effects on the sustainability of economic, social and environmental indicators of rural development in Kohgiluyeh and Boyer Ahmad province, standard deviation and variance were used. The results showed that in terms of economic indicators the items including "Investing of non-local people in the production of medicinal plants" with a variance of 1.94, "Government investment in the production of medicinal plants" with a variance of 1.92 and "The stability of appropriate marketing systems for selling medicinal plants" with a variance of 1.79 have more effects on economic

sustainability. In the social indicator, the items including "People's awareness of the benefits of products and creating motivation in the activities of medicinal plants" with a variance of 1.99, "Improving non-governmental and local institutions (cooperatives, associations) in the field of medicinal plants" and "The cooperation of local institutions associated with medicinal plants" with a variance of 1.71 have more effects on social sustainability. In the environmental indicator, items such as "Increasing environmental vulnerability in the village" with a variance of 1.93, "Supporting medicinal plant and species" and "The activity and advertisement of village residents to preserve medicinal plant species" with a variance of 1.80 have the most effects on environmental sustainability (Table 5).

Table 5. Assessing the activities of medicinal plants from the producers' point of view

Indicator	Item	Mean	Standard deviation	Variance
Economic sustainability	The demand for medicinal products	2.70	1.24	1.55
	The stability of appropriate marketing systems for selling medicinal plants	2.68	1.34	1.79
	Purchasing medicinal products by the government	2.82	1.19	1.42
	Creating income and employment obtained due to the activities of medicinal plants	3.01	1.32	1.76
	Distributing income due to activities of medicinal plants	2.41	1.18	1.41
	Strengthening the local economy due to the activities of medicinal plants	2.85	1.31	1.71
	Economic diversification due to the activities of medicinal plants	1.86	1.08	1.18
	Investing of local people in the production of medicinal plants	4.26	1.02	1.05
	Investing of non-local people in the production of medicinal plants	2.85	1.39	1.94
	Government investment in the production of medicinal plants	2.63	1.38	1.92
	Benefiting from the activities of medicinal plants	2.78	1.30	1.70
	Economic added value of medicinal plants	2.69	1.23	1.52
Social sustainability	The local community's satisfaction with the booming of medicinal plants	3.21	1.24	1.55
	Supporting sample models (flower and plant festivals)	2.51	1.16	1.36
	The cooperation and contributions of local people in medicinal plants	2.70	1.28	1.62
	The cooperation of local institutions associated with medicinal plants	3.27	1.30	1.71
	Improving non-governmental and local institutions (cooperatives, associations) in the field of medicinal plants	3.52	1.09	1.71
	Holding appropriate educational-extension classes on how to cultivate and harvest medicinal plants	3.30	1.28	1.65
	People's awareness of the benefits of products and creating motivation in the activities of medicinal plants	3.26	1.40	1.99

Indicator	Item	Mean	Standard deviation	Variance
	The cooperation and participation of the village council and manager in paving the way for the activities of medicinal plants in order to encourage people and producers	3.22	1.29	1.68
	The effects of medicinal plants on quality of life and making a living	2.81	1.32	1.76
	Supporting the progress of promoting and exporting products produced in the village	2.72	1.28	1.66
	Booming the activities of medicinal plants and reducing migration	2.71	1.28	1.65
	Access of local community to processing and complementary facilities	2.62	1.22	1.50
Environmental sustainability	The optimum use of water	3.85	1.06	1.13
	Reducing the extinction of plant species	3.53	1.26	1.60
	Raising environmental awareness	3.53	1.32	1.76
	Supporting medicinal plant and species	3.47	1.34	1.80
	Increasing environmental vulnerability in the village	3.41	1.39	1.93
	Learning opportunities to use better plant species	3.62	1.24	1.54
	The effects of climate and booming the activities of medicinal plants	3.42	1.29	1.66
	The activity and advertisement of village residents to preserve medicinal plant species	3.49	1.34	1.80

To have a better perception of the status of villages, the mean score of villages are compared in terms of economic, social and environmental sustainability of the activities of medicinal plants. Figure 1 shows that the environmental sustainability indicator has the highest mean score as most of the villages have a higher level of this indicator compared to other indicators. This indicates that the environmental indicators that have a closer relationship and interaction with the

production of medicinal plants have become a fundamental issue in the studied villages. Furthermore, the production of medicinal plants has led people to cooperating and participating in order to pave the way for more activities of medicinal plants, and the mean score of social sustainability indicator is at a higher level than (3). However, the economic sustainability is at a lower level rather than other indicators among the studied villages.

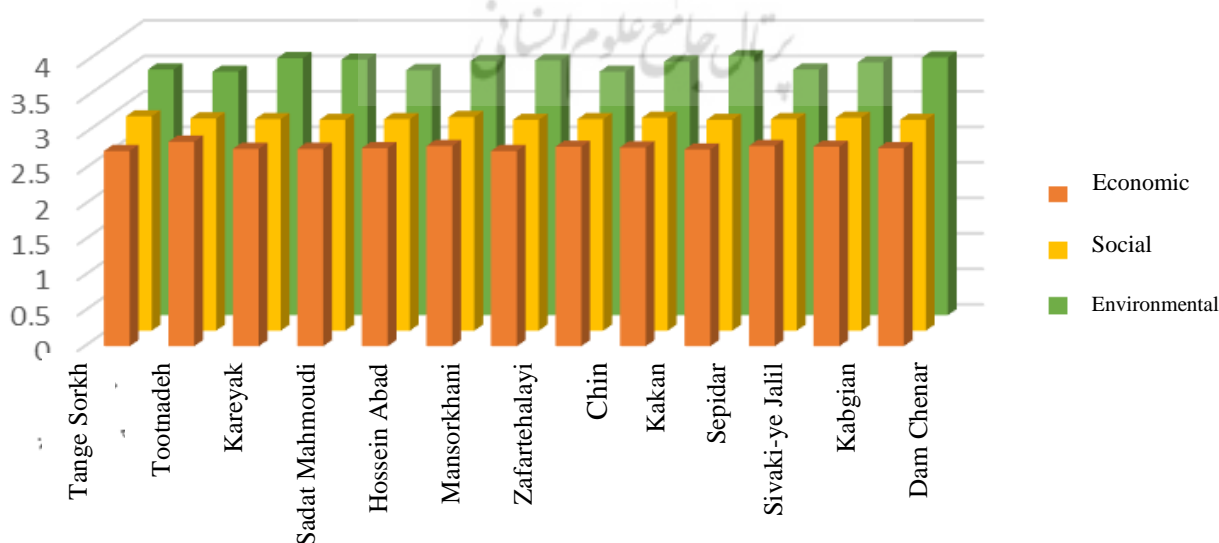


Figure 1. The mean scores of villages in terms of economic, social and environmental sustainability indicators

In the following, the status of sustainability indicators (economic, social and environmental) from the producers' point of view are assessed considering the assumed average of 3 by SPSS software. The results of the single-sample t-test indicate that the mean score of social and environmental indicators is higher than the theoretical average value (3) whereas the mean score of economic indicators is 2.80.

Based on this, the effects of the activities of medicinal plants in the social dimension with a mean score over average lead to cooperation and participation of local people in medicinal plants,

supporting sample models (flower and plant festivals), improving non-governmental and local institutions (cooperatives, associations) in the field of medicinal plants and holding appropriate educational-extension classes on how to cultivate and harvest plants, etc. In terms of environmental aspects, on the one hand, there has been an increase in environmental vulnerability in the village, and on the other hand, there has been a decrease in the extinction of plant species, raising environmental awareness and learning opportunities to use better plant species in the studied villages (Table 6).

Table 6. The status of sustainability indicators from the producers' point of view using the one-sample t-test

Indicator	Test Value = 3						
	Mean	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Economic sustainability	2.80	-11.732	282	0.000	-0.19952	-0.2330	-0.1661
Social sustainability	2.99	-0.482	282	0.630	-0.00805	-0.4090	0.0248
Environmental sustainability	3.54	23.233	282	0.000	0.54308	0.4971	0.5890

In order to use the VIKOR model to measure the differences between sample villages in terms of economic, social and environmental sustainability, the questionnaire data was first

averaged and presented in the initial matrix. Table (7) displays the indicators used and their mean score in the studied villages in the province.

Table 7. Matrix of current status of research indicators in the studied villages

Villages	Economic sustainability	Social sustainability	Environmental sustainability
Tange Sorkh	2.757	3.026	3.471
Tootnadeh	2.881	2.997	3.436
Kareyak	2.786	2.981	3.632
Sadat Mahmoudi	2.784	2.977	3.604
Hossein Abad	2.819	2.989	3.433
Mansorkhani	2.821	3.012	3.586
Zafartehalayi	2.759	2.976	3.595
Chin	2.819	2.989	3.374
Kakan	2.808	3.002	3.579
Sepidar	2.779	2.972	3.655
Sivaki-ye Jalil	2.823	2.983	3.471
Kabgian	2.819	3.000	3.563
Dam Chenar	2.799	2.979	3.640

In order to rank the proposed villages in the studied province and to determine the weight of each of the criteria, first, a questionnaire was compiled. Then, 12 experts in the production of medicinal plants were asked about the importance of sustainability indicators (economic, social and

environmental). Finally, their importance was determined in the form of the weight of the variables. To determine the weight, firstly, the items were added together. Secondly, the average is calculated. Finally, they are multiplied (Table 8).

Table 8. The weight of the indicators

Sustainability	Economic	Social	Environmental
Weight	0.36	0.33	0.29

According to Figure (2), the spatial analysis of the distribution of villages in the studied province shows a significant difference in terms of sustainability indicators (economic, social and environmental). Sepidar village has the highest rank in terms of sustainability indicators with a VIKOR index of (0.157) which is due to its

geographical location, the reduction of geographical isolation and their long-term activities in the region. Sadat Mahmoudi village with a VIKOR index of (0.993) has the lowest rank in terms of the sustainability owing to the increased geographical isolation and having poor infrastructure, etc. (Table 9).

Table 9. Final ranks

Villages	VIKOR index	Rank
Sepidar	0.157	1
Kareyak	0.392	2
Tange Sorkh	0.392	3
Sivaki-ye Jalil	0.419	4
Hossein Abad	0.448	5
Kakan	0.458	6
Mansorkhani	0.466	7
Chin	0.496	8
Zafartehalayi	0.508	9
Kabgian	0.757	10
Tootnadeh	0.786	11
Dam Chenar	0.903	12
Sadat Mahmoudi	0.993	13

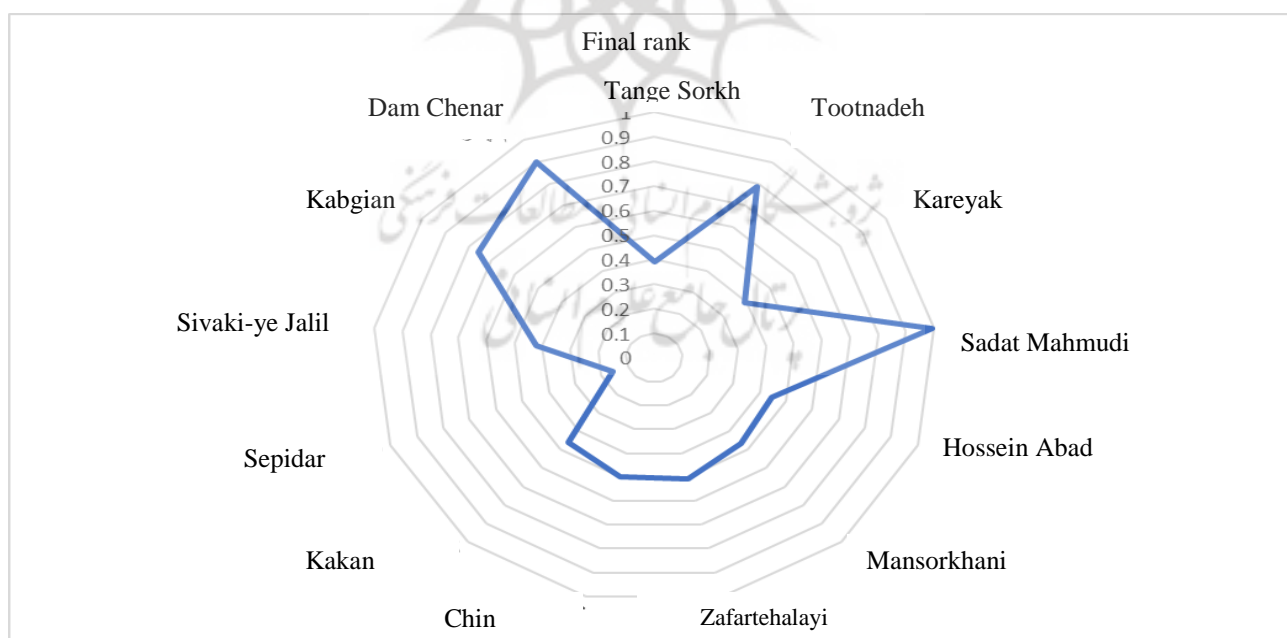


Figure 2. The final ranking of villages in terms of sustainability indicators

5. Discussion and Conclusion

One of the approaches that plays an effective role in the development of rural areas is the diversification of activities, which in recent years

has led to the expanding of employment among the local people. Therefore, this approach has emphasized on comprehensive and integrated thinking about poverty reduction and rural

development and has attracted the attention of many researchers. Considering that there are abundant natural resources in the rural areas; planning and applying efficient methods for its optimal exploitation and management can solve many environmental and economic-social problems in rural development. Medicinal plant industry is considered a huge economic resource with added value in many rural areas in Kohgiluyeh and Boyer Ahmad province. Therefore, knowing the potentials and employment programs can provide a valuable position for this industry, both inside and in the export sector, and a successful presence of the villages of Kohgiluyeh and Boyer Ahmad province in local and regional markets.

Half of the area of the province, approximately 8037 square kilometers with an average altitude of 900 meters, is located in the north and east of province including Boyer Ahmad and Dena counties, and the north of Kohgiluyeh and Gachsaran counties. In the cold region, there is a lot of snow and rain covered with dense forests of oak, pine, almond, cypress, etc. The rains start from the cold months of the year and continue until the beginning of the hot season, the average rainfall ranges from 600 to 800 mm, which plays a significant role in the growth of medicinal plants in this region. In this regard, attention to the production and consumption of medicinal plants and the prevalence of traditional medicine has been the focus of the support and planning of the economic-social managers and the health sector of the province and the country. Hence, the development and facilitation of rural development requires knowledge of the effective indicators and variables. Therefore, this research was carried out in order to assess and measure the economic, social, and environmental sustainability of the expansion of the activities of medicinal plants in the rural development of Kohgiluyeh and Boyer Ahmad province. The attitude of producers in 13 villages of this province was assessed and measured; and to address the mentioned goals, descriptive statistics (mean, standard deviation and variance) and inferential statistics including single-sample t-test and VAKOR model were applied.

The descriptive findings of the research showed that the items of "Investing of non-local people in the production of medicinal plants" and "Government investment in the production of

medicinal plants" had the highest effects on economic sustainability. In the social indicator, the items of "People's awareness of the benefits of products and creating motivation in the activities of medicinal plants", "Improving non-governmental and local institutions (cooperatives, associations) in the field of medicinal plants" and "The cooperation of local institutions associated with medicinal plants" were the most effective on social sustainability. In the environmental indicator, items such as "Supporting medicinal plant and species" and "The activity and advertisement of village residents to preserve medicinal plant species" had the most effects on environmental sustainability. The inferential findings of the one-sample t-test revealed that the mean score of social and environmental indicators was higher than the theoretical average value (3), while the mean score of economic indicators was 2.80. The results of the VAKOR model showed that Sepidar village with a VIKOR index of (0.157) had the highest rank and Sadat Mahmoudi village with a VIKOR index of (0.993) had the lowest rank in terms of the sustainability of the activities of medicinal plants among the villages in the study area. The results of this research can be compared with the findings of other researches, such as [Sojasi Qhidari & Azizi \(2019\)](#); [Safi \(2009\)](#); [Noorhosseini et al. \(2018\)](#); [Astutik et al. \(2019\)](#), [Mbuni et al. \(2020\)](#); [Ssenku et al. \(2022\)](#). Their results showed that firstly, attention should be paid to the identification of the benefits of medicinal plants. Paving the way for expanding the cultivation of medicinal plants can lead to increasing the diversification of rural economy. In this regard, their findings are in line with the results of this study. Accordingly, the issue of the activities of medicinal plants is of paramount importance in order to strengthen sustainable rural livelihoods, and should be taken into consideration by authorities and people. What can play a fundamental role in increasing the production of medicinal plants is the education and promotion of the benefits of medicinal plants. In this regard, the following solutions can be proposed to improve the sustainability of the activities of medicinal plants in the study area.

- 1- Paying attention to economic indicators which are at a lower level rather than other social and environmental indicators.
- 2- Paying more attention to the villages of Sadat Mahmoudi and Dam Chenar, where are in a

lower status in terms of the activities of medicinal plants.

- 3- Strengthening the level of the activities of medicinal plants through the cooperation of producers and authorities in providing expansion of these activities for villagers.

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Authors' contributions

The authors equally contributed to the preparation of this article.

Conflict of interest

The author declares no conflict of interest.

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ارزیابی و سنجش پایداری سکونتگاه‌های روستایی فعال در حوزه گیاهان دارویی (مطالعه موردی - استان کهگیلویه و بویراحمد)

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چکیده مبسوط

۱. مقدمه

یکی از فعالیت‌ها متنوع در مناطق روستایی، کاشت گیاهان دارویی و فعالیت‌های اقتصادی مرتبط با آن است که می‌تواند زمینه‌ساز توسعه اقتصادی نواحی روستایی باشد. تنوع گونه‌های دارویی، تنوع اقلیمی، نیروی انسانی و منابع انرژی در دسترس از جمله پتانسیل‌های مهمی در جهت توسعه کشت و صنایع مرتبط با گیاهان دارویی می‌باشد. گیاهان دارویی از ارزش و اهمیت خاصی در تامین بهداشت و سلامتی جوامع، هم به لحاظ درمان و هم از نظر پیشگیری از بیماری‌ها برخوردار بوده و هستند. این بخش از منابع طبیعی قدمتی هم پای بشر داشته و یکی از مهمترین منابع تامین غذایی و دارویی بشر در طول نسل‌ها بوده‌اند. با آن‌که نگرش انسان به فراورده‌های دارویی گیاهان، پیشینه عمیقی دارد ولی از حدود نیمه دوم قرن بیستم، مسئله افزایش تولید این فراورده‌ها در سطح مزارع و باغ‌ها شکل علمی نو به خود گرفت. بنابراین هدف از این پژوهش بررسی موانع کشت و تولید گیاهان دارویی در مناطق روستایی سردسیری کهگیلویه و بویراحمد است و به دنبال پاسخ‌گویی به این سوال کلیدی می‌باشد. میزان پایداری اقتصادی، اجتماعی، زیست‌محیطی گسترش فعالیت گیاهان دارویی در روستاهای استان کهگیلویه و بویراحمد چگونه است؟

۲. مبانی نظری تحقیق

از زمان‌های بسیار قدیم، مردم منابع گیاهی و جانوری را برای نیازهای خود جمع‌آوری کرده‌اند. به عنوان مثال می‌توان به آجیل خوراکی، قارچ، میوه‌ها، گیاهان، ادویه جات، صمغ، بازی، علوفه، لیاف مورد استفاده برای ساخت سرپناه و مسکن، پوشاک یا ظروف،

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و محصولات گیاهی یا حیوانی برای مصارف دارویی، آرایشی یا فرهنگی اشاره کرد. حتی امروزه، صدها میلیون نفر، عمدتاً در کشورهای در حال توسعه، بخش قابل توجهی از نیازهای معیشتی و درآمد خود را از جمع‌آوری محصولات گیاهی و حیوانی به دست می‌آورند. جمع‌آوری محصولات با ارزش بالا مانند قارچ (مورل، ماتسوتاکه، ترافل)، گیاهان دارویی (جین سینگ، کوهوش سیاه، گلدن سیل) نیز به دلایل فرهنگی و اقتصادی در کشورهای توسعه یافته ادامه دارد. در میان این مصارف، گیاهان دارویی نه تنها به عنوان داروهای سنتی مورد استفاده در بسیاری از فرهنگ‌ها، بلکه در تجارت کالاهایی که تقاضای بازارهای اغلب دوردست را برآورده می‌کنند، نقش اساسی دارند. تنوع و در دسترس بودن گیاهان بومی به استفاده از آنها توسط مردم و جوامع گوناگون مانند جوامع روستایی (غیرسنتی)، جوامع سنتی، جمعیت‌های بومی و حاشیه رودخانه کمک می‌کند. جوامع روستایی قادر به شناسایی بسیاری از گونه‌های گیاهی هستند که محصولات متعددی از جمله غذا، هیزم، دارو، علوفه و ابزار مورد نیاز روزانه خود را تولید می‌کنند.

۳. روش تحقیق

نوع تحقیق کاربردی و بر اساس ماهیت توصیفی، تحلیلی است و اطلاعات آن با استفاده از روش کتابخانه‌ای (به منظور تدوین مبانی نظری موضوع) و روش میدانی جمع‌آوری شده است. پس از مشخص شدن متغیرهای تحقیق، از روش تمام شماری جهت تکمیل پرسشنامه‌ها استفاده گردید. جامعه آماری این تحقیق تولید کنندگان محصولات گیاهان دارویی در ۱۳ روستای تولید کنندگان گیاهان دارویی بالغ بر ۳۸۳ نفر واقع در استان کهگیلویه و بویراحمد است و طبق گزارش‌های منابع طبیعی استان به عنوان

از میزان پایداری فعالیت های گیاهان دارویی در بین روستاهای محدوده مورد مطالعه بوده است.

۵. بحث و نتیجه گیری

به منظور ارزیابی و سنجش پایداری اقتصادی، اجتماعی، زیست-محیطی گسترش فعالیت گیاهان دارویی بر توسعه روستایی استان کهگیلویه و بویراحمد این تحقیق صورت گرفت. نگرش تولید کنندگان در ۱۳ روستای این استان مورد بررسی و سنجش قرار گرفت؛ و برای پاسخ به اهداف مطرح شده از آمار توصیفی (میانگین، انحراف معیار و واریانس) و استنباطی از آزمون t تک نمونه و مدل وایکور بهره گرفته شد. یافته های استنباطی حاصل از آزمون t تک نمونه ای نشان داد که مقدار میانگین وضعیت شاخص های اجتماعی و زیست محیطی از مقدار میانگین نظری (۳) است. اما در شاخص اقتصادی این مقدار برابر ۲/۸۰ بوده است. نتایج مدل وایکور نشان داد که روستای سپیدار با میزان (۰/۱۵۷) بالاترین رتبه و روستای سادات محمودی با میزان (۰/۹۹۳) دارای پائین ترین رتبه از نظر میزان پایداری فعالیت های گیاهان دارویی در بین روستاهای محدوده مورد مطالعه بوده است. بنابراین یافته های این تحقیق را می توان با یافته های تحقیقات دیگران از جمله سجاسی قیداری، و عزیز (۱۳۹۸)؛ سفی (۱۳۸۸)؛ نور حسینی و همکاران (۱۳۹۶)؛ استوتیک و همکاران (۲۰۱۹)؛ مینی و همکاران (۲۰۲۰)؛ اسسکو و همکاران (۲۰۲۲) مقایسه کرد. نتایج آنها نشان داد که ابتدا باید به شناسایی فایده گیاهان دارویی توجه کرد و با بستر سازی زمینه گسترش پرورش گیاهان دارویی را به وجود آورد و این باعث افزایش تنوع بخشی در اقتصادی مناطق روستایی می شود؛ لذا با پژوهش حاضر همسوی خاصی دارد.

کلیدواژه ها: پایداری اقتصادی، پایداری اجتماعی، پایداری زیست-محیطی، فعالیت گیاهان دارویی، استان کهگیلویه و بویراحمد.


تشکر و قدرانی

پژوهش حاضر برگرفته از رساله دکتری نویسنده اول (اکبر دهبان نژادیان)، گروه جغرافیا و برنامه ریزی روستایی، دانشکده علوم جغرافیایی و برنامه ریزی، دانشگاه اصفهان، اصفهان، ایران است.

جامع آماری تحقیق انتخاب شدند. همچنین سوالات در پرسشنامه تحقیق با مقیاس رتبه ای براساس طیف لیکرت (بسیار کم، کم، متوسط، زیاد و خیلی زیاد) طراحی شد.

۴. یافته های تحقیق

از ۳۸۳ پرسشنامه که بین تولیدکنندگان گیاهان دارویی توزیع و پخش گردید، یافته های توصیفی پرسشنامه نشان داد که از لحاظ ویژگی های سن پاسخگویان، افراد بین ۳۰-۳۱ سال، با ۳۸/۵ درصد پاسخ، از لحاظ تحصیلات، گزینه دبیرستان با ۲۳/۵ درصد، از لحاظ جنسیت، مردها با میزان ۵۶/۹، بیشترین پاسخ ها را به خود اختصاص داده اند. یافته های انحراف معیار و تحلیل واریانس نشان داد که شاخص های اقتصادی، گوپه سرمایه گذاری افراد غیر بومی در تولید گیاهان دارویی با مقدار واریانس ۱/۹۴، سرمایه گذاری دولتی در تولید گیاهان دارویی با مقدار ۱/۹۲ و پایداری سیستم های بازاریابی مناسب برای فروش گیاهان دارویی با مقدار ۱/۷۹ بیشتر اثرات بر پایداری اقتصادی را به دنبال داشته اند. در شاخص پایداری اجتماعی، گوپه های آگاهی مردم از مزایای تولیدات و ایجاد انگیزه در فعالیت گیاهان دارویی با مقدار واریانس ۱/۹۹؛ بهبود نهادهای غیردولتی و محلی (تعاونی ها، انجمن ها) در عرصه گیاهان دارویی و همکاری نهادهای محلی مرتبط با گیاهان دارویی هر کدام با مقدار واریانس ۱/۷۱ را به خود اختصاص دادند. در پایداری اجتماعی گوپه های مانند افزایش آسیب پذیری زیست محیطی در روستا با مقدار واریانس ۱/۹۳ و حمایت از گونه های گیاهی و دارویی با میزان ۱/۸۰ و فعالیت و تبلیغات ساکنان روستا برای حفظ گونه های گیاهان دارویی با مقدار واریانس ۱/۸۰ بیشتر اثرات بر پایدار توسعه روستایی را به دنبال داشته اند. تحلیل فضایی توزیع روستاها در استان مورد مطالعه در شاخص های پایداری (اقتصادی، اجتماعی و زیست محیطی) نشان دهنده تفاوت معنادار زیادی است. به طوری که روستای سپیدار با میزان (۰/۱۵۷) بدلیل موقعیت ارتباطی و کاهش انزوای جغرافیایی و فعالیت طولانی مدت تر آنها در منطقه، تولیدات گیاهان دارویی بیشتری صورت گرفته است که بالاترین رتبه و روستای سادات محمودی با میزان (۰/۹۹۳) بدلیل افزایش انزوای جغرافیایی و داشتن زیرساخت های ضعیف و غیره دارای پائین ترین رتبه به لحاظ بر خورداری

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