Research Paper: The Role of Rural Guide Plans in the Sustainability of the Physical System of Rural Settlements (Case Study: Abdanan County, West of Iran)

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ABSTRACT

Purpose: Rural guide plans are extensive rural physical plans in Iran that mainly focus on the physical texture of villages. These projects need evaluation and examination to be sustained and improved. The current research investigated the role of rural guide plans in the sustainability of the physical system of rural settlements of Abdanan County in the west of Iran.

Methos: This study used a descriptive and analytical method. The statistical research population is rural settlements where the Rural Guide Plans have been implemented. Data collected through library studies, interviews, surveys of experts and officials and field observations. ArcGIS and SPSS software and Prescott-Allen's sustainability measurement model method were used to analyze the data.

Results: The study used the barometric method for the level of physical-spatial sustainability Rural Guide Plans. The results on housing indicators showed that the villages of Shahrak-e Hezarani, Haft Cheshme and Posht Ghale have a good level of sustainability with values of 0.763, 0.714 and 0.614, respectively. However, Hungeh Village is at an unsustainable level with a value of 0.189. The effect of Rural Guide Plans on road network indicators was at the highest point in the villages of Shahrak-e Hezarani, Haft Cheshme, and Posht Ghale are in good sustainability levels with sustainability values of 0.782, 0.756 and 0.689, respectively. In this regard, Hungeh Village was at an unsustainable level with a value of 0.162. For the land use and service indicators, the villages of Shahrak-e Hezarani and Haft Cheshme are at the level of good sustainability with sustainability levels of 0.659 and 0.636, respectively. For this indicator, Hungeh Village is unsustainable, with a value of 0.112. Finally, the lowest sustainability indicators are in the land use and service components, with an average value of 0.348.

Conclusion: In conclusion, Rural Guide Plans impacted the dimensions of physical-spatial sustainability in the studied villages, and the highest impact was for the housing and participation dimension.

Keywords:
Rural Guide Plan, Sustainability, Rural development, Abdanan County, West of Iran

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1. Introduction

Rural living is a particular form of human inhabiting and livelihood with an evident economic, social and environmental life (Rezvani, 2004). Every place needs planning for growth and development. The local-spatial shaping and ordering of areas have always been a concern of human life and the use of natural resources on different scales. As a result, the higher the level of culture, the more advanced the organization and order of the environment, tools and technical knowledge of human groups (Saeedi, 1998). Iranian rural areas as a spatial reality result from the interaction of different ecological, social-cultural, political and physical components (Azkia & Ghaffari, 2004). The villages are the outcome of specific cultural, social, economic and geographical conditions over the centuries. The physical texture of the village that slowly formed by its social and economic systems, has remained the same without any fundamental changes in the last few decades due to the inertia of these systems. Therefore, the rural areas of Iran call for fundamental changes, especially physical development, to have suitable and sufficient facilities (Nazari, 1998).

About a century ago, half of Iran's population lived in rural areas. The share of the rural population has gradually decreased since that time. Despite the decrease in the proportion of the rural population during the last few decades, the rural population was slowly growing. However, this slow growth was finally halted in the last decade and turned into a negative amount (Yedghar, 2004). Today, development means improving people's life and Quality of life and improving society's welfare. The additional concept of sustainability refers to the continuation of this process throughout human generations. The concept of development in rural development is related to structural processes such as socio-economic, physical, and environmental processes. Territorial sustainable development depends on the development of rural settlements as a sub-system of the land system (Rabieifar et al., 2015).

The unplanned physical growth of villages has led to the formation of an uneven landscape of residential areas that lacks proper physical-spatial relationships within rural areas. Neglecting physical and spatial management and the role of rural centres in economic and social developments has resulted in uncertain physical changes and cultural and social confusion in accepting the appropriate spatial and economic role of the country's villages (Saeedi, 2004). The process of rural development is as crucial as the planning for it. In other words, successful development programs in rural areas directly relate to the process of gaining the desired goals (Ajoudani & Hosseini, 2016). The rural guide plan is a tool to realize rural development. This comprehensive plan can create an excellent opportunity to improve the physical condition (housing, roads, land use) of rural settlements, or on the other hand, have irreversible effects on the rural physical texture. The Rural Guide Plan, emphasizing physical changes in the development of villages, has implemented ten interrelated projects which sought to change the physical structure of villages and result in rural development. Although all these projects are based on physical aspects, the changes will affect other aspects of the rural environment, including the natural environment of the villages (Anabastani et al., 2013). This plan was legalized after the Islamic Revolution, and from 1989 to 2013, the Housing Foundation of Islamic Revolution prepared 24,899 and implemented 9,912 Rural Guide Plans in the villages (Mohammadi et al., 2017). There is a severe need to evaluate the design and process consequences of these plans. 39,400 villages with more than 20 households in the country (over 20 million people), and Governorate, District Administrative and branches of the Housing Foundation of Islamic Revolution identified 37000 eligible villages to have a Rural Guide Plan (Housing Foundation of Islamic Revolution, 2018).

In Illam Province, the amount of 180 billion Rials was allocated for implementing the Rural Guide Plans in 10 counties. So far, 90.744 dollars of this amount have been allocated to the villages. In other words, Rural Guide Plans have been implemented in 313 out of 604 villages of Illam Province (Housing Foundation of Islamic Revolution of Ilam Province, 2017). It can be said that the development of rural settlements and poverty alleviation will be provided through these plans. This study aims to explain the role of Rural Guide Plans in the physical-spatial sustainability of rural settlements and the effectiveness of Rural Guide Plans on the physical stability of rural settlements in Abdanan County. In other words, this study explains to what extent Rural Guide Plans affected the physical development of the settlements in the villages of this county. According to this goal, the research question is as follows:

What physical changes have the implementation of the Rural Guide Plans in the villages of Abdanan County?

2. Literature Review

Many studies about Rural Guide Plans have been conducted in Iran, which investigated various physical, economic, social and political aspects of these plans. We provided a summary of previous studies on the subject in this section.

Shahram Amirentakhi et al. (2021), in the analysis of the effects of the Rural Guide Plans on improving the Quality of life in rural areas of Khalejestan District, Qom County concluded that there is a significant difference between the two investigated groups in physical, environmental, social and economic dimensions. However, the plan's implementation has had more effect on the physical than the economic dimension. The study used Cohen Criteria and the results showed that the effect in the physical dimension was "high", and in the environmental, social and economic dimensions was "medium". The strategy of the physical stability of rural settlements will be possible within the framework of the region's political, economic and social system under the characteristics of the natural attractions of Mahdisher County. Rabieifar et al. (2015), explained the stability of the physical-spatial structure of rural housing in Zanjan Province using the AHP model and found that the condition of the physical-spatial indicators of rural housing in Zanjan Province is adverse based on the principles of sustainable rural development. The result also indicated that 50% of rural housing in terms of physical-spatial structure in Ijrud, Mahneshan and Khodabande Counties and 40% of rural houses in Zanjan, Khormadreh, Tarem and Abhar Counties are unsustainable. Jalalian et al. (2017) evaluated the effects of Rural Guide Plans on the physical development of rural settlements in Samerin District in Ardabil County. They concluded that the average effects of Rural Guide Plans on the physical development of rural settlements were "medium to high". In the indicators of physical development in the studied villages, the indicators of surface and water disposal channels and housing and rural construction, the Quality of the rural land use system and location selection and the Quality of access to services were evaluated to be high. The implementation of Rural Guide Plans had a significant impact on the physical development of rural settlements in the study area. Hassan Abadi and Tajik (2015), evaluating the physical-spatial sustainability of the villages of Pakdasht County, found a significant relationship between the physical-spatial development of various aspects, including health, sports, education, security, and the level of satisfaction of the villagers. Darvishi et al. (2014) stated that construction projects had had favorable effects from the residents' point of view in some of the villages. Pourtaheri et al. (2012), in the evaluation of the performance of the Rural Guide Plans in the physical development of Nabovat and Khoran's rural settlements, found that the implementation of the Rural Guide Plans in both villages achieved goals such as improving the Quality of roads and curbs, agricultural drainage channel, improving the housing and the constructions. However, according to the results of the Wilcoxon test, the Rural Guide Plans did not meet the objectives in the improvement of rural services. Knaap &Chakraborty (2007), in an article entitled "Comprehensive Planning for Sustainable Rural Development", concluded that rural development requires the preparation of comprehensive rural programs that are based on local conditions and can address weak services and facilities, environmental vulnerability and lack of access to economic markets. Also, to achieve these goals, the government need to make investments.

Physical development planning is multiple processes that consider different principles and dimensions. They believe that since land use is the basis of physical planning, planners need to pay attention to sustainable use of water and land resources, optimal distribution of facilities and services, ensuring environmental responsibility, increasing accessibility to residential areas, agricultural areas, social and economic facilities within the network of habitats. Some researchers believe in four goals of physical planning, namely, production activity, residence, travel and leisure, communication and commuting.

Space also can be the source of identity for the residents (Rabbani, 2002). Therefore, a space for residents should have an identity and a structure (Fijalkow, 2004). A village also has a unique identity as a combination of natural, social and environmental factors for human beings, in which the resident population is concentrated (Shieh, 2006: 4). Humans are affected by their external environment, and in the same way, the identities of villages have various effects on the collective life of villagers. Spatial identity is part of one's identity and the result of their general cognition about the physical world in which one lives (Proshansky, 1978: 147).

Rural planners emphasize the sustainable development process for the physical development of rural settlements. In addition, government institutions and organizations should always be aligned with the cultural conditions and traditions of an area. Therefore, the functional and structural policies will be implemented to bring about physical stability in rural settlements and create equal opportunities in rural areas and improve the quality of life of villagers (Pourtahari & Naqhvi, 2012: 61). Rural physical planning theories are divided into

groups: explanatory theories and change theories. Also, it is required that projects adhere to the time frames because it is only possible to respond to some of the continuous demands of the villagers and rural target groups. This is also the reason that these projects are a combination of social, economic, environmental and physical planning so that the physical aspect will not be over-emphasized. Therefore, physical planning with a multi-sectoral approach for developing a rural settlement is often proposed, which cannot be achieved in a short time. As for the dominant perspective of rural development, Rural Guide Plans follow the same framework. In practice, physical planning is more prominent than other types of planning in rural areas (Riahi et al., 2017: 136-137).

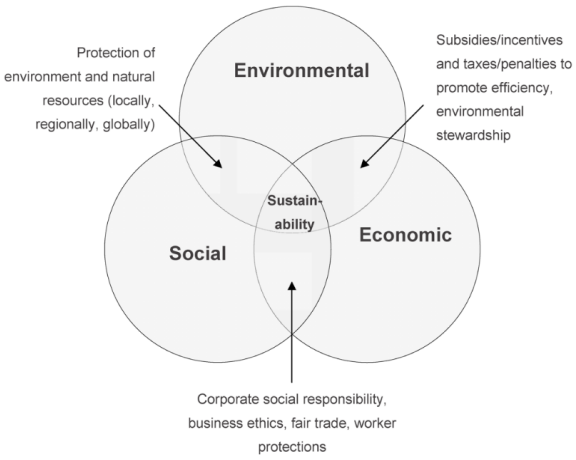

Figure 1. Systematic approach in physical planning (Pourtahari et al., 2012: 30)

In the constitution of the Housing Foundation of Islamic Revolution approved on 2009.02.26, the Islamic Council has defined the Rural Guide Plan as follows: The Rural Guide Plan aims to provide a framework for revitalization and guidance of the village in terms of economic, social and physical dimensions. In other words, the Rural Guide Plan is the revival of the village again in terms of economic, social and physical dimensions (Rezvani, 2004: 155).

The population is the criterion for prioritizing the villages which need the Guide Plan. Therefore, it starts from villages with higher to lower populations. The villages with over 400 households are the first group and the capital of rural districts after that. The villages with 100 households are the third priority, and the last group is the villages with a municipal budget. According to Article 11 of the Housing Protection Law, the government must prepare and implement plans for all villages of 20 households by the end of the Fifth National Socio-economic Development Plan. Therefore, rural Guide Plans in Iran have continually been required to improve in all stages of plan preparation, approval and implementation. Although a Guide Plan has established a framework for order (including the prevention of illegal constructions and control of land grabbing, identifying the need and provision of public uses and services, and coordination of physical expansion) in the village, it also has reverse consequences for the village and villagers. Disruption of the spatial organization, weakening the cohesion of the physical texture, creating elements incompatible with the village environment, reducing the diversity in the physical texture, diminishing the visual landscape, changing the cultural identity, promoting urbanism, weak attention to the participation of the villagers are among these issues (Azizpour, 2013).

Adopting an approach based on the centrality of physical changes in the development of villages, the Rural Guide Plan implements projects that all seek to transform the physical structure of villages, hence achieving rural development (Jalalian et al., 2017). Other goals of the Rural Guide Plan include providing the necessities for improving the residential environment and creating environmental and public services, guiding the physical development of villages, guiding the constructions and providing equitable facilities, taking into account the cultural, economic, and social conditions and matching up with the upper hierarchal plans, such as the organization plan and the comprehensive city plan (Sajasi Gheidari , 2015). In this regard, a conceptual framework of the study is as follows (Figure 2).

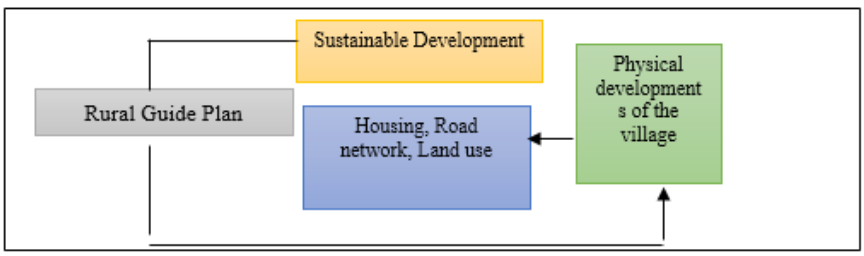

Figure 2. Conceptual framework of the study

3. Methodology

In terms of purpose, this is a descriptive-analytical study carried out using field research. This study used a mixed method. In the quantitative part, a questionnaire was designed for practitioners and experts to study the villages. The qualitative part of the research was designed for individual and group interviews and observations. The next part was the combination of data in addition to documents (recorded audio, video, photos and researcher's notes) and transforming them into texts. The statistical population of this research includes 16 villages in Abdanan County, located in Ilam Province, where Rural Guide Plans were implemented. We selected villages of Anjireh, Gandab, Posht Ghale, Jaber Ansar, Haft Cheshme, Shahrak-e Hezarani, Vachak Ab, Vachakbud-e Olya, Sar Poleh, Zhivar, Gol Gol-e Olya, Gol Gol-e Sofla, Hungeh, Ab Anar, Siah Gol and Heliveh. Therefore, the sample size in this research is 16 villages of Abdanan County with 3793 households (13868 people).

Abdanan County is located in the South of Ilam Province and the west of Iran. The position of this county is between two mountains, Kabir Kuh and Dinar Kuh, which caused it to be marginalized. Darreh Shahr is the major city in connection with this county, where the mountain roads are dangerous on Kabir Kuh. Abdanan County consists of Central, Sarab bagh and Murmuri Districts. Except for the Central District, the other districts do not have many urban characteristics. The north and south of the county are dry and mountainous. Oak trees covered most of the county, but the southern parts are plains with fertile soil for agriculture. The county is adjacent to Dehloran County from the west and south, Darreh Shahr County from the northeast, Poldokhtar in Lorestan and Andimeshk County from the southeast (Figure 3).

4. Findings

Investigation of Rural Guide Plans in the villages of Abdanan County

Many Rural Guide Plans have been implemented in the villages of Ilam Province. So. some basic research was conducted on the villages of this province.

Gol Gol-e Olya, Heliveh, Jaber Ansar, Vachak Ab, Zhivar, Sar Poleh, Gandab are the villages where Rural Guide Plans are being implemented (Table 3).

Anjireh, Ab Anar, Shahrak-e Hezarani, Posht Ghale, Haft Cheshme are the villages where Rural Guide Plans were implemented (Table 4).

Table 1. Population characteristics of the studied villages

Number of households	Population	Village	Row
330	1322	Ab Anar	1
37	148	Hungeh	2
67	240	Siah Gol	3
88	301	Heliveh	4
225	901	Anjireh & Tisheh Kand	5
297	1116	Gandab	6
406	1465	Posht Ghale	7
454	1608	Haft Cheshme	8
807	2860	Shahrak-e Hezarani	9
224	806	Jaber Ansar	10
174	621	Vachak Ab	11
55	209	Vachakbud-e Olya	12
47	177	Gol Gol-e Sofla	13
107	396	Gol Gol-e Olya	14
217	845	Zhivar	15
258	853	Sar Poleh	16
3793	13868	Total	

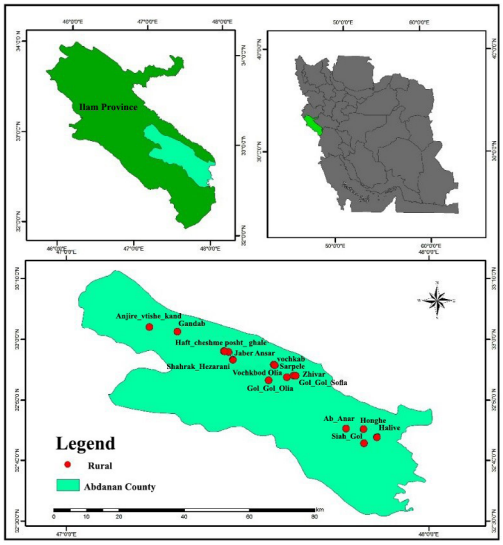

Figure 3. Location of Abdanan County and Ilam Province

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Table 2. Classification of villages with Rural Guide Plans in the studied area

Population	Village	Villages with Rural Guide Plans	
		Number	Per cent
Less than 250 people	Hungeh, Gol Gol-e Sofla, Siah Gol, Vachakbud-e Olya	4	25
250 - 500	Heliveh, Gol Gol-e Olya	2	12.5
500 - 1000	Anjireh, Jaber Ansar, Vachak Ab, Zhivar, Sar Poleh	5	31.25
more than 1000 people	Ab Anar, Gandab, Posht Ghale, Haft Cheshme, Shahrak-e Hezarani	5	31.25
	Total	16	100

Source: Research Findings, 2020

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Table 3. Classification of the villages with ongoing Rural Guide Plans

Population	Village	Ongoing Rural Guide Plans	
		Number	Per cent
Less than 250 people	---	-	-
250 - 500	Gol Gol-e Olya, Heliveh	2	28.5
500 - 1000	Jaber Ansar, Vachak Ab, Zhivar, Sar Poleh	4	57.14
more than 1000 people	Gandab	1	14.28
	Total	7	100

Source: Research Findings, 2020

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Table 4. Classification of the villages with Rural Guide Plans

Population	Village	Implemented Rural Guide Plans	
		Number	Per cent
Less than 250 people	-	-	-
250 - 500	-	-	-
500 - 1000	Anjireh	1	20
more than 1000 people	Ab Anar, Shahrak-e Hezarani, Posht Ghale, Haft Cheshme,	4	80
	Total	5	100

Source: Research Findings, 2020

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Moreover, responsible organizations have been revising some villages, including Anjireh, Vachakbud-e Olya, Ab Anar, Sar Poleh, Vachak Ab, Zhivar (Table 5).

The effects of Rural Guide Plans on the physical sustainability of housing in the studied villages

In this study to evaluate the effects of Rural Guide Plans on the physical sustainability of the villages, all indicators were classified and turned into the barometric sustainability measurement model to score the sustainability level. Based on the importance of each sub-criterion, a score between 1 to 9 was used.

We used 13 indicators to evaluate the performance of Rural Guide Plans in the housing component. We investigated the Rural Guide Plans of the villages and their current situation (Table 6). To analyze Rural Guide Plans' effect on the study area's housing dimension, we used Prescott-Allen's sustainability barometer and radar (Table 7).

As Table 6 shows, the indicator of the " separation of human settlements and livestock pens" has the highest performance with an average of (3.79). On the other hand, indicators like architectural sustainability in the village, building sustainable housing (less energy consumption and local knowledge), the proximity to other land uses, use of local materials in construction, and aesthetic view of the building had the lowest average performance. On the other hand, the indicators of using technical standards of the design in new constructions, and the health and hygiene quality of the house (toilet, bathroom) are higher than the average in the studied villages.

Table 5. Classification of villages with revision plans

Population	Village	Revising Rural Guide Plans		Revised Rural Guide Plans		Village
		Number	Per cent	Number	Per cent	
Less than 250 people	Vachakbud-e Olya	1	16.16	1	20	Vachakbud-e Olya
250 - 500	-	-	-	-	-	-
500 - 1000	Anjireh, Zhivar, Jaber Ansar	3	50	3	60	Sar Poleh, Anjireh, Vachak Ab
more than 1000 people	Posht Ghale, Shahrak-e Hezarani	2	33.33	1	20	Ab Anar
Total		6	100	5	100	

Source: Research findings, 2020

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Table 6. The effect of Rural Guide Plans on the physical sustainability of housing indicators

Dimension	Components	Indicators	Mean
Physical	Housing regulations	Improvement and retrofitting of the house against natural disasters	3.45
		The level of suitable housing facilities (heating and cooling system, smell, sound and visual)	3.46
		Lighting quality and building direction	3.53
		Use of local materials in construction and for aesthetic view of the building	2.64
		Architectural sustainability pattern in the village	2.24
		Reducing the number of abandoned and dilapidated houses	3.24
		Health and hygiene quality of the house (toilet, bathroom)	3.65
		Using technical standards of the design in new construction	3.75
		Space separation of living place and livestock pens	3.79
		Building sustainable housing (less energy consumption and local knowledge)	2.66
		Proximity to other land uses	2.74
		Building density based on economic and social conditions	3.25
		Construction according to climatic and environmental conditions	3.37

Source: Research Findings, 2020

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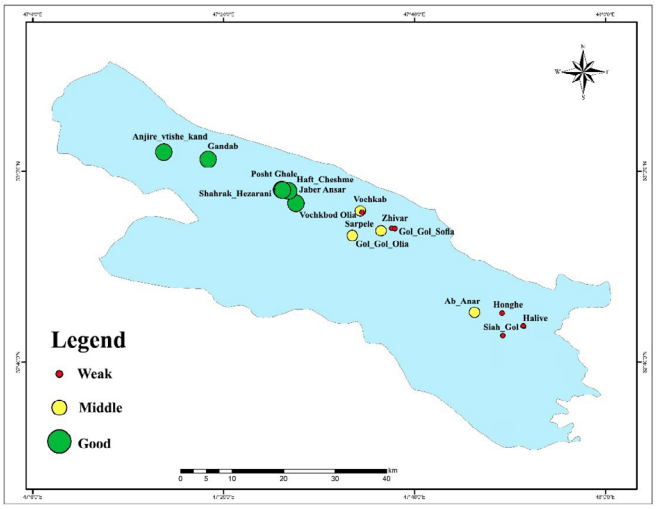

Figure 4. A map of the effect of Rural Guide Plans on housing indicators in the villages of the study

The second part of the study analyzes the effects of Rural Guide Plans on the physical sustainability of the villages and measures their sustainability in terms of housing using Prescott-Allen's sustainability barometer and radar. The sustainability barometer consists of 13 housing indicators, which must be improved to reach sustainable conditions. Sustainability is rated between zero and one. The radar model, which can integrate different and diverse indexes, includes equiangular spokes starting at the same point. In this model, there is one angle and one axis for each index. The performance associated with each index is specified on the axes, and the score related to the indexes will be connected (Ebrahimzadeh & Kashfi Doost, 2018).

The weighted score for each sustainability value is shown in Table 8.

The findings of the research showed that the sustainability status of the effects of Rural Guide Plans on physical sustainability in Shahrak-e Hezarani Village is at a reasonable level, with a sustainability rate of 0.762 and the highest score among other villages. The villages of Haft Cheshme, with 0.714 and Posht Qale, with 0.619, are in the following position. On the other hand, Hungeh Village, with 0.189, has the worst level of sustainability among the villages and is in an unsustainable situation. The villages of Ab Anar, Gandab, Jaber Ansar, Vechkab, Zhiyor and Sar Poleh are at the medium level of sustainability. Finally, the effect of Rural Guide Plans on housing indicators in the studied villages is 0.432 and is at the medium level of sustainability.

Road network

This study used 16 indicators to evaluate the performance of Rural Guide Plans in the road network component. The results of the Table show that the indicators of ease of access to farms and gardens, neighbouring residential units), ease of access to shopping and services centres), quality of road network with an average of 3.70, 3.69 and 3.66 are the highest effect of Rural Guide Plans on road network sustainability of rural settlements. On the other hand, the reduction of commuting distance indicators by a sustainable lifestyle, the status of the watercourse dredging, the quality of canalization, and the road widening have lower scores than the average. In the following, sustainability scores for each of the studied rural settlements were determined based on the Road network indicator.

Table 10, shows the results of the barometric sustainability measurement model of road networks of villages in Abadanan County. Overall, most of the studied villages have relatively similar conditions. 9 out of 16 villages are at a weak level of sustainability. The village of Shahrak-e Hezarani has a good level of sustainability, with an average of 0.782. The villages of Ab Anar, Gandab, Posht Ghale and Sar Poleh also have medium conditions. To sum up, the effect of Rural Guide Plans on Road network indicators in the studied villages is 0.432 and is at the medium level of sustainability.

Table 7. Values of sustainability based on Prescott-Allen's classification

The value of sustainability	Value	Sustainability state	Weighted score
0-0.2	0-20	Unsustainable	1
0.2-0.4	20-40	Almost Unsustainable	3
0.4-0.6	40-60	Medium	5
0.6-0.8	60-80	Almost Sustainable	7
0.8-1	80-100	Sustainable	9

Source: Ebrahimzadeh & Kashfi Doost, 2018

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Table 8. Physical sustainability level of the effects of the Rural Guide Plans on the housing indicator based on the sustainability barometer

Sustainability level	Score of sustainability	Village	Row
Medium	0.576	Ab Anar	1
Unsustainable	0.189	Hungeh	2
Poor	0.376	Siah Gol	3
Poor	0.384	Heliveh	4
Poor	0.393	Anjireh & Tisheh Kand	5
Medium	0.489	Gandab	6
Good	0.619	Posht Ghale	7
Good	0.714	Haft Cheshme	8
Good	0.762	Shahrak-e Hezarani	9
Medium	0.411	Jaber Ansar	10
Medium	0.441	Vachak Ab	11
Poor	0.218	Vachakbud-e Olya	12
Poor	0.214	Gol Gol-e Sofla	13
Poor	0.232	Gol Gol-e Olya	14
Medium	0.428	Zhivar	15
Medium	0.474	Sar Poleh	16
Medium	0.432	Mean	

Source: Research Findings, 2020

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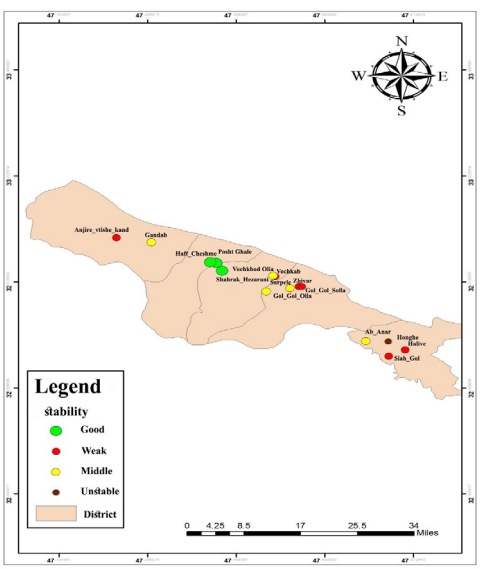

Figure 5. Physical sustainability map of the studied villages based on the housing indicator

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Table 9. The effect of Rural Guide Plans on the physical sustainability of road network indicators

Dimension	Components	Indicators	Mean
Physical	Road network	Ease of commuting for villagers (access to farms and gardens, neighboring residential units)	3.70
		Ease of commuting for villagers (access to shopping and services centers)	3.69
		Road traffic security	3.41
		Quality of road surface	3.66
		Rural furniture under the environmental sustainability of the village (benches, trash cans, etc.)	3.30
		Accessibility for disabled	2.37
		Reduction of commuting distance under sustainable lifestyle	2.45
		Path widening availability	2.79
		Status of the watercourse dredging	2.70
		Modifying sidewalks for physical texture	2.80
		Adapting the new roads to the livelihood of villagers	2.73
		Improving the road network to reduce accidents	2.79
		Village surface water disposal	2.83
		Village lighting system	3.69
		Status of the street gutter dredging	2.51
		Road arrangements according to the climate conditions of the village	2.48

Source: Research Findings, 2020

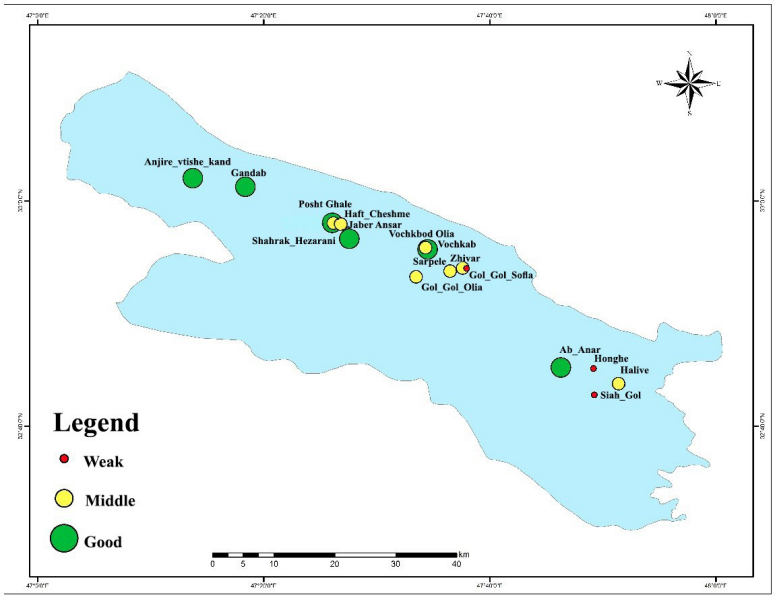

Figure 6. Spatial distribution map of the road network effect on the studied villages

Table 10. Physical sustainability level of the effects of the Rural Guide Plans on the road network system based on the sustainability barometer

Sustainability level	Score of sustainability	Village
Medium	0.452	Ab Anar
Unsustainable	0.164	Hungeh
Poor	0.298	Siah Gol
Poor	0.321	Heliveh
Poor	0.341	Anjireh & Tisheh Kand
Medium	0.523	Gandab
Good	0.689	Posht Ghale
Good	0.756	Haft Cheshme
Good	0.782	Shahrak-e Hezarani
Poor	0.396	Jaber Ansar
Poor	0.354	Vachak Ab
Poor	0.218	Vachakbud-e Olya
Poor	0.214	Gol Gol-e Sofla
Poor	0.232	Gol Gol-e Olya
Poor	0.372	Zhivar
Medium	0.474	Sar Poleh
Medium	0.411	Mean

Source: Research Findings, 2020

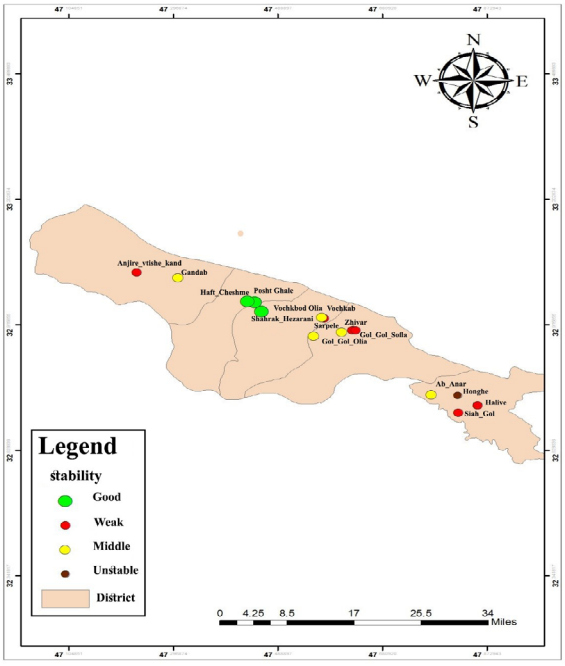

Figure 7. Physical sustainability map of the studied villages based on the road network indicator

Land use system for public services

In this research, to evaluate the performance of the Rural Guide Plans on land use and public services, 14 indicators were examined. The results of the Table show that the indicators of villagers' access to service infrastructure for determining the land use, improvement of transportation in the village and reducing changes in agricultural land use, respectively had the highest averages of 3.69, 3.66, and 3.41 in the studied villages. Also, the indicators under the medium average include maintaining the population by providing service and welfare facilities, preserving the identity of the village versus new land uses, the adaptation of new land uses in the village with the social and economic activities of the villagers, and preservation of agricultural land uses for production.

Table 11. The impact of Rural Guide Plans on the physical sustainability of land use system indicators and services in the studied villages

Dimension	Components	Indicators	Mean
Physical	Land use and public services	Improvement of transportation in the village	3.66
		Reducing changes in agricultural land uses	3.41
		Village boundaries demarcation (roads, rivers and canals, etc.)	3.30
		Villagers' access to services (water, gas, telephones, industrial units, banks, schools, libraries, health centers, etc.)	2.70
		Reducing incompatible land uses	2.73
		Maintaining the population by providing service and welfare facilities	2.45
		Sustainability of the villages' green space	2.63
		Preserving the identity of the village versus new land uses	2.51
		Adaptation of new land uses in the village with the social and economic activities of the villagers	2.53
		Improving the quality of the rural land use system (residential, commercial, educational, cultural-religious, health, industrial, administrative, sports, etc.)	2.80
		Village expansion direction and boundary	2.73
		Preservation of agricultural land uses for production	2.35
		Recognition of the valuable historical context of the village	2.52
		Villager's access to service infrastructure for determining the land uses	3.69

Source: Research findings, 2020

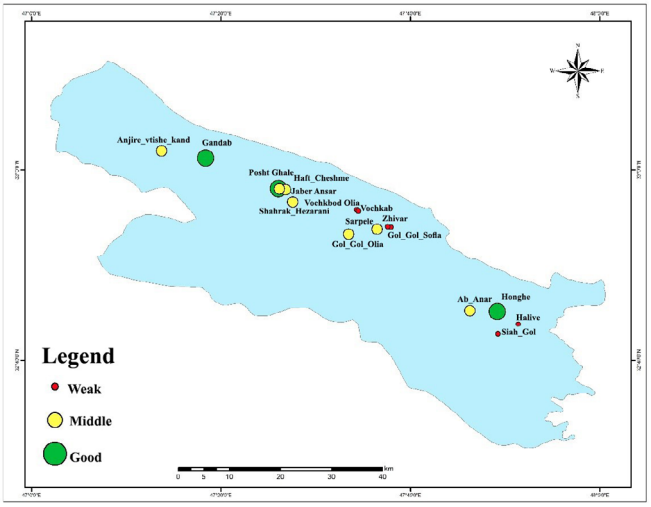

Figure 8. Spatial distribution map of the effect of land use system and public services on the studied villages

In the following, the components of physical sustainability of land use and public services are measured, and then their sustainability status is determined based on Prescott-Allen's sustainability levels (Table 12). The investigation of the effects of the Rural Guide Plans on the indicators of land use system and public services based on the sustainability barometer in the studied villages indicates a weak sustainability level with an average of 0.348. In this regard, the villages of Shahrak-e Hezarani and Haft Cheshmeh have the highest sustainability scores of 0.659 and 0.636, respectively. 9 out of 16 villages are in the poor sustainability level, and Hungeh Village is in the unsustainable level with a score of 0.112.

The effects of the Rural Guide Plans in the dimensions of physical-spatial sustainability of the studied villages indicate an average score of 0.397, based on the views of residents, officials and experts. The housing component, with a score of 0.432, has the highest level of sustainability, and the land use dimension and services component has the lowest level of sustainability.

Table 12. Physical sustainability level of the effects of the Rural Guide Plans on the Land use system indicator based on the sustainability barometer

Sustainability level	Score of sustainability	Village
Medium	0.402	Ab Anar
Unsustainable	0.112	Hungeh
Poor	0.201	Siah Gol
Poor	0.278	Heliveh
Poor	0.291	Anjireh & Tisheh Kand
Medium	0.473	Gandab
Medium	0.582	Posht Ghale
Good	0.636	Haft Cheshme
Good	0.659	Shahrak-e Hezarani
Poor	0.249	Jaber Ansar
Poor	0.254	Vachak Ab
Poor	0.278	Vachakbud-e Olya
Poor	0.203	Gol Gol-e Sofla
Poor	0.263	Gol Gol-e Olya
Poor	0.341	Zhivar
Medium	0.351	Sar Poleh
Poor	0.348	Mean

Source: Research Findings, 2020

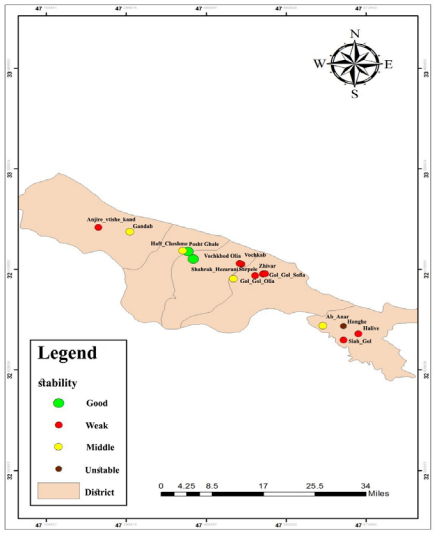

Figure 9. The map of the physical sustainability of the studied villages based on the indicator of land use system and public services

Table 13. Conclusion of the effects of the Rural Guide Plans on the physical sustainability of the studied villages

Components of physical-spatial sustainability	Score of sustainability	Sustainability level
Housing	0.432	Medium
Road network	0.411	Medium
Land use system for public services	0.348	Poor
total	0. 397	Poor

Source: Research Findings, 2020

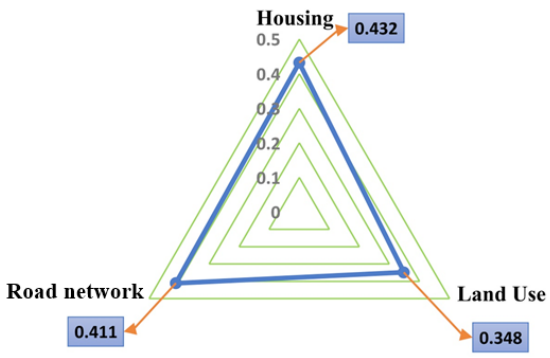

Figure 10. Comparison radar chart of physical sustainability in the studied villages

5. Discussion

After nearly three decades since the implementation of the Rural Guide Plans in the rural areas of the country, these areas experienced various physical-spatial changes, such as transformation in the physical structure of the village, changes in the pattern of housing construction, changes in the village road network, facilitating the commuting of villagers, improving the welfare and the livelihood of villagers. Therefore, this study aimed to investigate the physical-spatial sustainability of rural settlements in Abdanan County. In this regard, the findings showed that implementing the Rural Guide Plans affects the physical-spatial sustainability in the studied villages. Also, the Rural Guide Plans had a more positive effect on the housing and participation dimension in comparison with other dimensions of the physical-spatial sustainability of the rural settlements of Abdanan County.

The Rural Guide Plans affected the indicators such as separation of human settlements and livestock pens, health and hygiene, quality of the house (toilet, bathroom), lighting quality and building direction, the level of suitable housing facilities (heating and cooling system) and improvement and retrofitting of the house against natural disasters. However, these plans did not meet the need for indicators such as architectural sustainability patterns in the village, use of local materials in construction and aesthetic view of building sustainable housing (less energy consumption and local knowledge). The main reasons for not being successful in these areas is emphasizing urban culture, changing the landscape and also weather condition. In the road networks component, relative success can be confirmed in the ease of commuting of access to farms and gardens, neighboring residential units, ease of access to shopping and services centers), quality of road surface and village lighting system. On the other hand, the performance of Rural Guide Plans was poor in road arrangements according to the climate conditions of the village, the status of the road gutter dredging, accessibility for the disabled and adapting the new roads to the rural housing. For the land use and service component, the plans were successful in villagers' access to service infrastructure for determining the land uses, improvement of transportation in the village and reducing changes in agricultural land use. However, these plans have not succeeded in the preservation of agricultural land uses for production, maintaining the population through providing service and welfare facilities, preserving the identity of the village vis-a-vis new land uses, the adaptation of new land uses in the village with the social and economic activities of the villagers and improving the quality of the rural land use system (residential, commercial, educational, cultural-religious, health, industrial, administrative, sports, etc.). Also, the results of the spatial analysis of the studied villages, emphasizing Rural Guide Plans, indicate the difference

in the effects of these plans, so it is necessary to take measures for spatial justice. The results of the research are consistent with the studies of Amirentekhabi et al. (2021), Jalalian et al. (2017). Finally, in line with the research results, we suggest the followings:

Adherence to the construction rules for the physical appearance of the buildings and maintenance of valuable texture

Preventing unauthorized constructions in the village and providing villagers with technical and engineering services

Following the improvement and widening of the road network and their future development based on the Rural Guide Plan

Creating and developing green spaces in public places under the texture of the village for a beautiful landscape and appearance of the village

Implementing Rural Guide Plans according to the rules and regulations of planning, construction of roads based on regulations of rural roads (width, length, slope, etc.) and classification of roads such as alleys and streets.

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Conflict of Interest

The authors declared no conflicts of interest.

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