Research Paper: Assessing Rural Livability with the Rural Ecovillage Approach (Case Study: Villages in Lorestan, Iran)

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ABSTRACT

Purpose: This research aimed to assess rural livability using the Ecovillage model in selected villages of Lorestan province.

Methods: A sample of 55 villages in Lorestan was selected using spatial and cluster sampling methods. Data were collected through a researcher-made questionnaire and analyzed using the Structural Equation Modeling (SEM) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) models. Indices were categorized into social, economic, physical, ecological, and information technology dimensions.

Results: The TOPSIS model ranked Darband, Shahpourabad, and Horrabad-e Bala as the top three villages regarding rural livability.

Conclusion: The study indicates that the rural Ecovillage model in Lorestan does not meet desired criteria for livability.

1. Introduction

Human settlements worldwide face the challenge of adapting to climate change and redefining sustainability paradigms, parameters, and indicators. The concept of "Ecovillage" is gaining attention as a model for sustainable human settlements. While this term is new, it embodies the ancient idea of harmonious human development with nature (Koduvayur & Joshi, 2022: 3). Rural ecovillages, in contrast to eco-cities, are small-scale, grassroots communities experimenting with sustainable living. They integrate social, ecological, and spiritual aspects of human existence in line with the principles of eco-cities (Gilman, 1991: 43). The Findhorn Ecovillage in Scotland, one of the oldest and most renowned ecovillages, has collaborated with the United Nations and has been recognized as a model community (Lockyer & Veteto, 2013: 9).

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An analysis of upper-level documents and the Sixth Five-Year Economic, Cultural, and Social Development Plan demonstrates that policymaking and planning prioritize rural areas and tribal regions. The Permanent Provisions of Development Programs and the Sixth Development Plan contain 33 articles specifically addressing rural and tribal development, indicating the government's intention to revitalize these areas with an emphasis on environmental sustainability. However, expert reports suggest that the government's efforts have failed to achieve infrastructure and construction targets, and fundamental aspects of rural and tribal development have been neglected (Varmaziari & Babaei, 2021: 14).

Lorestan province boasts environmental potential for tourism (Heidari et al., 2022: 45), social cohesion (Tavakolli, 2014: 73), and strategic situation with important national communication routes passing through, including the main road connecting Tehran and Khuzestan (Shahrokhi & Nemati, 2017: 1283). The region's environmental characteristics also provide opportunities for industrial and agricultural development, rural entrepreneurship, and the achievement of rural livability (Sepahvand et al., 2019: 265; Pourjamshidi, 2018: 33). However, challenges such as rural migration, lack of economic diversity, drought, and underutilization persist (Hosseinabadi, 2019: 497; Savari et al., 2021: 15). This study seeks to evaluate rural livability in selected villages of Lorestan province using the ecovillage model.

According to regional planning, lorestan province is located in the third region of land development. The province's development plan highlights agriculture, industry, and tourism as its main potentials, constraints, and issues. The province's strategic geographic location in the west, proximity to major agricultural and industrial hubs, and location on key north-south road and rail axes make it an attractive destination for the industry. Additionally, the province has a wealth of natural, historical, and cultural attractions that have the potential to drive tourism growth. Other development potentials include hydropower generation capabilities, abundant non-metallic minerals (especially building stones), large surface and underground water resources, diverse climatic conditions, and fertile lands and forest and pasture areas. (Lorestan Land Development Plan, 2020: 78; Planning and Budget Organization of Iran, 2017: 56).

Based on the distribution of rural development and livability across the counties in Lorestan province, there appear to be inconsistencies and imbalances evident in various economic, social, and infrastructure sectors. These variations indicate fundamental differences in livability criteria across the different counties in the province. As the disparity between these figures increases or decreases, the discrepancy in development and livability indicators increases or decreases. In light of these observations, this study aims to classify the livability status of selected rural settlements.

2. Literature Review

As a planning approach for sustainable development, the Ecovillage model has been largely shaped by the concepts of "sustainable livelihood" and "ecosystem management." The former is based on bottom-up empowerment and cooperation among people and nature, prioritizing freedom, satisfaction, autonomy, quality of life, and human dignity. The latter underscores the significance of natural systems as habitats for human settlements and emphasizes the protection and restoration of ecosystems as a key policy for societal design and development. Overall, the Ecovillage model highlights the importance of waste reduction, energy efficiency improvement, industrial pollution reduction, water conservation, green space preservation, security, and rural participation in development (Divsalar & Parhizgar, 2005:20).

Demographic processes, such as aging, population decline, and migration of highly educated individuals, heavily influence life in rural areas. These processes generate concerns among residents and policymakers that good quality of life is not guaranteed in rural areas. In the planning discourse, the concept of livability is frequently utilized to evaluate how people value the quality of their living environment and the factors that determine it (Veenhoven, 2000: 44; Haartsen & Venhorst, 2010: 219; Kaal, 2011: 533). Policymakers typically assume that active citizenship is a significant determinant of a village's livability (Leidelmeijer, 2012: 79). Active citizenship is believed to create opportunities for accumulating social capital, leading to higher levels of social cohesion, which can benefit the village in various ways. This argument is closely linked to the "Big Society" or "Participatory Society" concept, which involves shifting responsibilities from the central government to local communities (Kisby, 2010: 5; Pattie & Johnston, 2011: 410; Putters, 2014: 77). At the local level, this involves promoting voluntarism, self-reliance, and social initiative to replace the prevailing belief that the government should be accountable for the development and quality of the local public space and community. To achieve this goal, policymakers increasingly expect rural citizens to be devoted to their living environment and voluntarily participate in various aspects of rural life to keep

their village livable (Mohan, 2012: 1125; Verhoeven & Tonkens, 2013: 420; Jones & Heley, 2014: 179). While no definitive definition of livability is found in the literature, in a geographical context, livability typically refers to the extent to which the physical and social living environment aligns with individual needs and desires (Pacione, 1990: 15; Newman, 1999: 230; Leidelmeijer, 2008: 59).

Livability and quality of life are two distinct concepts. Quality of life is typically concerned with individuals' social and mental well-being, measured by self-assessments such as happiness, life satisfaction, and a sense of belonging. In contrast, livability refers to how individuals evaluate the qualities of their neighborhood or rural community. It is a spatial dimension that is not usually included in quality-of-life models. However, some geographers have argued that livability should be considered one of the quality of life dimensions. Therefore, exploring how rural residents evaluate the quality of their living environment through the livability lens offers promising research avenues. (Van Kamp et al., 2003: 13-14; Shucksmith et al., 2009: 1276; Ruth & Franklin, 2014: 20; Wang & Wang, 2016: 20; Gieling & Haartsen, 2017: 584).

Khorrami et al. (2020) suggest that livability can be assessed by examining living environments, including factors such as access to resources and safety from threats, as well as social-cultural domains, such as education, employment, services, and cultural activities, and local management participation and learning. Livability can therefore measure resilience, well-being, satisfaction, and even happiness.

The Economist Intelligence Unit's Global Livability Index is an annual report that evaluates the livability of major cities worldwide through expert surveys and rankings based on qualitative and quantitative factors. The rankings are determined by five main categories: stability, healthcare, culture, education, and transport infrastructure (Alasalmi, 2022: 45).

Improving ecologic livability requires enhancing the ecology and living environment and achieving harmonious coexistence between humans and nature. It is essential to create a sustainable environment to promote rural revitalization. Livability has become a shared objective in rural settlement development, regional progress, and regeneration. It is crucial to enhancing farmers' sense of profit and happiness, achieving resident sustainability, and improving livelihoods in rural areas. Historically, limited economic resources and poor living conditions in rural areas have resulted in depopulation, particularly among young and middle-aged individuals, leading to an aging and declining rural population. It has caused a breakdown in the traditional social structure of rural communities, leading to a decline in rural autonomy and a weakening of the rural collective economy.

The disappearance of the class that once dominated the traditional social governance of rural areas has led to the gradual deterioration of the livability of the rural social and economic environment. As a result, rural populations are migrating to cities and regions with better development conditions, creating a vicious cycle that contributes to the decline of rural areas. The relationship between people and land resulting from changes in rural population levels has become a major factor in transforming rural settlements. Promoting a regular flow of urban and rural populations is an important means of transforming the urban structure and rebuilding rural spaces (Li et al., 2021). Therefore, a proper understanding of the various types of rural livability, their coordination with population flow, and the reconstruction of rural settlements based on local conditions and development needs are crucial for a successful rural regeneration strategy.

Seymour (2008) proposes that some principles and conditions must be met to achieve livable villages, which apply to all villages regardless of location. These principles are essential characteristics of livable villages, and any damage to one of them could jeopardize their livability from a particular perspective. However, these principles are necessary but insufficient conditions for achieving livable rural areas.

In a study conducted by Wang et al. (2019), the determinants of satisfaction with rural livability in the underdeveloped eastern regions of China, specifically in the Jiangxi province, were investigated. The findings and discussions presented in the study could potentially serve as a solid foundation for policymakers to build beautiful and livable rural environments in the future effectively.

Liu et al. (2022) employed the TOPSIS model to investigate the indicators of rural revitalization, including industrial development, effective governance, ecologic livability, and quality of life. The study found that rural industrial development, ecologic obstacles, cultural heritage, and other functions must be given attention to achieve rural revitalization. The authors emphasized that the natural environment in rural areas is a valuable asset, and the optimal utilization of ecologic resources and

the achievement of rural ecologic livability are essential for successful rural revitalization. Furthermore, Liu et al. (2022) examined the relationship between rural livability and population density in Langxi County, China. The study revealed significant spatial differences in the natural, residential, economic, and social environments and overall livability. The authors found that the livability of villages near rivers among the mountains was higher than that of villages near foothills and mountainous areas in the south and northwest.

Buzarjomehri et al. (2017) found that indigenous knowledge contributes significantly to the sustainability of rural areas in Shiran by promoting environmental balance and stability and enabling collective participation to enhance the quality of life and livability of the region.

Khorasani et al. (2012) revealed that the livability of villages in Varamin is generally unsatisfactory, with most of the villages being undesirable. Specifically, livability's economic and social dimensions are average, while the environmental dimension is poor.

Amanpour's research demonstrates a significant correlation between livability components and village population in the Izeh region. The strongest relationship was found between pollution, housing, infrastructure facilities, and participation. Additionally, there was no significant variation in livability among the villages. It is because none of the villages have achieved an acceptable level of livability and are in an unsatisfactory or mediocre state, with minimal differences between them.

Sheikh al-Islami et al. (2016) investigated the livability in rural areas around Doroud and found that the quality of life and livability in these areas is low. The study revealed that people assess the quality of life and livability as significantly lower in all social, economic, and environmental dimensions. Moreover, there is a notable variation in the livability and quality of life among the rural areas in the research region.

According to Sojasi Qeidari et al. (2019), their research on livability indicators in Nezamabad and Azadshahr counties ranked Qurchay and Hajinabi villages the lowest, while Aqcheli-ye Olya and Bahram Soufi villages received the highest rank. The findings suggest that larger villages with higher populations, located closer to cities and main transportation routes, have a higher level of livability. It can be inferred that proximity to urban areas and larger people provide better access to services and enhance livability.

A comprehensive study on the effective components of rural livability has yet to be carried out, likely due to the lack of standardized dimensions and indicators for analysis and evaluation. This research has distinct features not investigated in other studies, which is a strength and innovation. Previous research has helped identify relevant issues and criteria, but there remains a gap in rural livability studies, particularly in Lorestan province. This gap limits planning and practical action for rural development. Therefore, organized research on this subject is crucial in this important rural province. The present study is innovative in addressing this gap.

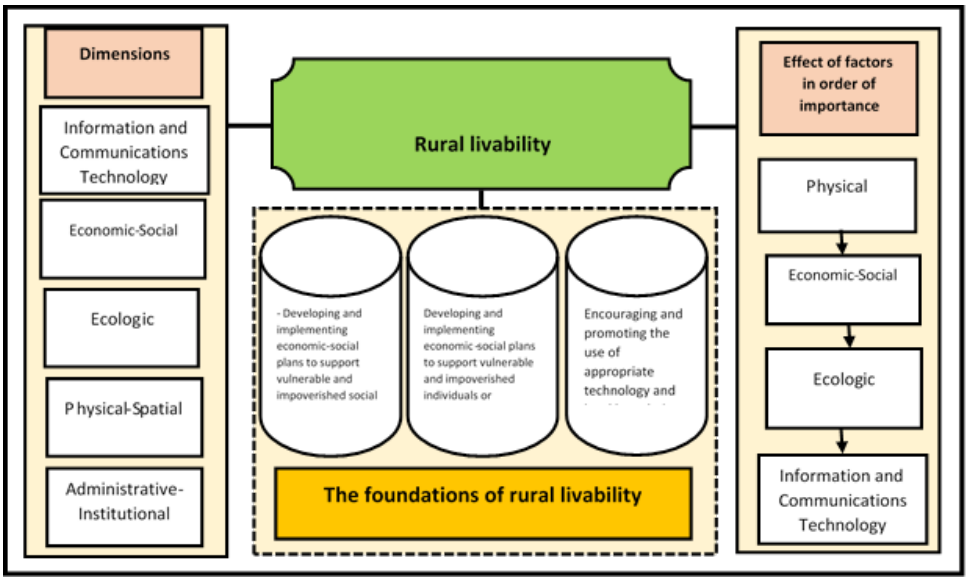

Figure 1. The conceptual model of the research

3. Methodology

The research was conducted using library and field methods, and a researcher-made questionnaire was employed to collect data. The study's statistical population consisted of villages with a population of more than 20 households in Lorestan province, totaling 1,526. To determine the sample size, 55 villages were selected according to the following formula, with the number of villages to be assigned in each county being determined accordingly:

$$\text{Selected number of villages} = \frac{55 * \text{number of households in villages in each county}}{\text{total number of villages with more than 20 households}}$$

The study selected 55 villages for analysis, with 14 villages in flat areas (190-1200 meters altitude), 38 villages in foothill areas (1200-2200 meters altitude), and five villages in mountainous regions (2200-4050 meters altitude above sea level).

We reviewed various indicators from previous studies to identify livability indicators. After careful consideration, we selected 35 indicators across six factors that are relevant to the study area: economic, social, managerial-institutional, physical-infrastructure, ecologic, and information and communication technology. The list of selected indicators is presented in the Table 2.

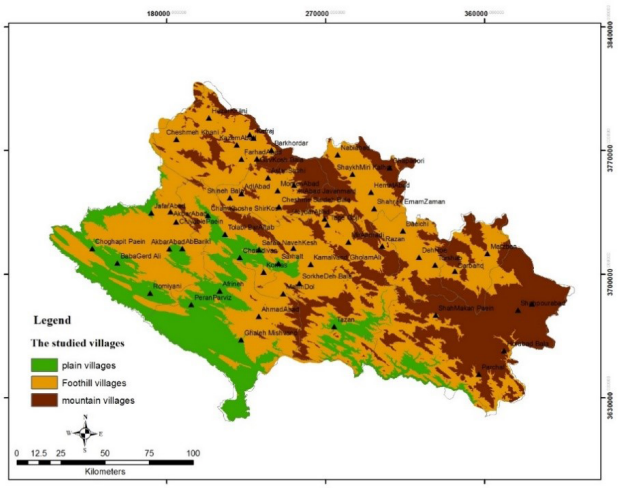

Figure 2. Studied villages in terms of their location in mountainous, plain, and hilly areas.

Table 1. Studied Villages

County	The number of villages with more than 20 households	Number of selected villages in each county
Azna	72	2
Aligudarz	131	5
Borujerd	131	5
Poldokhtar	101	4
Khorramabad	289	10
Delfan	216	8
Doroud	93	3
Dowreh	140	5
Roumeshkan	32	1
Selseleh	157	6
Kouhdasht	164	6
Total	1532	55

Table 2. Factors and Variables of Livability

Factors	Variables
Economic	Job creation for diverse age and gender groups Information and communication technology diversity and occupational dynamism Government and non-governmental organization support local entrepreneurs Definition of sustainable occupations compatible with environmental conditions Optimization of rural product marketing Adequate income to meet household needs
Social	Strengthening of attachment to the rural living environment and promotion of rural permanence Encouragement of community participation in rural projects Provision of skill-building and training courses Creation of conditions for reverse migration Ensuring social security to attract private sector investment Provision of cultural, religious, and sports infrastructure for rural residents (e.g. libraries, mosques) Leisure time activity patterns
Managerial-Institutional	Provision of low-interest facilities with easy access Guaranteed purchase of products Monitoring of credit allocation for rural employment development Reduction of the process of registering land and assets, obtaining necessary licenses, and establishing rural businesses Development of comprehensive service providers in rural areas Optimization of government service distribution at the rural level Collaboration of organizations in rural issues towards rural development (e.g., rural unit management)
Physical-Infrastructure	Renovation and reconstruction of rural housing Construction of rural roads and highways Widening of narrow rural roads and improving the quality of rural road networks (e.g., asphalt) Preservation of historical and tourist sites Creation of furniture and beautification of public spaces in the village Management of surface water disposal in rural areas Management of human and animal waste disposal in rural areas Level of mechanization of agricultural activities Availability of transportation for transporting goods to markets and sales centers
Ecologic	Green business practices Use of renewable energies Production of organic products
Information and Communication Technology (ICT)	Establishment and operation of rural information and communication technology centers Development of banking services Use of optical fiber for communication

A combination of multi-criteria decision-making and structural equation modeling methods were utilized to assess the livability of rural areas and the ecovillage in Lorestan province. Drawing from prior research (Safaipoor et al., 2017: 57; Mahdavi & Hatami, 2019: 105), the ecovillage indicators considered for this study include the use of renewable energy sources (e.g., wind, solar), natural building materials (e.g., wood, stone, straw), education on ecological values (e.g., solidarity, respect, hospitality), organic agriculture and local food production, social cohesion, promotion of a "responsible and committed economy," and the cultivation of an ecologically sustainable lifestyle in harmony with nature. These indicators were applied to determine the livability of the rural areas in question.

Structural equation modeling (SEM) is a statistical technique used to systematically analyze multi-variable data and measure their theoretical structures and relationships. This method enables researchers to develop an experimental model from a hypothesis. SEM is based on correlation regression and analysis of statistical variance techniques and can model all regression equations simultaneously, providing a flexible framework for testing various relationships between variables in the model, including mediation effects and latent confounding variables (Barmar et al., 2018: 58).

The TOPSIS method is a multi-criteria decision-making technique that ranks options according to assigned performance scores. The method, proposed by Hwang and Yoon in 1981, involves defining two hypothetical options: the positive ideal option, which represents the best possible observed values, and the negative ideal option, which describes the worst possible scenarios. The criteria can be positive or negative, and their measurement units vary. The score for each option is calculated based on its proximity to the positive ideal and distance from the negative ideal choice. The perfect solution increases the profit criterion and decreases the cost crite-

rion. In short, the TOPSIS method ranks options based on their similarity to the ideal solution, with the optimal choice being the one that is closest to the positive ideal and farthest from the negative ideal (Momeni, 2006: 49).

Study Area

The study was conducted in Lorestan province, situated in the southwest of Iran, between 46 degrees and 50 minutes to 50 degrees and 1-minute east longitude and 32 degrees and 40 minutes to 34 degrees and 23 minutes north latitude from the Greenwich meridian. The province has an average altitude of over 2200 meters above sea level, with the highest peak being Mount Oshtorankooh, located in the Zagros Mountains range and reaching 4080 meters above sea level. Lorestan Province is bordered by Hamedan Province to the north, Markazi Province to the northeast, Isfahan Province to the east, Khuzestan Province to the south, Ilam Province to the west, and Kermanshah Province to the northwest (see Figure 2). As per the latest national and provincial divisions in 2016, the province comprises 11 counties, 25 cities, 31 districts, 87 villages, and 3384 rural settlements, with its capital being Khorramabad City.

4. Findings

Based on the questionnaire data, most respondents are between 45 and 47 years old, comprising eight individuals. The age group of 23 to 29 has four respondents, while three are 31, 35, and 37 years old, respectively. One respondent is 44 years old, and three are in the age group of 39 to 41. The age group of 54 to 55 has the lowest percentage, with only two respondents. Notably, eight individuals preferred not to disclose their age.

Regarding gender, most of the respondents are male (45 individuals), while only five are female. Among the respondents, 38 are married, and six are single. Six respondents did not provide their marital status.

Regarding educational level, most respondents (28 individuals) have a diploma or bachelor's degree, while nine individuals have education below the diploma level but have higher degrees. Six respondents did not disclose their educational level.

Regarding occupation, eight respondents are village council members, followed by six self-employed individuals. Only seven individuals work in other fields, representing the lowest percentage. Notably, 17 respondents did not disclose their occupations.

Economic component: The study findings reveal that four indices show significant loadings for rural livability's "economic indicators" measurement model. Among these indicators, "diversity of information and communication technology and dynamism in occupations" has the highest correlation, while "creating job opportunities for different age and gender groups" has the lowest correlation with the rural livability economic index. Hence, it can be inferred that these indicators have the highest and lowest roles, respectively, in measuring the economic variable of rural livability in line with the ecovillage pattern. The analysis demonstrates that, except for the "definition of sustainable occupations consistent with environmental conditions" index, all other cases exhibit a factor loading greater than 0.40, indicating a significant relationship between the manifest variables (indices) and the latent variable (economic variable). Therefore, it can be concluded that manifest variables with a factor loading greater than 0.40 can explain the measurement of the latent variable "economic."

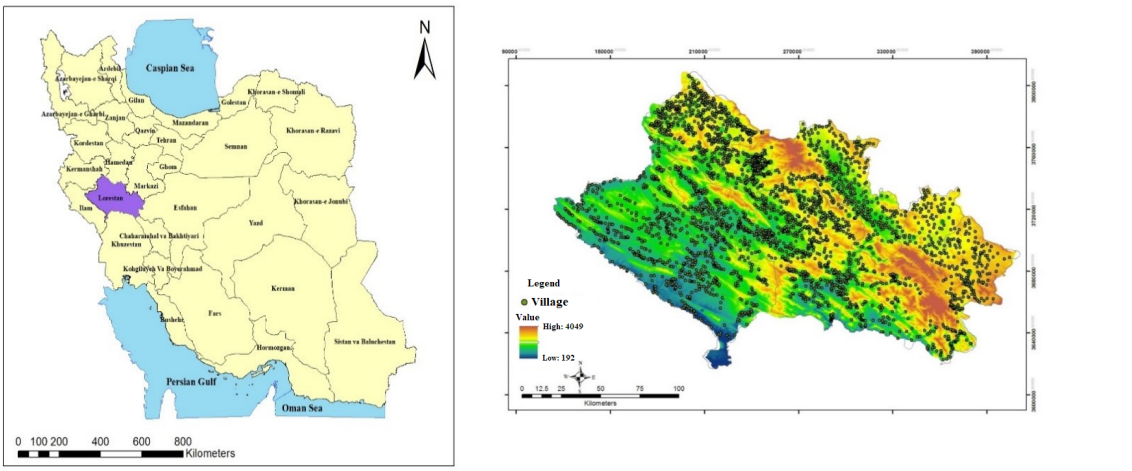

Figure 3. Study Area

Table 3. Values of model fit indicators for measuring rural livability index based on the ecovillage approach

Model Fit	Index	Acceptable range (interval)	Index value	Result
Measurement model	The reliability of the index (Cronbach's alpha)	Cronbach's alpha ≤ 0.7	0.88	confirmed model
	"Composite Reliability (CR) or Rho"	CR≥0.7	0.85	confirmed model
	Factor Loadings	0.4≤λ	Higher than 0.40	confirmed model
	Convergent validity (average extracted variance)	AVE≥0.5&0.4	0.41	confirmed model
	Discriminant validity (Method of Cross-Loading)	The correlation between the index and the structure is higher than the correlation between the index and other structures.	Higher correlation than other structures	confirmed model
	Fornell-Larcker	The square root of AVE is greater than structures that are lower than itself	The numbers in the diagonal of the matrix are greater than the following numbers.	confirmed model
Structural model	(t-value)	t-value≥1.96	3.8	
	(R2) R-squared correlation	Weak (0.19), moderate (0.33), strong (0.67)	0.81	confirmed model
	Effect sizes/f2	Weak (0.02), moderate (0.15), strong (0.35)	3.3	confirmed model
	Q2 criterion (Stone-Geisser criterion)	Weak (0.02), moderate (0.15), strong (0.35) prediction	0.13	confirmed model
Overall goodness of fit	GOF	Weak fit (0.01), moderate fit (0.25), strong fit (0.36)	0.53	confirmed model

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Social component: The findings suggest that the "social indicators" have significant weights in measuring rural livability, with five indicators showing a significant correlation. Among these indicators, "creating the groundwork for reverse migration" and "providing religious, cultural, and sports infrastructure for rural people (library, mosque)" demonstrate the highest and lowest correlation with the variable of rural social livability based on the rural pattern model, respectively. Consequently, these indicators have the highest and lowest factor loadings in measuring the social variable of rural livability based on the rural pattern model. All social dimension livability indicators exhibit a factor loading greater than 0.40, indicating a significant relationship between the manifest variables (indicators) and the latent variable (social variable). Thus, manifest variables with a factor loading greater than 0.40 can effectively explain the measurement of the latent "social" variable.

The managerial-institutional component: The study reveals that the "managerial-institutional" measurement model in rural livability has significant factor loadings in 5 indices. Among these indices, "collaboration of various relevant organizations in rural development issues (management of rural unit)" and "providing low-interest facilities and ease of access to these facilities" exhibit the highest and lowest correlation, respectively, with the variable (structure) of the managerial-institutional index of rural livability based on the village ecosystem pattern. These indices, therefore, have the highest and lowest roles (factor loading) in measuring the managerial-institutional component of rural livability based on the village ecosystem pattern. Notably, all livability indices in the managerial-institutional dimension have a factor loading greater than 0.40, indicating a significant relationship between the manifest variables (indices) and the latent variable (managerial-institutional variable). Consequently, manifest variables with a factor loading greater than 0.40 can explain the managerial-institutional component's latent variable (element).

Physical component: The findings reveal that the "physical" measurement model's weights in assessing rural livability are significant in 6 indices. Among the physical indices, the "widening of narrow rural streets and upgrading the quality of rural road networks (such as asphalt)" and the "preservation of historical and tourist sites" exhibit the highest and lowest correlation, respectively, with the variable (structure) of rural livability, based on the ecovillage pattern. Hence, it can be inferred

that these indices carry the highest and lowest contribution and significance (load) in measuring the variable (factor) of the physical component of rural livability according to the ecovillage pattern. Notably, all livability indices in the physical dimension have a load greater than 0.40, indicating a significant relationship between the manifest variables (indices) and the latent variable (physical component). Therefore, manifest variables with a load greater than 0.40 can explain the latent variable (physical component).

Ecologic component: The study reveals that the "ecologic" measurement model factors have significant loads in three indices of rural livability based on the ecovillage pattern. The correlation analysis indicates that "renewable energy utilization" and "organic products" have the highest and lowest correlations, respectively, with the ecologic livability index of rural areas. Hence, these indices have the highest and lowest factor loads in measuring the ecologic livability variable of rural areas based on the ecovillage pattern. All ecologic livability indices and indicators have a factor load above 0.40, indicating a significant relationship between the manifest variables (indicators) and the latent variable (ecologic). Consequently, manifest variables with a factor load greater than 0.40 have the explanatory power to measure the latent variable (ecologic).

Information Technology Component: The study reveals significant factor loadings of the "Information Technology" measurement model in three indicators of rural livability within the ecovillage pattern. "Development of banking services" and "Use of optical fiber" show the highest and lowest correlation with the Information Technology index of rural livability based on the ecovillage pattern. These indicators have been assigned the highest and lowest shares and roles (factor loadings) in measuring the Information Technology variable of rural livability. All livability indicators in the Information Technology dimension have a factor loading greater than 0.40, indicating a significant relationship between the manifest variables (indicators) and latent variables (Information Technology). Therefore, manifest variables with a factor loading greater than 0.40 can effectively explain the measurement of the Information Technology latent variable.

Combination of livability components: The findings indicate that the measurement model loads of "livability" in four indices are significant within the ecovillage pattern framework. Among these indices, "quality of life and desirable rural life" and "economic sustainability" have the highest and lowest correlation with the rural livability index. Thus, it can be concluded that these indices have the highest and most subordinate shares (factor loading) in measuring the rural livability variable based on the ecovillage pattern. All livability indices have a factor loading greater than 0.40, indicating that the relationship between the manifest variables (indices) and the latent variable (livability) is significant. Therefore, manifest variables with a factor loading greater than 0.40 can be deemed to have explanatory power for measuring the latent variable "livability."

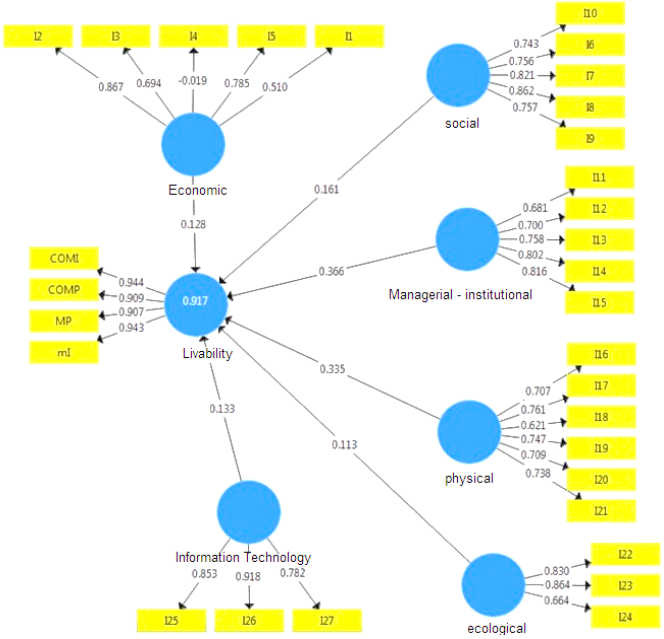

Figure 4. Integrated components model of rural livability based on the ecovillage approach

In this section, after identifying six selected components (information and communication technology, ecology, physical and infrastructural, managerial and institutional, social and economic), the status of each section and the ranking of counties of Lorestan province according to the mentioned indicators has been presented based on the TOPSIS model. This section provides the final result of ranking rural areas of Lorestan province in terms of livability.

The figure above illustrates the order of the studied rural areas based on the mentioned indices. Khorramabad has the highest weight of 0.76, followed by Poldokhtar with 0.69, Doroud with 0.65, Selseleh with 0.63, Delfan with 0.54, Boroujerd with 0.54, Azna with 0.34, Roumeshkan with 0.30, and Dowreh Chegeni with 0.30.

The TOPSIS model was also employed to rank each village based on the 24 selected indices, as categorized in the study.

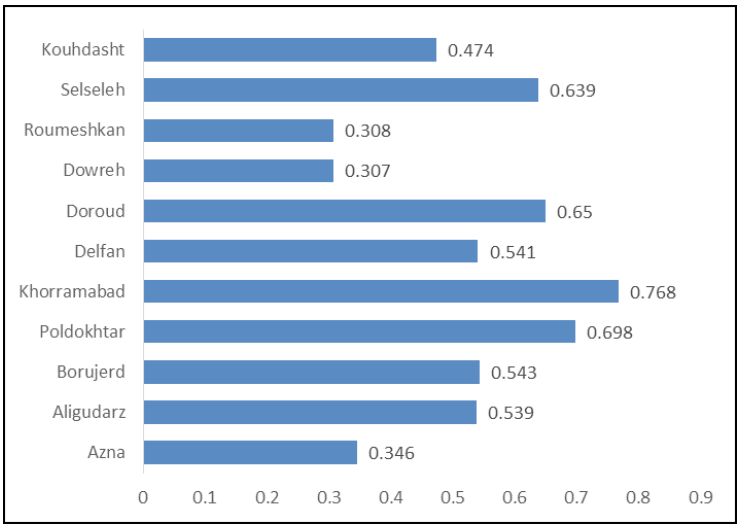

Figure 5. Ranking of rural areas in counties using the TOPSIS model

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Table 4. Status of Ecovillage Indicators

Variables
The amount of renewable energy use, such as wind and solar energy.
The use of natural environmental resources, such as wood, stone, and straw, in building construction.
People's education in learning positive values of ecology, such as solidarity.
Respect for others and hospitality - organic agriculture.
Local food production.
Social solidarity.
Encouraging and promoting a "responsible and committed economy".
Creating an ecologically coordinated lifestyle.
Livelihood production.
Strengthening social values.
Integrating human activities with the environment without destruction.
Satisfaction and meeting the needs of all humans.
Preventing the privatization and commercialization of nature in favor of the general public.
Using technologies and innovations towards sustainable living.
Preserving the village through urban-rural interactions.
Safety and participation of rural people in development.
Focusing on the use of local resources, including agricultural products.
Using photovoltaic panels and boards.
Using heating and cooling systems.
Government support for ecovillage projects.
Developing the principles of ecologic business.
Creating social institutions for managing human-environment relationships.

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The mentioned indices, including educating people to learn positive values of ecology such as cohesion, social solidarity, local food production, and promoting a "responsible and committed economy," are ranked in the following order. The final ranking is presented below, consistent with the findings of Safaipoor (2017) and Mahdavi and Hatami (2019).

5. Discussion

Based on the examined criteria, the study results indicate that the ecovillage model is not currently present in Lorestan. To implement this model, it is necessary to prepare the cultural groundwork by educating and convincing the public and officials about its significance. Once the mental and psychological readiness is established, the economic, social, and ecological infrastructure, as presented in the figure below, must be provided. It is important to note that implementing this model is a time-consuming process that cannot be accomplished within a short period, and sustained effort and determination are needed to develop and implement the necessary components in rural areas to establish the ecovillage model in Lorestan.

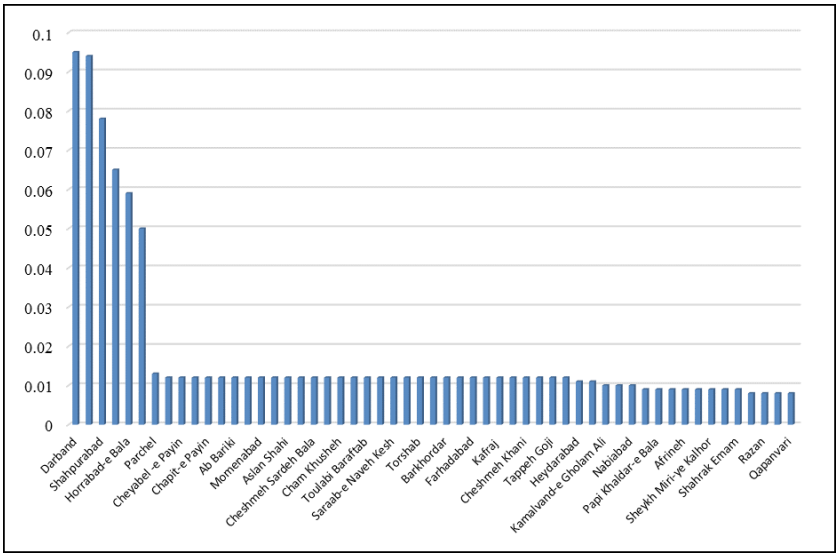

Figure 6. Ranking of villages in the province based on the ecovillage Index using the TOPSIS model

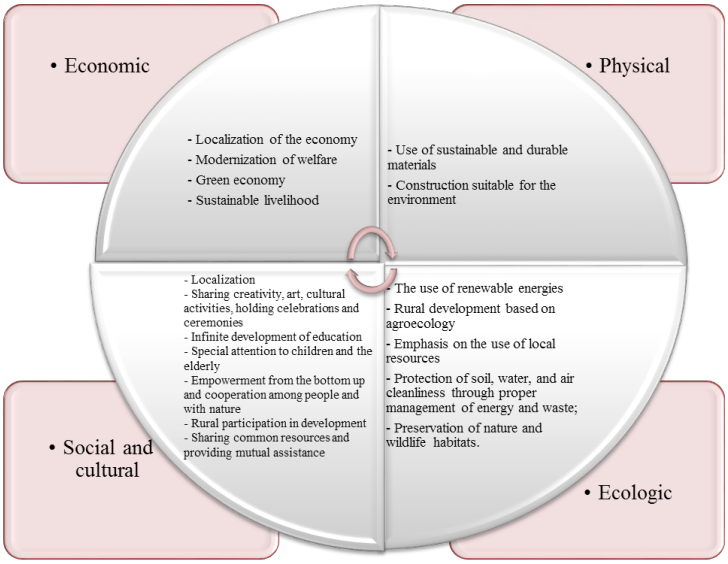

Figure 7. Feasibility conditions of the ecovillage model approach in the rural area of Lorestan in western Iran

The results of the data analysis indicate that all livability indicators, including physical, economic, social, ecologic, and information technology, have a factor loading greater than 0.40, which implies a significant correlation between the observable variables and the latent variable of livability. Hence, variables with a factor loading greater than 0.40 explain livability. Based on the weights assigned to the indicators, the economic and physical-infrastructure indicators have the highest importance, with 0.27 and 0.25, respectively, followed by social, ecological, institutional management, and information and communication technology indicators. Using the TOPSIS model, the studied villages were ranked, with Darband, Shahpourabad, and Horrabad-e Bala receiving the first to third ranks, respectively.

The following proposals are suggested to enhance rural livability in Lorestan province:

- Organizing national and regional festivals to showcase local initiatives, experiences, and actions in rural development and ecovillage formation.

- Establishing membership and maintaining communication with international and regional organizations, such as the Global Network of Rural Communities, and setting up an Ecovillage Headquarters at the national, provincial, and district levels.

- Providing training for local institutions, including village leaders and members of rural Islamic councils, in ecovillage development programs.

- Introducing diverse, indigenous models for ecovillage formation and development adapted to the specific conditions of different regions in the country.

- Coordinating local development plans and projects towards achieving ecovillage goals by reviewing and modifying the planning and implementation processes.

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Conflict of Interest

The authors declared no conflicts of interest.

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