# Research Paper: Analysis of the Smartening Infrastructure Role on the Quality of Life of Suburban Rural Settlements (Case Study: Zabol City, Iran Southeast)

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## ABSTRACT

**Purpose:** Rural smartening means taking advantage of communication and information tools to provide services to society, which causes an increase in quality of life. This study aimed to investigate the role of smartening infrastructures on the quality of life in suburban areas in Zabol City, southeast of Iran.

**Methods:** The current research is applied in terms of purpose and survey regarding the nature and method. The data required for the research has been collected by questionnaire. The statistical population includes the residents of the villages in the suburbs of Zabol City (Haji-Abad and Qasim-Abad), and the sample size was 360 people using the Cochran method. SPSS software was used for data analysis. SPSS software and F-SORA and F-KOPRAS models were used for data analysis.

**Results:** The results showed that there is a significant and positive relationship between the intelligent infrastructure and the quality of life in the rural settlements in the suburbs of Zabol city, in such a way that the human variable and social capital with a direct effect value of 0.121 and an indirect effect value of 0.043, management and politics with a direct effect value 0.133 and the value of indirect effect 0.055, information technology with the value of direct effect 0.124, and the value of indirect effect 0.045 have an impact on improving the quality of life. Also, among the proposed infrastructures, management and politics have the most impact on improving the quality of life in the rural settlements in the suburbs of Zabol City, with a total causal effect of 0.188. In the following, the results of the combined models (F-SORA and F-KOPRAS) showed that the economic, environmental, and social dimensions with scores of 2.320, 70.12, and 70.00 showed more affectability from the smartening infrastructures in suburb settlement in Zabol city.

**Conclusion:** Improving the quality of life, decreasing living costs, and increasing efficiency will be acquired using smartening infrastructures in the villages of the suburbs.

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# 1. Introduction

**I**n recent years, smartening infrastructure planning has been followed to improve people's quality of life and help managers improve public infrastructure operations and management (Yang et al., 2021: 8). Therefore, paying attention to infrastructure smartening is necessary for development planning. To achieve sustainable patterns in planning, knowing the dimensions, contexts, and analysis of its role in the development of urban neighborhoods is necessary (Shokrgozar et al., 2015: 46). The cities and villages of Iran require modern management according to the needs of the 21st century. In this way, the quality of life in this area can be improved using planning to solve the problems and challenges (Mohammadi, 2020: 1). Smartening approach has a considerable role in sustainable rural development. This approach enhances the quality of life of people, seeks to respond to socio-economic, environmental, and physical problems, improves the rural management to use facilities optimally, and solves rural problems (Bahadori Amjaz et al., 2022: 91). Rural areas are deprived of many facilities due to distance and dispersion, so the use of smart technologies can play an influential role to providing services (educational, administrative, banking, etc.) (Akbaroghli & Qasemi, 2020: 211), through the expansion of information and communication technology in smart rural areas, improving the provision of health, education, and job services and increasing the level of awareness about production, an agricultural area, and marketing the agricultural and non-agricultural products, etc. Therefore, technology is considered one of the platforms for comprehensive development and will reduce the digital gap between the city and the rural (Akbaroghli & Qasemi, 2020: 211).

Zabol City, in the north of Sistan and Baluchistan province, is a deprived area requiring new approaches and organization of affairs due to the weather, geographical conditions, and different problem. These problems include unbalanced expansion and growth in urban areas, land use changes, especially agricultural lands, lack of reconstruction of worn-out structures in urban areas and rural settlements in the suburban area, the large area of the suburbs, lack of providing good services in the suburbs, imbalance in different land uses of urban areas, lack of employment and high immigration rate, the low level of happiness among the people, lack of necessary incentives to participate in urban affairs, and the profit of dealers to destroy high-quality places in urban neighborhoods to the growth of suburbs. In the same neighborhoods of Zabol city, the challenges of management misperception, inadequate distribution of land uses, and the disordered situation of cultural, social, and economic dimensions revealed the need for logical solutions and new approaches such as the smartening infrastructures to answering the different challenges. Indeed, the smartening infrastructures, especially in rural neighborhoods in the suburb of Zabol City, can be a sustainable source of benefit. Other infrastructures such as energy networks, gas, heat, water distribution systems, public and private transport, hospitals, buildings, and commercial buildings have a crucial role in smartening Zabol City and forming the life of people in urban neighborhoods. In this regard, this study aimed to investigate the role of smartening infrastructures on the quality of life of rural settlements in the suburban area of Zabol City, southeast of Iran. Indeed, this study provides strategies to improve the situation and sustainable development of urban neighborhoods concerning smartening.

## 2. Literature Review

The term development aims to improve the level and quality of life of people and improve society's general welfare. Its stability refers to the continuation of this process throughout human generations. So, sustainable development includes all aspects and dimensions of human life. In this regard, the theory of smartening is not considered a reality but a kind of strategy that has been paid attention to in the direction of future development (Ansari et al., 2021: 1). The first steps in the field of smart villages were taken in 2011, its objective was making the better life in rural areas (Poggi et al., 2015: 46). Indeed, what is vital in smartening is the importance of the quality of rural life. However, it isn't easy to define the quality of life or people's well-being through smartening (Bocinell et al., 2015: 105). In this regard, a pilot project for rural smartening in Germany was carried out under the "Digital Villages" title from 2015 to 2019. Integrated bottom-up approaches, public-private partnerships of the society, and supportive policy frameworks and financing mechanisms effectively create a smart village (Van Gevelt et al., 2018: 140). The purpose of creating smart villages is to develop social, physical, institutional, and economic infrastructures, improve the quality of life, and attract people and investment (Smart Villages, 2018). An accurate insight into the initiative of urban smartening at the global level will enable us to make proper conclusions toward sustainable development (Poggi et al., 2015: 44; Poggi et al., 2017: 57). The European Union defines the smart standards as follows: deprivation and adjustment of demographic changes, finding local so-

lutions, exploring the relationship with small towns, improving the economy of rural areas, and promoting digital transformation (Smart Villages, 2018).

Some studies have analyzed the role of smartening infrastructures on urban and rural life quality. Taghiloo et al. (2021) investigated strategic smart villages for sustainable development (case study: Nazlo village, Urmia City). They concluded that most of the villages have an unfavorable status in terms of ecological indicators. Hail Moghadam & Nouri Kermani (2019), studied the role of urban management in the smartening of District 5 of Tehran and found a significant relationship between urban management and six components of smart urban.

Mahdizadeh (2019), investigated the relationship between smart cities for sustainable development and the challenges of achieving a sustainable smart city. He found that technologies can be used to reduce or even eliminate the problems different societies face. Parsa et al. (2018) analyzed the impact of urban smartening on sustainable development indicators in District 1 of Karaj. They concluded that smart urban (smart governance, energy, construction, mobility, infrastructure, technology, health care, and smart citizenship) is effective in sustainable development. Azharianfar (2014), in a study entitled "Smartening and its impact on the quality of urban life (case study: district 7 of Tehran)" found that smart cities created as a long-term program in the face of the control of upcoming damages and disasters caused by natural and human phenomena to improve the quality of life of citizens through information technology. Yang et al. (2021), in a study entitled "the need for local adaptation of smart infrastructure for sustainable economic management," found that a primary data management approach is needed to develop an efficient, safe, and strong society. This approach is an effective solution for designing a safe, efficient, practical society, urban development principles, smart urban conceptual models, etc. Xia et al. (2021) investigated the effect of environmental and social responsibility on efficient energy management models concerning smartening infrastructures. They found that smart models seek alternatives to promote clean energy sources in networks with energy storage systems. Van Gevelt et al. (2018), to achieve global energy and rural development through smart villages, suggested that by operationalizing the capability approach in a specific context, policies and programs be improved to include more marginalized communities and thereby achieve ICT-based development. Poggi (2017), in a study entitled "smart village, a model for net energy balance planning", suggested a new approach with low complexity based on the market

rules and responsive mechanism to manage demands for multi-priority group control of non-smart devices in off-grid rural settings.

## 3. Methodology

This research is an analytical and descriptive study according to its practical aim and the data collection method, a survey type according to the implementation method, and a quantitative study according to the research method. This study used documentary and field methods for data collection and analysis. In the documentary stage, the information was collected by studying research backgrounds such as books, articles, maps, and websites. Data collection by field method included observing, asking questions from the rural residents and experts, and filling out the researcher-made questionnaires. The research tools were 2 questionnaires on quality of life and urban smartening. The indexes (smartening infrastructures and quality of life) were determined using the study of the theoretical backgrounds and were used for preparing the questionnaires (Tables 1 & 2). The validity of the tools was investigated through the opinion of experts in the related area. Also, to further ensure the accuracy of the indexes, the questionnaires were filled out by 30 subjects through a pre-test. The reliability of the questionnaires was investigated using SPSS software by Cronbach's alpha method, in which the coefficient was the same for the two questionnaires (0.84), confirming the reliability. In this study, we have two statistical populations: the first was the residents of villages in the suburb of Zabol City (Haji-Abad and Qasim-Abad), and the sample size was determined to be 360 by the Cochran formula. The second population was experts in smartening and quality of life which was selected by purposive sampling (N=20). Data were analyzed using SPSS software and F-SORA and F-KOPRAS models. The methodology was implemented through the following steps:

- Pearson correlation and multiple regression tests were used to analyze the smartening infrastructures and quality of life in rural settlements in the Zabol City suburb.

- F-SORA and F-KOPRAS models were used for investigating the affectability of the dimensions of quality of life from the smartening infrastructures.

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**Table 1.** Smartening indicators

| Criteria | Sub criteria | Sub criteria |
|---|---|---|
| Human and social capital | Citizens' awareness and computer knowledge of smart technologies | Awareness and computer knowledge of the relevant municipal officials of technology |
| | Persistence of municipal experts and related organizations in the field of improving information and using urban smart technologies | Citizen education in the field of smart urban technologies by the municipality |
| | Citizens' interest in accepting changes and innovations | Specialization of city officials in choosing technology-oriented projects |
| | Participation in the creation the smart technologies in the municipality and urban organizations | Votes of citizens in the selection and implementation of smart municipal technologies |
| | Improvement of association, trust, participation, etc. among citizens in the spread of smart technologies based on the city managers' opinion | Participation of citizens in the implementation of smart technologies by departments |
| Management and policy (institutional) | Drawing a perspective on the development of smart technologies by the municipality | Facilitating accountability to citizens in choosing smart urban technologies by city officials |
| | The desirability of organizations and the organizational structure of departments to create smart technologies in the city | Accepting the failure of smart urban projects by officials |
| | The desirability of the legal and contractual structure of municipal offices in contracting | Collective participation and the formation of intellectual working groups to create smart technologies in city organizations |
| | Attention of city officials to expression freedom and free circulation of information in the selection of urban smart technologies | Collective agreement of civil institutions, private sector and municipality to create smart urban technologies |
| | Importance of creating information and communication technology infrastructure | The performance of city departments in the use of expert consultants for application of smart technologies in the city |
| Technology and information | Efficiency and effectiveness of projects in the selection of urban technological projects | Believability in the use of domestic production technologies in the municipality and city administrations |
| | The relationship between the university and the city administration in the field of developing smart technologies | Availability and compatibility of information and communication technology |
| | The cost of information and communication technologies | The possibility of connecting networks, organizations, social groups and businesses located in urban areas |
| | Creating areas with high capacity to make the backgrounds for learning, innovation, and creating knowledge by people, institutions, and infrastructure and digital services. | Creating spaces with the aim of learning and innovation |
| | The possibility of creating innovative virtual environments based on multimedia tools, specialized systems, and interactive technologies | |

Reference: Roostaei et al., 2018; Moulaii et al., 2016

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**Table 2.** Dimensions and indicators of quality of life

| Dimensions | Indicators |
|---|---|
| Environmental | Green space, weather, water quality, basic infrastructure |
| Social | Education, citizen participation, safety and security, population, social status |
| Economic | Income and consumption, market, job, the housing market, economic dynamics |

Reference: Salari Sardari et al., 2014

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Zabol is a city in and the capital of Zabol County, Sistan, and Baluchestan Province, Iran. Zabol lies on the border with Afghanistan. Geographically, Zabol, the city's center, is located at 61 degrees and 29 minutes of east longitude and 31 degrees and 1 minute of north latitude. It has a 216-kilometer paved road to Zahedan, the capital of the provinceprovince's capital. Zabol is located near Lake Hamun, and the Hirmand River irrigates the region. Lake Hamun is a seasonal lake that is often dry. The people of Zabol are predominantly Persians who speak a variant of the Persian language known as Sistani or Seistani, which is very similar to Dari, also known as Afghan Persian, and a minority of Baluchs who speak Baluchi, a southeastern Iranian language.
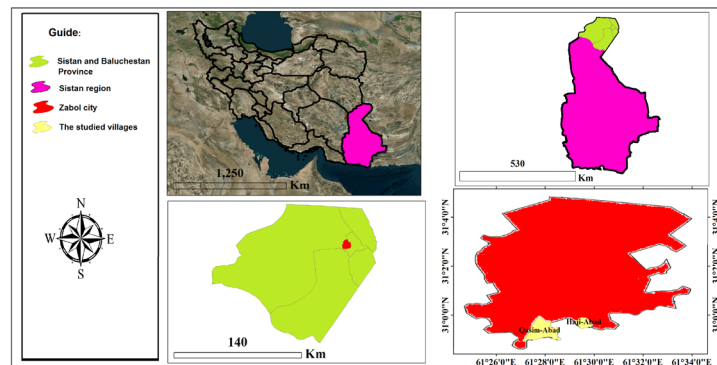
**Figure 1.** Location of the study area in the country and province. Reference: Authors, 2022

## 4. Findings

The Pearson correlation coefficient was used to investigate the smartening and quality of life in rural settlements in Zabol City's suburbs. The findings showed a significant level of 0.000, meaning a significant relationship between smartening infrastructures and quality of life in suburban settlements of Zabol city. In other words, the more the smartening infrastructures, the more the quality of life in the suburban settlements (Table 3).

Multiple regression was used to investigate the effect of smartening infrastructures on the quality of life in suburban settlements in Zabol City. Based on the adjusted determination coefficient, 95% of the changes in the dependent variable (quality of life) are explained by the 3 factors of infrastructures (human and social capital, management and (institutional) policy, technology, and information factors). The significance of regression was observed in the 3 elements. So, the 3 factors of infrastructure have a considerable effect on improving the quality of life in the suburban settlements of Zabol City (Table 4).

Based on Table 5, the importance and the role of each of the infrastructures on the dependent variable of quality of life can be evident by comparing Beta standard coefficients. The Beta coefficients in the regression equation showed that out of the independent variables, the share of management and policy criteria on predicting positive changes in the dependent variable is more than other criteria.

**Table 3.** Investigating the relationship between smart infrastructure and quality of life

| Relationship analysis | | The amount of quality of life | The level of intelligence infrastructure |
|---|---|---|---|
| | Pearson | 1 | 0.766 |
| Quality of life | Significance level | - | 0.000 |
| | N | - | 360 |
| | Pearson | 0.766 | 1 |
| Smart infrastructure | Significance level | 0.000 | - |
| | N | 360 | - |

Reference: Research findings, 2022

**Table 4.** Independent variable coefficients in explaining the variance of the quality of life variable

| The independent variable | R | R2 | R2Adj |
|---|---|---|---|
| Human and social capital | 0.577 | 0.556 | 0.476 |
| Management and policy (institutional) | 0.588 | 0.512 | 0.509 |
| Technology and information | 0.554 | 0.561 | 0.554 |

Reference: Research findings, 2022

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**Table 5.** Regression analysis results for the effect of smart infrastructure in improving the quality of life

| The independent variable | B | Std-Error | Beta | t | P |
|---|---|---|---|---|---|
| Human and social capital | 1.334 | 0.034 | 0.564 | 7.221 | 0.000 |
| Management and policy (institutional) | 1.445 | 0.023 | 0.665 | 7.886 | 0.000 |
| Technology and information | 1.354 | 0.031 | 0.576 | 8.462 | 0.000 |

Reference: Research findings, 2022

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The path analysis method was used to determine infrastructures' direct and indirect effects on improving quality of life. There was a direct relationship between the 3 factors with the quality of life in the suburban settlements of Zabol City (p=0.000). The 3 factors as the important criteria for improving quality of life were used to prepare the structural-causal model, and each factor's direct and indirect effects on the quality of life were explained (Table 6).
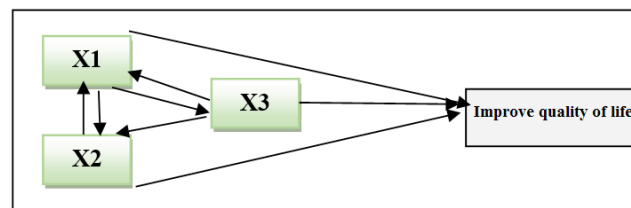
Based on Table 6, the direct and indirect effects of the variables were as follows: human and social capital with a direct effect value of 0.121 and indirect effect value of 0.043, management and politics with a direct effect value of 0.133 and an indirect effect value of 0.055, technology and information with a direct effect value of 0.124, and a value of 0.45. Out of the variables, the management and policy with the total causal effect of 0.188 showed the highest effect on improving the quality of life in the suburban settlements in Zabol city. Each of the dimensions of quality of life was scored by F-SORA and F-KOPRAS models. Due to the number of tables resulting from the used models, only the final table was shown in this study. To analyze the results in Table 7, a qualitative index was suggested to determine the quality of life in the suburbs of Zabol, emphasizing the smartening infrastructures. The value of 0.000-0.3 and between 0.30-0.40 showed the red condition and poor quality and relatively poor quality levels, respectively. The value of the qualitative index between 0.0-40.60 and between 0.60-0.70 showed a yellow status and moderate and fairly good quality levels, respectively. If the value is in the range of 0.70-0.80, the status of the variable is green, and the quality level is good. The spectra of 0.80-0.90 and 0.90-0.100 showed the green status and good quality level and the green status and great quality level, respectively.

**Table 6.** Direct and indirect effects of smart infrastructure in improving the quality of rural life in the suburbs of Zabol

| Raw | Symbol | The independent variable | Direct Effects | Indirect effects | A sum of causal effects |
|---|---|---|---|---|---|
| 1 | X1 | Human and social capital | 0.121 | 0.043 | 0.164 |
| 2 | X2 | Management and policy (institutional) | 0.133 | 0.055 | 0.188 |
| 3 | X3 | Technology and information | 0.124 | 0.045 | 0.169 |

Reference: Research findings, 2022

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**Figure 2.** Direct and indirect effects of smart infrastructure in improving the quality of rural life in the suburbs of Zabol

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**Table 7.** Analysis of the influence of each aspect of the quality of life on the smart infrastructure

| Dimensions | QL | QMAX | QMIN | Distance between QMIN and QMAX | Score out of 100 |
|---|---|---|---|---|---|
| Environmental | 12.765 | 13.342 | 11.543 | 1.799 | 70.12 |
| Social | 11.321 | 12.453 | 10.342 | 2.110 | 70.00 |
| Economic | 13.012 | 14.123 | 12.443 | 2.320 | 71.03 |

Reference: Research findings, 2022

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Based on Table 7, the economic, environmental, and social dimensions with scores of 2.320, 70.12, and 70.00 showed more affectability from the smartening infrastructures in suburb settlement in Zabol city.

## 5. Discussion

This study aimed to investigate the role of smartening infrastructures on the quality of life in suburban areas in Zabol City, southeast of Iran. Smartening is a new concept in urban planning, and its implementation needs infrastructure changes in the 3 factors of information and technology, management-policy, and human resources and social capital. Most of Iran's provinces are passing the initial levels of turning to smart cities. Planning the quality of life is a reaction to the mono-dimensional development regarding improving the qualitative dimension of life. In this regard, smartening infrastructure is vital in improving the quality of life. The findings showed a significant positive relationship between the smartening infrastructures and the quality of life in suburban settlements of Zabol city. The management and policy observed a high level of effectiveness in improving quality of life. The results of the models showed the highest level of affectability from the smartening infrastructures in the economic dimension. Considering the infrastructures of human resources and social capital, management and policy, and information and technology, the good backgrounds for improvement of the quality of life of suburban settlements in Zabol city can be planned by the existing potentials and considering the infrastructural costs. Therefore, the creation of smart infrastructure in Zabol City should be viewed as a necessary matter by urban organizations, including the municipality; smartening will reduce many of the problems in rural settlements in the suburbs of Zabol and turn these areas into favorable environments for living. The results of this study agreed with the findings of Taghiloo et al. (2021), Parsa et al. (2018), and Van Gevelt et al. (2018).

Considering the results of this study, the following strategies are suggested:

• the essential solution in smartening the rural settlements in the suburbs of Zabol City is to identify the current quality of life for planning the smartening programs based on the resources and infrastructures and preparing good backgrounds for achieving the objectives.

• It is also suggested to document the processes and development level of smartening in rural settlements in the suburbs of Zabol City and the effect of smartening on the quality of life. In this way, the necessary planning to achieve the goal of smartening will be implemented.

## Conflict of Interest

The authors declared no conflicts of interest.

**References**

Akbaroghli, F., Qasemi, M. (2020). Factors Influencing ICT Offices' Performance in Rural Intelligence (Case Study: Tabas Township Villages). Rural Development Strategies, 7(2), 211-220. (In Persian) doi: 10.22048/rdsj.2020.229796.1851

Ansari, M., Vali Shariatpanahi, M., Malek Hosseini, A., Madiri, M. (2021). Modeling Factors Affecting the Implement Ability of Smart Growth Principles in Malayer. MJSP 2021; 25 (2):1-34. (In Persian) URL: http://hsmsp.modares.ac.ir/article-21-42841-fa.html

Azharianfar, S. (2014). Smartening and its impact on the quality of urban life (case example: District 7 of Tehran), Master's Thesis, Islamic Azad University, Central Tehran Branch, Faculty of Literature and Humanities. (In Persian)

Bahadori Amjaz, F., Anabestani, A., Tavakolinia, J. (2022). The Roles of the Main Components of the Formation of Smart Growth Approach in the Sustainable Development of Rural Settlements: A Case Study of Jiroft County. Spatial Planning, 12(2), 91-118. (In Persian) doi: 10.22108/sppl.2022.132321.1639

Bocinell, F., Pagnotta, G., Riccioli, F., Casini, L. (2015). the determinants of quality of life in rural areas from a geographic perspective: The case of Tuscany. Rev. Urban Reg. Dev. Stud, 27, 104–117. https://ideas.repec.org/a/bla/revurb/v27y-2015i2p104-117.html

Hail Moghadam, K., Nouri Kermani, A. (2019). Investigating the role of urban management in making the city smart (case study: District 5 of Tehran Municipality), Journal of Geographical Sciences (Applied Geography), 15(30), 127-138. (In Persian) https://geographic.mashhad.iau.ir/article_679994.html

Mahdizadeh, M. (2019). investigating the relationship between smart city and sustainable development and the challenges of achieving a sustainable smart city, Shabak Magazine, 5 (7), 119-128. (In Persian) https://www.sid.ir/paper/524871/en

Mohammadi, J. (2020). evaluation and analysis of the city in terms of the components of a smart city with a spatial planning approach, a case study: Zanjan city. Ph.D. thesis, a field

Mir, M., et al. (2022). Analysis of the Smartening Infrastructure Role on the Quality of Life of Suburban Rural Settlements. *JSRD, 6*(2), 195-202.

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of geography and urban planning. Mohaghegh Ardabili University. (In Persian)

Moulaii, M., Shahhoseini, G., Dabaghchi, S. (2016). Explaining and analyzing how to make smart cities in the context of the influencing components and key factors. Naqshejahan, 6 (3):75-93. (In Persian) URL: http://bsnt.modares.ac.ir/article-2-3435-fa.html

Parsa, P., Daneshmandmalairi, F., Pourmusoi, S.M. (2018). The impact of the smart city on sustainable development indicators of Region 1 of Karaj Municipality, the first conference on examining the challenges and presenting new solutions of urban management, Tehran. (In Persian)  EPCPSUM01_047

Poggi, F., Firmino, A., Amado, M. (2015). Moving Forward on Sustainable Energy Transitions: The Smart Rural Model. Eur. J. Sustain. Dev., 4, 43–50. doi:10.14207/ejsd.2015.v4n2p43

Poggi, F., Firmino, A., Amado, M. (2017). SMART RURAL: A Model for Planning Net-Zero Energy Balance at Municipal Level. Energy Procedia, 122, 56–61. https://doi.org/10.1016/j.egypro.2017.07.287

Roostaei, D., Poormohamadi, D., Ghanbari, H. (2018). A Theory of Smart Cities and Assessment its Infrastructure Components in Urban Management (Case Study: Tabriz Municipality). Geography and Territorial Spatial Arrangement, 8(26), 197-216. (In Persian) doi: 10.22111/gaij.2018.3634

Salari Sardari, F., Heydari Moghadam, M., Sobhani, N., Arefi, A. (2014). investigating the components of quality of life in urban spaces, a case study: Lamard City, Journal of Landscape Research. 1(2), 1-15. (In Persian) magiran.com/p1356650

Shokrgozar, A., Jamshidi, Z., & Jamshidi, P. (2015). Evaluating the Principles and Guidelines of Urban Intelligence Growth in Future Development of Rasht City Based on Heldern Population Density Model. Geography and Development, 13(41), 45-64. (In Persian) doi: 10.22111/gdij.2015.2228

Smart Villages. (2018). Providing Global Means to Local Needs. Available online: http: Smart Villages.org/lt.aspx(accessed on 9 May 2018). https://www.mdpi.com/2073-445X/9/5/151

Taghiloo, A.A, Movaqqari, A. R., Babaei, N. (2021). Smart Villages a Way to Sustainable Development-A Case Study: Nazlou Villages of Urmia City. Geographical Engineering of Territory, 5(1), 29-42. (In Persian) doi: JGET-2005-1165

Van Gevelt, T., Canales Holzeis, C., Fennell, S., Heap, B., Holmes, J., Hurley Depret, M., Jones, B., --Safdar, M.T. (2018). Achieving Universal Energy Access and Rural Development through Smart Villages, Sustain. Dev. 2018, 43,139-142. https://doi.org/10.1016/j.esd.2018.01.005

Xia, X., Wu, X., Murugan, S.B., Karuppiah, M. (2021). Effect of environmental and social responsibility in energy-efficient management models for smart cities infrastructure, Sustainable Energy Technologies and Assessments, Volume 47, October 2021, 101525. https://doi.org/10.1016/j.seta.2021.101525

Yang, F., Wen, X., Aziz, A., Luhach, A.K. (2021). The need for local adaptation of smart infrastructure for sustainable economic management, Environmental Impact Assessment Review, Volume 88, May 2021, 106565. https://doi.org/10.1016/j.eiar.2021.106565