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Analysis of Key Propellants Affecting the Formation Of Smart Rural Development in Iran

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Abstract

Smart development is a sustainable development which can be obtained through increasing the use of innovation, knowledge, and learning. Promoting smart rural development requires policies to facilitate innovation, knowledge, and learning in the rural context. However, applying the concept of smart development into rural areas may be more complex. Smart development is not a concept of one size to fit all, but its application in rural areas requires the incorporation of various initiatives with widespread management. The present study was designed to analyze the key propellants affecting the formation of smart rural development in Jovein. For this purpose, the recent study was designed to determine the key propellants affecting the smart rural development; the indices were merged in pairs, converted into three indices, and the MICMAC quantitative model was used. The results of the study indicate that, based on the results of the MICMAC quantitative model the two following indices have been identified as key propellants in formation of smart rural development: (a) increasing people with higher education and tendency to stay in the village with a +5 direct impact and a +2567 indirect impact; and (b) creating interactive industrial activities such as tourism, food, and cultural production with direct impact of +3 and the indirect impact of +2269.

Keywords: Sustainable development, key propellants, futurology, rural settlements, Iran

1.0 Introduction

Rural development is a holistic approach and the process of improving (a) people's choice, (b) democratic expansion, (c)promoting people's empowerment to make decisions about their living spaces, (d) enhancing wellbeing, (e) expanding potential opportunities and capacities, (f) empowerment of women, the poor and independent free peasants to organize their own living space and (g) encourage teamwork (Roknodin Eftekhari, 2010). Rural development, according to its concept has multidimensional goals. There seems to be a correlation in nine goals of rural development. These goals are: (a) reduction of poverty and elimination of malnutrition, (b) providing minimum social services, (c) increasing employment opportunities, (d) improving efficiency and increasing revenue, (e) increasing agricultural products and foodstuffs, (f) providing food security, (g) transferring

general interests to rural areas, (h) preventing social discrimination, (i) maintaining the power of the natural and biological environment, (j) increasing participation and improving self-confidence (Firouznia & Roknodin Eftekhari, 2003). Without rural development—which is an important part of macro development programs in any country—industrial development will either not succeed or, if successful, will create such severe internal imbalances that the problems of extended poverty, inequality, and unemployment will increase. Therefore, due to the importance of rural development, several views and theories about it have been proposed worldwide. In other words, rural development which means improving the well-being and livelihood of the villagers, has always been a concern to development thinkers and policy makers (Rezvani, Badri, Torabi, & Hajari, 2016). The importance of sustainable rural development and its vital role in the development of most developing countries, is apparent to everyone, and according to experts, this principle depends above all on having the right capital—especially social capital—which is possible through participation and social trust (Roknedin Eftekhari, Mahmoudi, Ghaffari, & PourTaheri, 2015). In this approach, the principle is based on the role of knowledge-centered agents (Apostolopoulos, Chalvatzis, Liargovas, Newberry, & Rokou, 2020). In other words, knowledge transfer and innovation are vital for sustainable rural development. The EU Rural Development Policy has long been a stimulus for innovation in rural spaces. In particular, during the 2007–2013 programing period, some measures were explicitly targeted to support knowledge transfer and innovation in agriculture and rural economics (Bonfiglio et al., 2017).

In order to achieve sustainable development as the ultimate goal of planning, the first step is to get a real understanding of the status quo and the extent to which areas have the potential for development. In order to understand the status quo, the use of comprehensive indicators and indices as well as various theories that can analyze the status quo is inevitable(pour Taheri et al., 2014). Smart development is a theory of urban and regional planning based on assumptions and movements such as sustainable development and new urbanism that try to put their principles into strategies rather than in details to maximize their capability to achieve adaptation to solve the problem in different geographical locations. By adopting these strategies and methods of approaching the issue, it is possible to propose solutions or, in other words, policies, and then implement them, which will lead to the adjustment and elimination of the problem of sparse growth in cities (Hawkins, 2011). To this end, they emphasize growth in the city center and support compact land allocation with a focus on (a) public transport, (b) a walkable and convenient city for cycling, (c) mixed land use, and (d) a variety of housing options (Chrysochoou et al., 2012).

Smart development is a guarantee that the development of neighborhoods, cities, areas, and housing is economically precise, environmentally responsible, and socially responsible for the development of sustainability, resulting in improved quality of life (Hoseinzadeh & Safari, 2012). In another perspective, smart development is a sustainable development that is achieved through increased use of innovation, knowledge, research, and learning. Promoting smart rural development requires policies that facilitate innovation, knowledge, and learning. However, applying the concept of smart development into rural areas may be more complex. As McCann and Ortega-Argilés (2013), Vanthillo, and Verhetsel (2012) point out, smart development is not a concept of specific size for everyone, but its application in rural areas requires the incorporation of various initiatives with

widespread management(Naldi et al., 2015). Sustainable rural development is a process that emphasizes the all-round promotion of rural life by fostering and encouraging activities commensurate with environmental capabilities and impasses. As a way of making life accessible to current and future generations, emphasizing the continuous improvement and development of human environmental relationships has been identified as one of the most important goals of sustainable rural development (Hemmati & Pazira, 2018). Therefore, it can be said that smart rural development and sustainable rural development have the same goal as they both seek to improve the village based on their own local knowledge and capabilities and impasses.

The United States Environmental Protection Agency (2015) provided questionnaires to assess smart growth strategies in 11 districts in small towns and rural communities so that users can use them to monitor smart growth and identify gaps in policies and programs. Yang (2009) proposes the concept that «if smart is sustainable?» using the index-based evaluation model to evaluate smart growth policies and their successful approaches shows that smart growth policies do not fully incorporate sustainability values. Edwards and Haines (2007) in their study have presented a framework for evaluating the use of smart growth principles in local master plans and showed that communities do not fully embrace smart growth guidelines. In a paper focusing on smart growth from the perspective of rural areas Naldi, Nilsson, Westlund, and Wixe (2015) analyzed the logical ideas of smart growth policies. The present paper also presents indicators of smart rural development and investigates their relevance in future empirical studies. In a study Mirza Danish Beg (2018) argued that we should give priority to «smart rural development» since maintaining the sustainability of rural areas will have a positive impact on cities and every economic sector in the long run, as well as providing potentials for smart cities (Park & Cha, 2019). As stated by Zavratnik, Kos, and Stojmenova Duh (2018):

> They argued, along with focusing on the existing practices of the concept of smart village and the importance of digital transformation for rural areas, we have reviewed the existing procedures. We give special attention to EU policies, which we are currently using as a framework for understanding our future examples. We have shown the differences between the findings and insights of different regions and evaluated the methods presented. Our main argument stems from previous experiences and other research approaches, arguing that rural areas are not uniform and that smart rural development should be applied in conjunction with a place-based approach. We present the case of Slovenian experimental methods and support our argument by proposing the FabVillage concept.

In their book entitled "Smart development for rural areas," Torre, Corsi, Steiner, Wallet, and Westlund (2020) question the thinking of the Horizon 2020 Strategy Framework and smart development policies. Its purpose is to answer the following question: Is it possible to have a smart development policy and smart expertise in rural and peripheral areas? Based on detailed analytical studies, experimental

methods and econometrics, as well as various European case studies, different conclusions are obtained. Smart development policies are well suited to developed or intermediate areas containing rural and urban areas at the same time, but in fact are no different for rural or peripheral areas. Rural development policies along with their specific characteristics, should be consistent with the structure of their economies—agriculture, small businesses—and also in their diversity—remote areas, middle areas, rural areas near urban areas. It seems that the exploitation of natural and cultural facilities, the development of multifunctional agricultural personality, and the promotion of land innovation in all its forms, are in favor of synergy between different land and space applications, and the development of knowledge in the field of environment, socio-economic processes and territorial governance mechanism. These results are crucial because they call into question the validity of Horizon 2020 policy and smart development policies and their application throughout the European region and not just for most urban and affluent areas.

The results of the research by Anabestani and Javanshiri (2018) show that the rural creative economy index with a weight of 0.534 has the highest value in rural development and environmental factor and human capital values indices accounted for weights of 0.214 and 0.148 ,respectively, in rural smart development. Also, studying smart development in rural areas of Binaloud city, Iran (Abardeh Olya, Jaghargh, Hesar Golestan, and Virani villages) Anabestani and Javanshiri (2016) are seeking to present a framework of this strategy including the principles and factors affecting its formation. The results of the study indicate that the physical and environmental indices of the sample villages are inadequate for smart development. Looking at the research background, it can be said that given the high degree of heterogeneity of rural areas—even in one area—potential indicators and measures for smart development and its effective indicators need further study and analysis in order to take advantage of the potentials and opportunities of this policy for the possibility of growth in a diverse set of rural areas. On the other hand, it is worth mentioning that there have been studies in the field of rural development, each of which has focused on specific aspects. Yet, few studies have been done in this area and lack of enough studies in the field necessitates the study of key propellants affecting smart rural development; in the present study, based on the indicators extracted from the research background, the key propellants affecting the formation of smart rural development in the study area are obtained.

Therefore, recognizing and investigating smart growth indicators as a new strategy in the development of rural settlements can be a helpful strategy for achieving sustainable rural development. Rural development must be designed within the overall framework of national policies. This is because national sustainable and integrated development focuses on sustainable development at the regional, urban, and rural levels. However, evidence suggests that rural development has been neglected in proportion to its share, position, and function in the national economy and that rural areas experience unequal access to opportunities and benefits resulting from growth and development. Smart development is a sustainable development that can be achieved through increasing the use of innovation, knowledge, and learning. Promoting smart rural development requires implementation of policies to facilitate innovation, knowledge, and learning in rural areas. The present study seeks to identify and analyze key propellants affecting the formation of smart rural development. Therefore, the main question of the study is: What are the key propellants affecting the formation of smart rural development in Jovein city?

2.0 Theoretical Literature of Research

In general, the concept of 'smartness' for smart urban communities is now fully established—for example, smart cities. The concept of the smart village has recently been proposed for rural communities. In the European Union, the Smart Village Initiative was launched by the European Parliament in 2017, and the EU Action Plan for smart villages was published by the European Commission and the European Parliament. In addition, 'smart villages' started as a subset of the European Network for Rural Development (ERND) in 'smart and competitive Rural Areas' between September 2017 and July 2018 (European Network for Rural Development, n.d.).

2.1 Smart Development

Smart development is a movement that controls the negative effects of sprawl and prepares alternatives for future development. Smart development is a proposed development paradigm that tackles sparse development by making effective use of nature and environmental structure, thereby reducing socio-economic inequalities, and protecting the natural environment. Smart urban development is a form of planning for urban-suburban development and transport theory that focuses on (a) balanced development in the city center, (b) avoiding unreasonable expansion and unbalanced congestion in the city, (c) a tendency towards appropriate displacement, (d) identifying routes for walking and cycling, and (e) comprehensive development with an appropriate degree of accommodation choice. Smart urban development has a long-term outlook and supports short-term plans. The goals of the program are to achieve a sense of social and spatial unity in (a) individuals, (b) transportation development, (c) employment, (d) choice of accommodation, (e) balanced distribution of costs and benefits of development, (f) preservation and improvement of natural and cultural resources, and (g) promotion of social welfare (Hosseinzadeh Dalir & Safari, 2012). Smart development has been recognized as a sustainable solution worldwide to existing urban planning issues, the principles of which are to deliver better quality of life and promote livable communities. Although its meaning is vague, because there is no universal definition. The reason for the ambiguity is the number of dimensions it represents and, therefore, this concept needs to be standardized to scale development around the world (Randhawa & Kumar, 2017).

2.2 Smart Rural Development and its Dimensions

Smart growth and all it entails, is not a new concept. In EU policy, the smart growth framework encompasses knowledge, innovation, education, and research policies: while in the United States it is more related to planning policies to counter urban sprawl. This can be attributed to different reflections and interpretations of particular challenges in the EU and the USA. The overall goal of smart growth in the United States is about urban planning and construction policies, especially preventing urban sprawl. But, in the EU, smart growth is less about planning and more about working with innovation, education, and research policies. But why the EU has not adopted the American definition of smart growth is probably because the problem of urban sprawl is a common problem in the United States, whereas, in the European Union the issues and problems of economic growth of European countries are focused, which include lower productivity, innovation, and growth

(Barca, McCaan, & Rodríguez-Pose, 2012; Combes & Overman, 2004; European Commission, 2010).

Smart development is a sustainable development that is achieved through increasing the use of innovation, knowledge, research, and learning. Promoting smart rural development requires policies that facilitate innovation, knowledge, and learning in rural areas. However, transforming the concept of smart development into rural areas can be more complex. As McCaan and Ortega (2015) and Vanthillo and Verhetsel (2012) point out, smart development is not a concept of specific size to fit all, but its application in rural areas requires the incorporation of various initiatives with widespread management. (Naldi et al, 2015). The current research approach to rural development is based on the EU perspective; the European Union vision of smart rural development is based on sustainable development and is a strategy to achieve the principles and objectives of sustainable development.

2.3 What is a Smart Village?

The so-called smart development of infrastructure is hardly divided into two polar sets of frameworks, rural and urban. As explained by (Srivatsa, 2015) on India's smart development, it is necessary to consider both spaces and intermediate connections simultaneously, and keep in mind that significant changes in one person will affect another person and the other way around. What exactly do we mean by smart development, what are smart villages? Is there a clear definition of a smart community?

There is no clear and specified definition of any of them (Gascó-Hernandez, 2018) since the communities are not a ‘thing’, and they are not unchangeable and inconvertible, therefore, they are always dependent on the environment and changes in social and cultural structures. Each proposed definition depends on different circumstances and social problems, and reflects the problems faced by each member of society. For example, in the discussion of smart growth programs in Wisconsin, USA, Edwards and Heinz (2007) define six goals of it which are mostly included in these programs in the case of Wisconsin. For their part, the emphasis has been on the following: (a) creating new housing options and opportunities, (b) access to communities on foot, (c) strengthening the sense of place in communities, (d) environmental protection of different regions, (e) connecting to new and existing development goals, and (f) more types in terms of transportation (Veronika Zavartnik et al., 2018). On the other hand, the European Union is moving towards the use of ‘smart’ growth on the wings of the ‘knowledge-based economy’ (Naldi et al., 2015). Orbàn, (2017) is preparing a report on sustainable villages in Hungary. Turistvandi, for example, is a small village that began its journey towards the "smart village" label in agriculture with a decision to become self-sufficient in food production. Due to smart and successful decisions agriculture and the level of education of the villagers has increased; the population has grown and health care has improved (Orbàn, 2017).

As claimed by Jucevičius, Patašiene, & Patašius (2014), a more comprehensive and precise analysis of innovations and actions, highlights the social smart system. The important finding is that, when we look at smart system, it is not always based on information and communication technology (ICT). In the proposed model, instead communication with the environment is put more into consideration.

Although, the digital dimension of all models of smart cities and villages are important to all of them (Glasmeier & Christopherson, 2015).

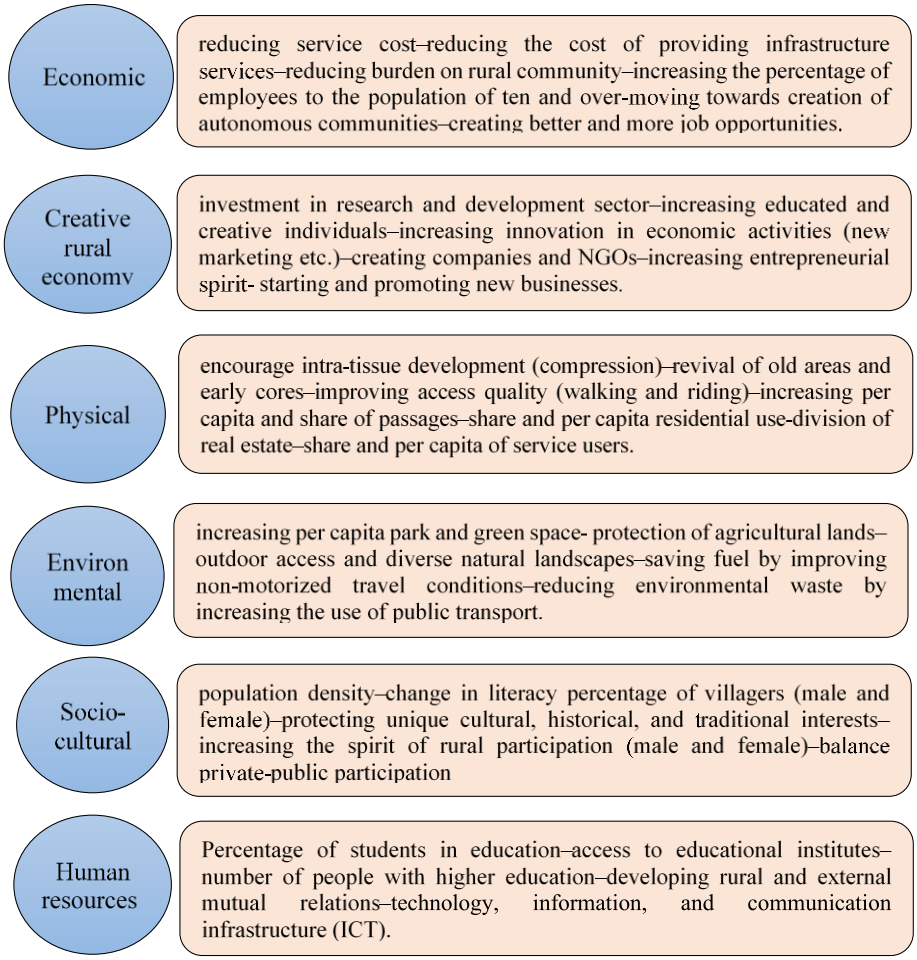
The smart dimension of development may not always be labeled 'smart', but can be intertwined with other dimensions. As with Sustainable Development Goals—most of which deal with smart dimensions—there are other specific aspects to consider: (a) stability, (b) welfare, (c) education—inclusive and fair quality, (d) enabling women and girls, (e) water resources management, (f) access to sustainable energy, (g) sustainable economic growth and proper jobs, (h) building flexible infrastructures, (i) strengthening innovation, (j) reducing inequalities, (k) constructing inclusive and sustainable human settlements, (l) measures to combat climate changes, and (m) maintaining ecosystems, etc. (Envision, n.d.).

Trying to define smart growth precisely allows us to propose only vague, very broad definitions of smart communities. This is because classifications are always dependent and based on specific conditions (e.g., geographical conditions—social and natural resources—and are affected by the challenges that societies face) (Hayat, 2016).

If the transition to smart infrastructure is important for urban living environments, this transition is more needed and complex in the case of residential areas. It is necessary to use local and regional knowledge and implement it in order to identify the challenges and their potential solutions in this case. More specifically, in the context of the European Union, the concept of smart villages refers to 'rural areas and communities' that build on their existing strengths and assets, as well as the development of new opportunities. In small villages, traditional networks and services are increasing with the use of digital technologies, telecommunications, innovations and better use of knowledge for people and businesses (EU Action for Smart Villages, 2018). To summarize, in order to use the concept of smart village, it is necessary to use integrated approaches, to create effective public-private partnerships, to create supportive policy frameworks and to provide access to financial mechanisms (Van Gevelt et al., 2018). The important point in this process is that communities should not apply growth patterns that are not compatible with the demands of society and cultural environments.

The Smart Village enables its residents to take advantage of their contemporary technological and social achievements, while their infrastructures are still developed in line with the goals of sustainable development, providing an opportunity to effectively address the future of energy security and local and regional economies (Zavartnik et al., 2018).

Figure 1. Six-dimensional diagram of smart rural development.



Source: Anabestani & Javanshiri, 2016.

Designing and compiling smart rural development indicators is one way to operationalize the concept of smart rural development. The European Commission's (2020) titled: "Europe 2020: A European strategy for smart, sustainable and inclusive growth" specifies that smart growth can be achieved through the development of a knowledge-based economy. The concept of innovation used by the European Commission is broader than technological innovation and technological advancement. Innovations include new and improved forms of service, new marketing, branding, and design methods as well as new forms of business. Therefore, entrepreneurship—starting and growth of a new local business—is an important dimension of innovation and a key indicator of smart growth, especially in rural areas, and that entrepreneurship is defined as «newly formed innovations of independent companies».The fact is that rural areas that are less attractive to non-local businesses are leading to the emergence and success of new local businesses, which are key aspects of smart rural development (McCaan & Argiles, 2015).

3.0 Research Methodology

The present study is conducted using descriptive-analytical method with applied purposes. In this research, data collection was done through documentary—library resources, scientific journals—and field—questionnaire—methods. In the present study, structural equation model was used to identify and extract key propellants affecting the smart rural development. The questionnaire was prepared in the form of the MICMAC and Schwartz questionnaires and distributed among the community members in order to extract the key propellants affecting the formation of smart rural development in the sample villages of Jovein County. The statistical population in this study will be rural municipalities of villages with a population of more than 1000 people per town; for this reason, these villages are expected to have the necessary infrastructure to achieve smart development. According to what was said 10 villages have been selected as a sample—in addition, a number of experts from 8 organizations involved in rural areas are also part of the statistical community. A total of 18 questionnaires were considered for rural experts in the relevant organizations. Questionnaires were completed by rural municipalities of 28 sample villages and experts of 20 relevant institutions including: (a) Jovein County governor, (b) bailiff, (c) agricultural jihad, (d) Labor Department, (e) Cooperative and Social Welfare, (f) Road and Urban Planning Department, (g) Faculty of Geography of Hakim Sabzevari University, (h) Imam Khomeini Relief Committee, and (i) Hope Entrepreneurship Fund. To evaluate the validity of the questionnaire, the opinions of university professors were used and the necessary modifications were made based on the suggestions presented. After completing the questionnaire, Cronbach's Alpha method was used to assess reliability. Given that the Alpha content of this variable is above 0.7, their reliability is considered acceptable and appropriate. MICMAC software was used for data analysis and structural impact analysis of each of the key indicators affecting the formation of smart rural development. Initially, the impact of the variables on each other was evaluated from zero to four based on the spectrum defined in the software and experts' opinions. Then, the direct and indirect impacts and the indicators having direct and indirect effective and impressionable potentials and finally the most effective key indicators have been identified. In this section it is worth noting that the six dimensions of smart rural development have been transformed into three indicators and tested. The three indicators under study include rural creative economy resulting from integration of economic and rural creative economy indicators; Physical-spatial indicator is the result of integration of physical and environmental indicators; Socio-cultural index is the result of integrating socio-cultural index and human capital. The reason for this has been to reduce the number of decision matrices and procedures based on the similarity of these dimensions.

Jovein County, is located in the center of the cities of Khorasan-e-Razavi province, which consists of two parts: central and Atamalek. The city, with an area of about 1,656 square kilometers, with an average elevation of 2 meters above sea level, is located on the northern slope of the Joghatai Mountains and the southern slope of the Aladagh Mountains and has a longitude of 57 degrees 25 minutes 19 seconds East and latitude of 36 degrees 42 minutes and 22 seconds North. Jovein is the neighbor of Esfaraien; Khoshab; Sabzevar and Dovarzan; and Joghatai from north, east, south, and west, respectively. It has a population of 54,488 according to the Census of 2016 (Iranian Statistical Center, 2016). In addition, passing the Tehran-Mashhad railway from the center of the region has made it a privileged location.

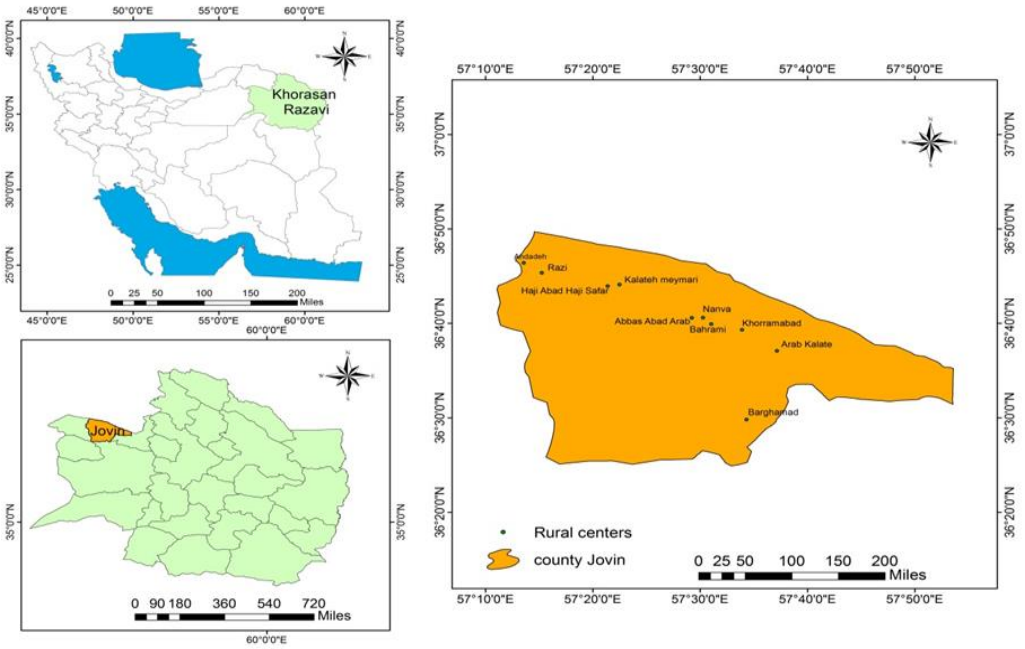
Figure (2) shows the position of the city in the province and the location of the province relative to the country.

Table 1. *Indices and Definitions Affecting the Formation of Smart Rural Development*

Dimensions	**Indices**
Rural creative economy	Reducing service costs, reducing the cost of providing infrastructure services, reducing burden on rural community, increasing the percentage of employees to the population of ten and over, creating better and more job opportunities, moving towards creation of autonomous communities, investment in research and development sector, increasing educated and creative individuals, increasing innovation in economic activities (new marketing etc.), creating companies and NGOs, increasing entrepreneurial spirit, starting and promoting new businesses, access to local markets (such as local festivals), the presence of industry interactions, empirical knowledge (individual skills)
Physical-spatial	Increasing per capita park and green space, protection of agricultural lands, outdoor access and diverse natural landscapes, saving fuel by improving non-motorized travel conditions, reducing environmental waste by increasing the use of public transport, encourage intra-tissue development (compression), revival of old areas and early cores, improving access quality (walking and riding), increasing per capita and share of passages, share and per capita residential use-division of real estate- share and per capita of service users
Socio-cultural	Population density, change in literacy percentage of villagers (male and female), protecting unique cultural, historical, and traditional interests, increasing the spirit of rural participation (male and female), balancing private-public participation Percentage of students in education- access to educational institutes, number of people with higher education, developing rural and external mutual relations, technology, information, and communication infrastructure (ICT).

Source: Anabestani & Javanshiri, 2016; Anabestani & Javanshiri, 2018.

Figure 2. Location of the study area.



Source: Authors, 2020.

4.0 Results

The descriptive findings show that out of 48 experts, 42 (87.5) are male and only six (12.5) are female. Of the respondents, 24 (50%) held diplomas and postgraduate degrees, seven (14.6%) held bachelor's degrees, 14 (29.1%) held master's degrees and only three (6.2%) held PhDs. Using field studies and libraries, the most important factors influencing the formation of smart rural development in rural areas were identified. Then using a quantitative method of future studies and structural equations (MICMAC), we attempted to address the extent to which the identified factors are influenced or effective (see Table 2). Given the dimension of the three matrices—rural creative economy, physical-spatial, and socio-cultural economy their Fill rate is between 90% and 100%, indicating that the selected factors had a great impact on each other. Of all 391 evaluable relationships in these matrices, there are 22 relationships with the value of zero which means the factors did not affect each other or were not influenced by each other. Fifty relationships had the value of one which meant that they had little impact on each other, 175 relationships had the value of two which meant they had a relatively strong influential relationship, 166 relationship with the value of 3 which meant the key factors had very strong relationship and affected each other or were affected by each other. Finally, there was no relationship with P value which shows the potential and indirect relationship of factors.

Table 2. *Matrix Data Analysis and Cross Effects*

Matrix data	**Rural creative economy**	**Physical-spatial**	**Socio-cultural**
Matrix dimensions	13	10	12
Number of repetitions	2	2	2
Number of zero	0	10	12
Number of one	17	6	27
Number of two	76	40	59
Number of three	76	44	46
Number of P	0	0	0
Total	169	90	132
Fill rate	100%	90%	91.66%

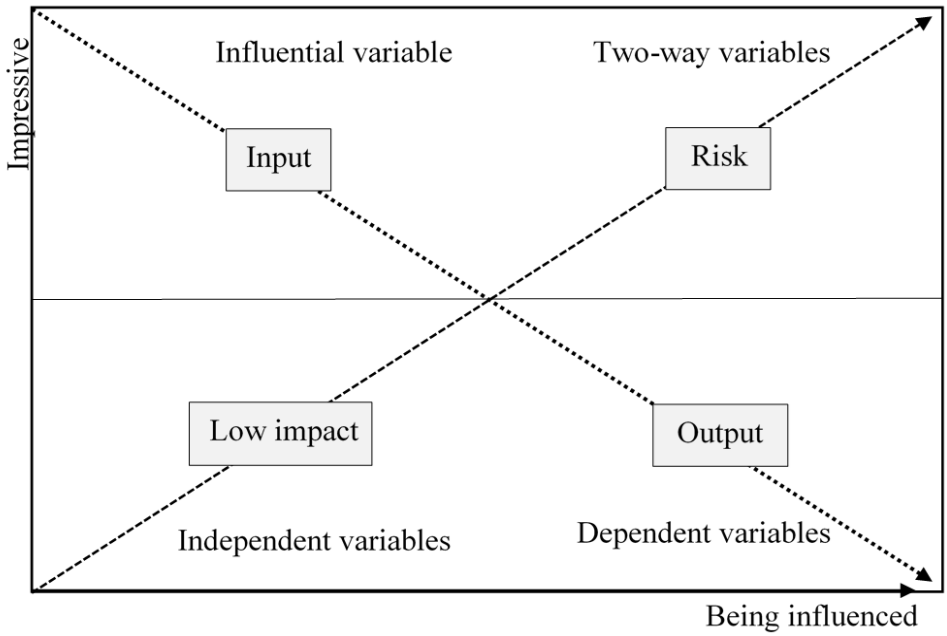
In the cross matrix, the sum of the rows of each variable shows the amount of impact and the column sum of each variable. It also shows the degree of impact of that variable on other variables. How the variables are distributed and dispersed on the scattering plate indicates the stability or instability of the system. In the methodology and MICMAC analysis, there are two types of dispersions known as stable systems and unstable systems. In stable systems the dispersion of variables was shown as L—which meant that some variables were highly effective and some were highly affected. In stable systems only three variables can be observed: (a) variables highly effective on system—key factors, (b) independent variables, and (c) system output variables—result variables.

According to Figure 3 the position of each of the factors and their roles in the system is quite clear. But, in unstable systems the status is more complex than in stable systems. In this system the variables are scattered around the polar axis of the plate, and the variables often exhibit an intermediate state of influence which makes it difficult to evaluate and identify key factors. However, there are ways in this system to guide the selection and identification of key factors. In general, the variables have two types of impact, which will be examined respectively.

4.1 The Key Propellants of Creative Economy Affecting the Formation of Smart Rural Development

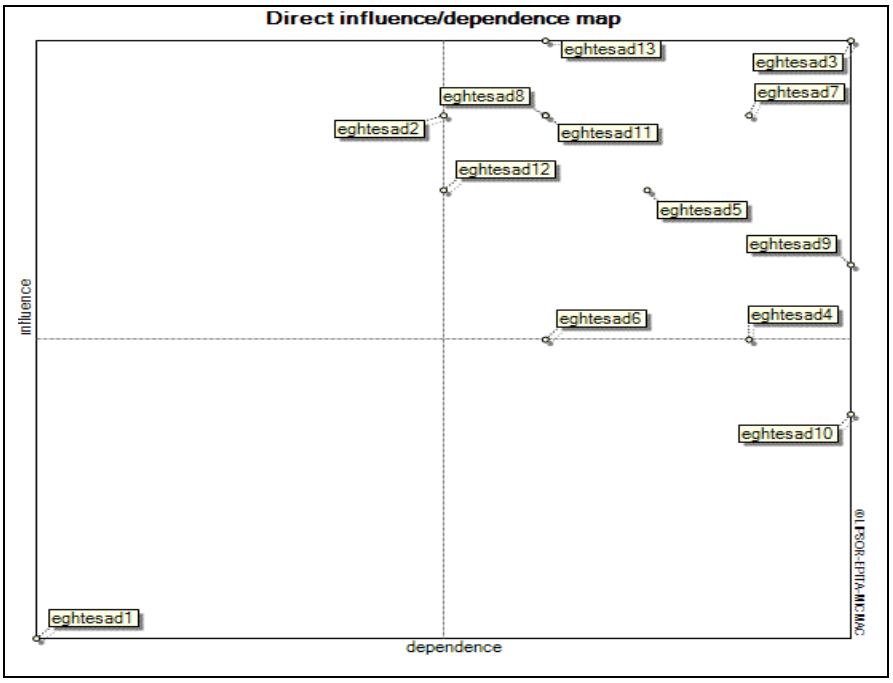
As can be seen in the output scatter map of the direct and indirect effects in Figure 4, 13 key factors of the rural creative economy index affect the formation of smart rural development in the villages under study. In addition, studying the effects of indirect potentials, it can be observed in Figure 4 (b bottom), that the most widely distributed and dispersed indicators are bi-directional variables.

Figure 3. Impact analysis of variables.



Source: Anabestani & Hosseini, 2018.

Figure 4. Status map of direct and indirect impacts of rural creative economy factors affecting the formation of smart rural development.



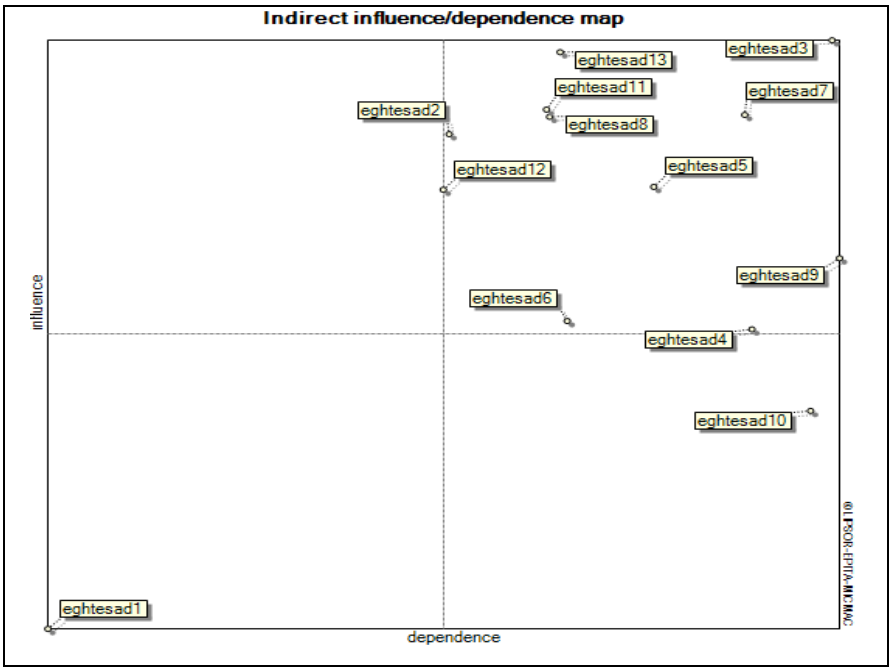
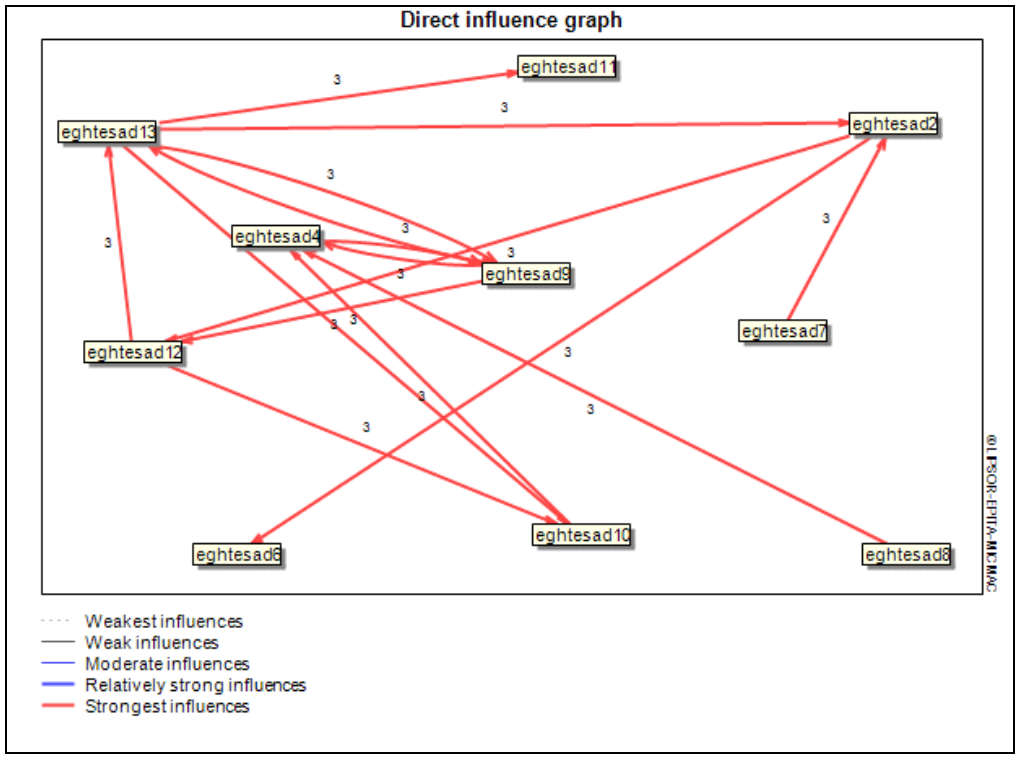


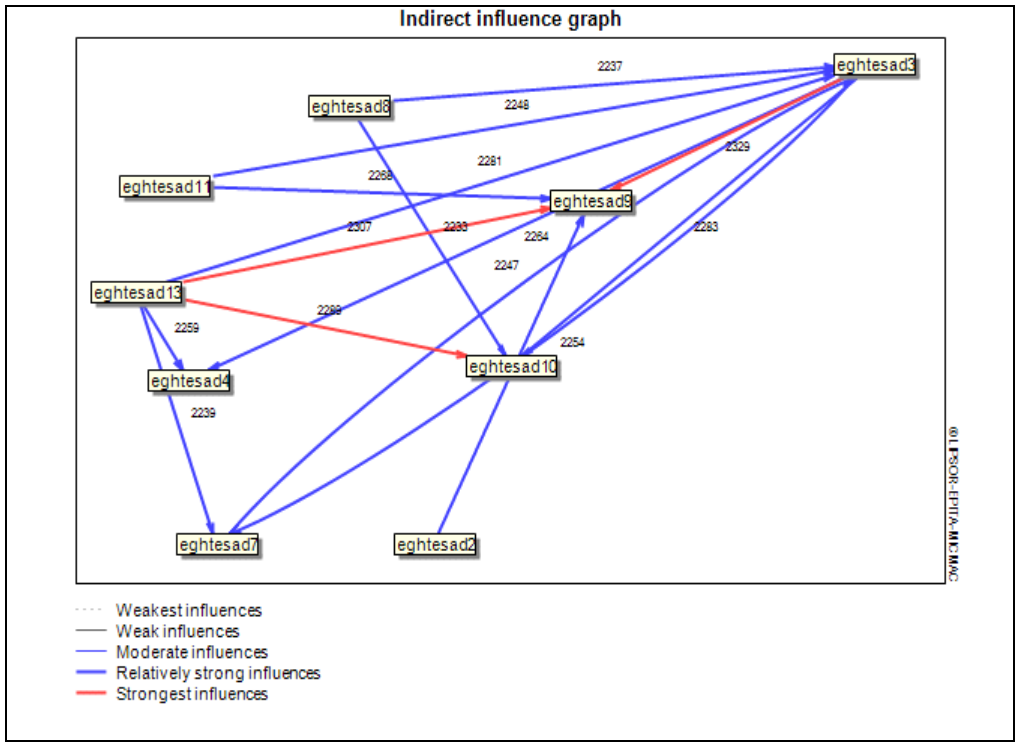
Table 3. *Analysis of Direct and Indirect Impact of Rural Creative Economy Factors Affecting the Formation of Rural Development*

Variable type	**Relevant indices**
Affecting variables	Cost reducing and efficient transportation of the village (2)
Affected variables	Attracting new economic activities in the village (10)
Independent variables	Reducing the cost of providing services to villages and facilities and infrastructure with intensive development (1)
Bi-directional variables	
Risk variables	Creating and developing better job opportunities resulting in increased employment along with reducing the burden of the rural population (3), creating autonomous communities by improving the services and facilities in the village (4), increasing investment in education and increasing the number of highly educated people in the village (5), increasing the innovation in the economic activities and marketing of the rural products (6), increasing the entrepreneurial spirit among the villagers (9), increasing access to creative workers (based on skills and knowledge) in the village (11), accessing local markets (eg, By increasing local festivals) (12), establishing cross-industry activities such as tourism, food, and cultural production (13)
Target variables	Attracting new economic activities in the village (10)

The amount of impact that each of these factors has on the others has reached to various exponentiations by the structural equation modeling (MICMAC): the sum of which makes little or no impact. In this regard, according to the 13 variables examined for the rural creative economy index (see Figure 5 [a above]), the variables of creation and development of better job opportunities resulting in increased employment, along with a reduction in the burden on the rural population (32), the launch and growth of local business in the village (32), the attraction of new economic activities in the village (32) respectively have the highest calculated column value and the most impact on other variables. In other words, the most important characteristic of these variables is being highly affecting and not being affected. In the indirect effect of the variables on each other, the software raises these variables to the powers of 2, 3, 4, 5, etc. and accordingly, the relevant effects are measured. Meanwhile, the variables of launch and growth of local business in the village (27,890), the creation and development of better job opportunities and consequently the increase of employment along with the reduction of burden on the rural population (27,827), the attraction of new economic activities in the village (27,647). had the highest calculated column values, respectively, and received the most impact from the other variables. Figure 5 (bottom).

Figure 5. Map of direct (above) and indirect (bottom) relationships between variables—very weak to very strong impacts.





In terms of the direct and indirect impact matrix, it can be said that the indices of creating and developing better job opportunities and consequently increase of employment along with reduction of burden on the rural population and creating cross-industry activities such as tourism, food and cultural production had the first and second larger impact and the largest share in the issue of rural development. The variables of creating and developing better job opportunities and consequently increasing employment along with reduction of burden on the rural population and creating cross-industry activities such as tourism, food and cultural production had the first and second indirect impact. In terms of the direct and indirect dependency matrix, it can be said that the indices of creating and developing better job opportunities and consequently increasing employment along with reduction of burden on the rural population and creating cross-industry activities such as tourism, food and cultural production and launching and growing local business in rural areas had first and second dependency rates and the highest share in smart rural development. The variables of local business growth and development in the village and creating and developing better job opportunities and consequently increasing employment along with reduction of burden on the rural population are in the first and second indirect dependency rates (see Table 4).

Table 4. *Key Factors of Creative Economy Affecting the Formation of Smart Rural Development*

Rank	Direct impact	Indirect impact
1	Creating and developing better job opportunities and consequently increasing employment along with reduction of burden on the rural population	Creating and developing better job opportunities and consequently increasing employment along with reduction of burden on the rural population

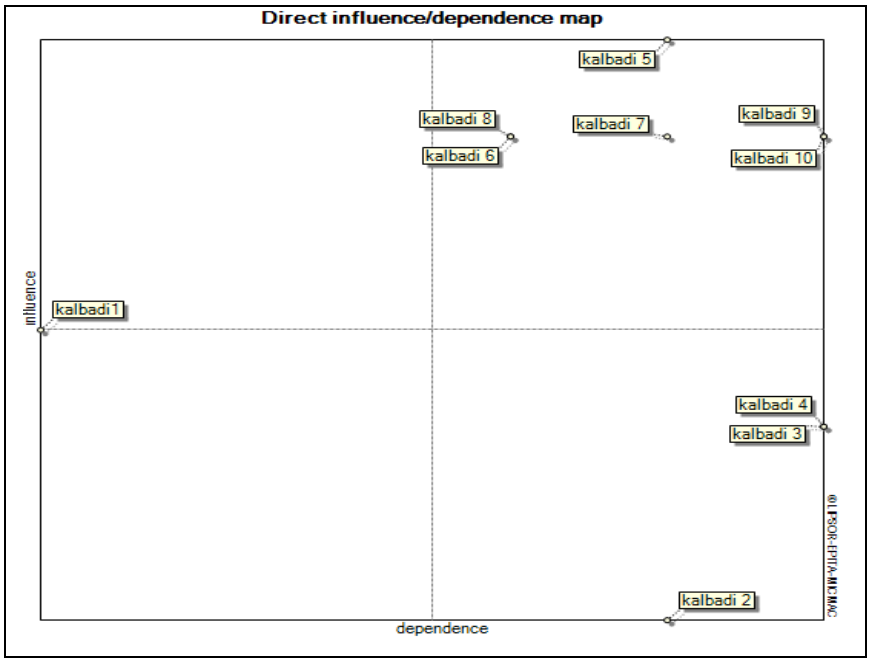
Table 4 continued

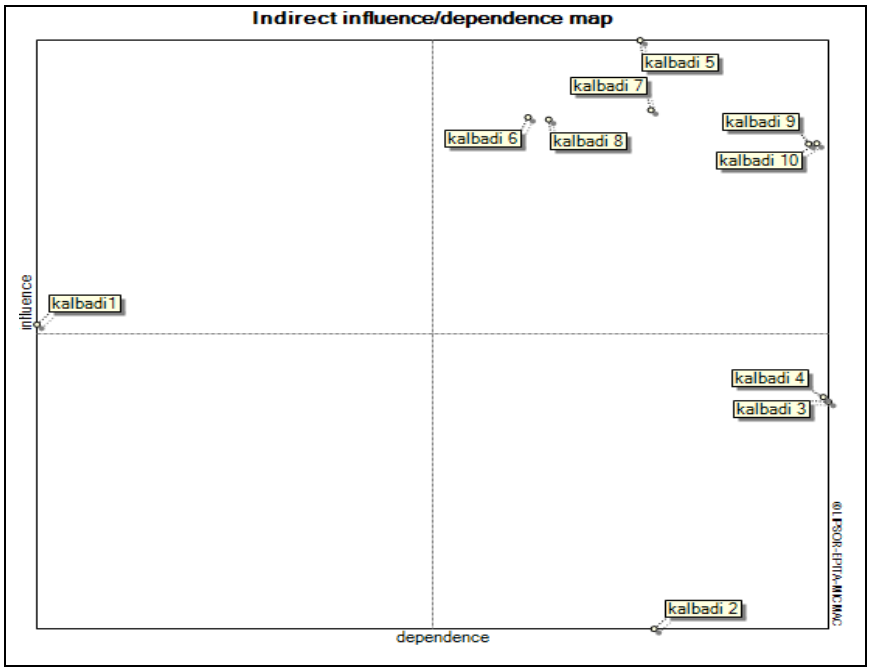
2	Creating cross-industry activities such as tourism, food and cultural production	Creating cross-industry activities such as tourism, food and cultural production
3	Reduction of costs and efficient transportation in the village	Increasing access to creative workers—based on skills and knowledge—in the village
4	Increasing entrepreneurial spirit among villagers	Increasing entrepreneurial spirit among villagers

4.2 Key Physical–Spatial Propellants Affecting the Formation of Smart Rural Development

As shown in the output scatter map of the direct impacts of Figure 6 (above), 10 key factors affecting the formation of smart rural development in the studied villages of the city of Jovein can be seen. In addition, the indirect potential impacts as shown in Figure 6 (bottom) it is observed that, the highest distribution and dispersion of the indices include the bi-directional variables.

Figure 6. Status map of direct (above) and indirect (bottom) impacts on physical–spatial factors affecting the formation of smart rural development.





The amount of impact that each of these factors has on each other was raised to various powers by the MICMAC structural equation model: the sum of which makes little or no impact. Based on the results of Figure 7 (above), the key propellant forces can be presented in terms of impact as follows. In this regard, with respect to the 10 variables examined for physical-spatial factors, per capita and pedestrian share indices (23), residential land use—new and large scale units—in the village (23), increasing public transport and non-motorized trips—bicycle and pedestrian—and saving fuel in the village (23) and reducing environmental waste in the village (such as pollution of soil and water and reducing waste production, etc.) (23), had the most impact comparing other variables. In other words, the most important feature of these variables is being low impacted and having high impact. In the direct effect of variables on each other, the software raises these variables to the powers of 2, 3, 4, 5, and accordingly the relevant impacts are measured. Meanwhile, the variables of increasing per capita and share and ratio of asphalt roads and pedestrians to rural areas (10,915), increase in share and per capita of residential land use—new and large scale units—in the village (10,902) and reduction of environmental waste in the village—such as pollution—(10,883) had the highest calculated column values and being highly impacted by other variables. Figure 7 (bottom).

Table 5. *Analysis of the Direct and Indirect Impact of Physical–Spatial Factors Affecting the Formation of Smart Rural Development*

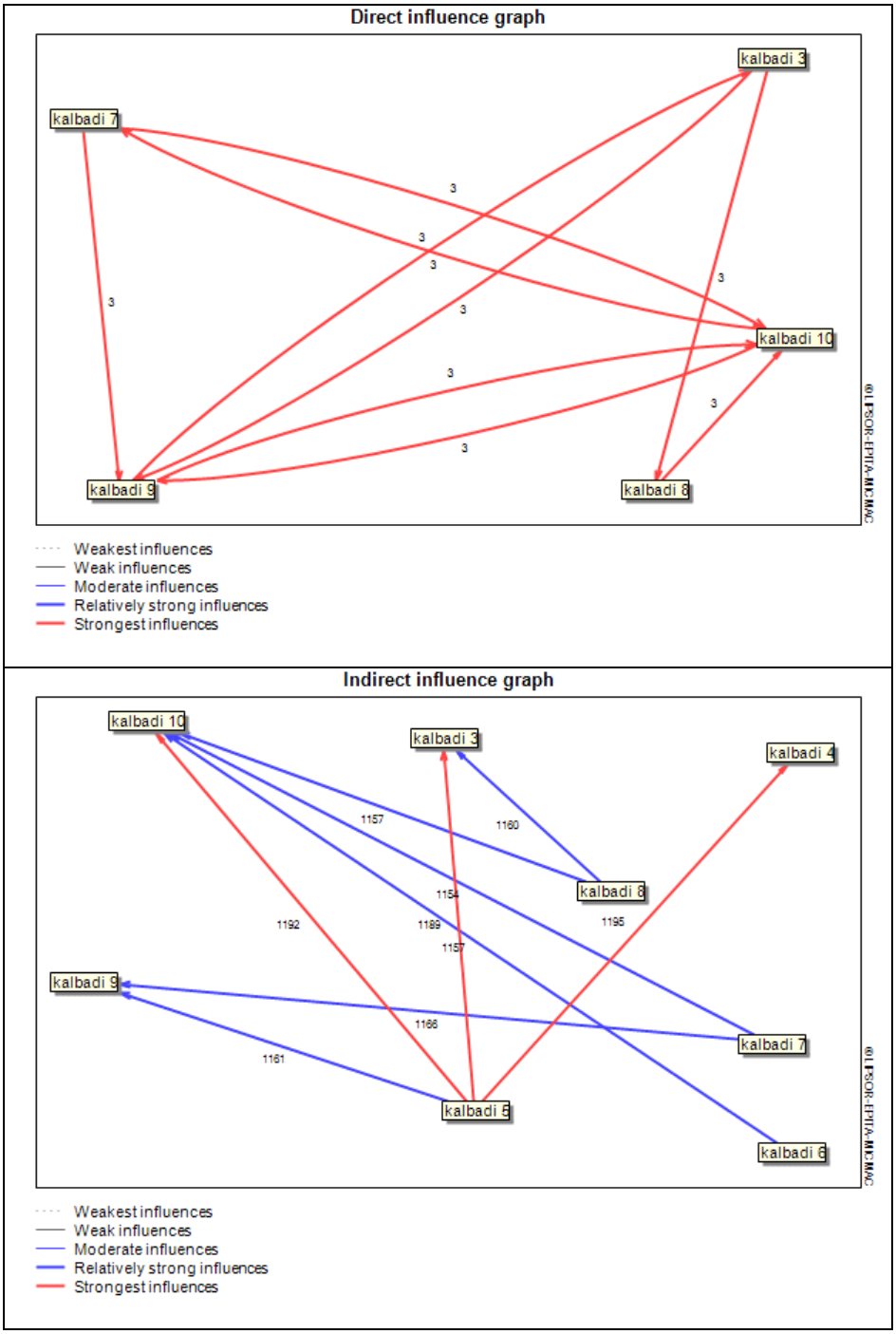
Variable Type	**Relevant Indices**
Impact Variables	Impact variables of building development within the physical texture of the village and compression rather than dispersal in future construction (interfacial development) (1).

Table 5 continued

Impacted Variables	Improving the quality of access roads (sidewalks, street and intersections) and the light rural traffic (2), increasing the per capita and share of asphalt roads and pedestrian crossings (3), increasing the share and per capita of residential use (new and large-scale units) village (4)
Independent Variables	
Bi-directional Variables	
Risk Variables	Increasing the share and per capita of service uses (commercial and mixed commercial, educational, cultural-religious, health and therapy, recreational, tourism, administrative, and law enforcement, etc.) in the village (5), increasing per capita green space and parks in the village (6). Protecting agricultural lands and increasing per capita yields (7), access to open landscapes in the countryside (8), increasing public transport and non-motorized trips—bicycles and pedestrians—and saving on fuel. Village (9), reduction of environmental waste in the village (such as pollution of the soil and water and reduction of waste production, etc.) (10).
Target Variables	Increasing per capita and share of roads, ratio of asphalt roads and sidewalks to rural areas, increase of share and per capita residential use—new and large-scale units—in the village (3).

According to direct and indirect impact matrix, it can be said that the indices of increase of share and per capita service use in the village and increase of per capita landscapes and parks in the village have the first and second rates of direct impact and had the highest share in relation with the issue of smart rural development. The variables of increase of per capita and share of service use in the village and protecting agricultural lands and increase of per capita crops have first and second rates of indirect impact respectively.

Figure 7. The map of direct relationship (above) and indirect (bottom) between variables-very low to very high impact.



According to direct and indirect dependency matrix, it can be said that the indices of increase of per capita and share of asphalt roads and pedestrians relative to the space of village and increase of per capita and share of residential use—new and large-scale units—in the village have the first and the second indirect dependency rates respectively.

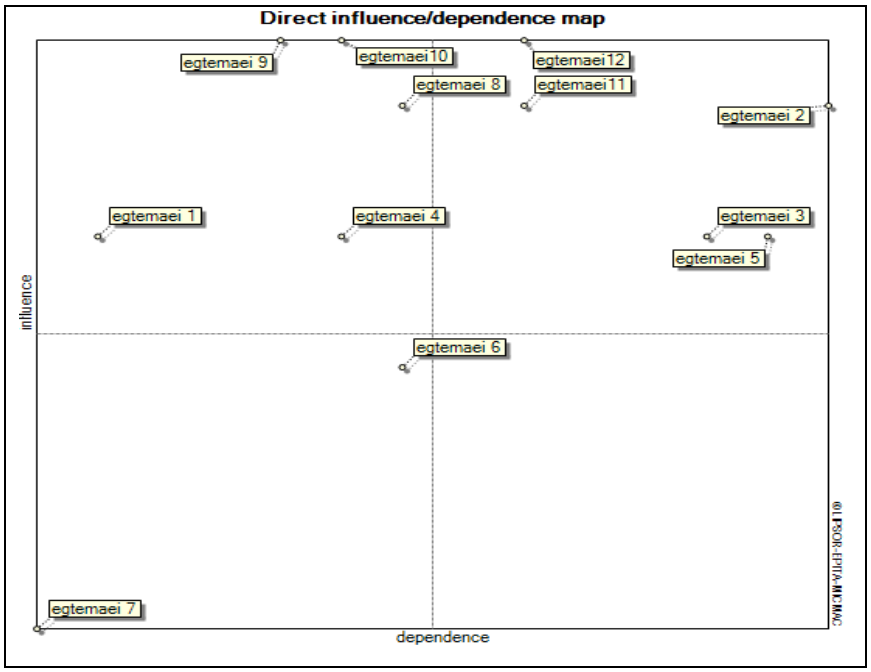
Table 6. *Key Physical–Spatial Factors Affecting the Formation of Smart Rural Development*

Rate	Direct impact	Indirect impact
1	Increase of share and per capita service use (commercial and mixed commercial, educational, cultural-religious, health and therapy, recreational-tourism, administrative-law enforcement, etc.) in the village	Increase of share and per capita service use (commercial and mixed commercial, educational, cultural-religious, health and therapy, recreational-tourism, administrative-law enforcement, etc.) in the village
2	Increase of per capita landscapes and parks in the village	Protection of agricultural lands and increase of per capita crops
3	Protection of agricultural lands and increase of per capita crops	Increase of per capita landscapes and parks in the village
4	Access to outdoor and diverse landscapes in the village	Access to outdoor and diverse landscapes in the village

4.3 The Key Socio-cultural Propellants Affecting the Formation of Smart Rural Development

As can be observed in the output dispersion map of direct impact in Figure 8 (above), there are 12 key factors of socio-cultural index affecting the formation of smart rural development in studied villages of Jovein. Also, studying the indirect potential impacts according to figure 8 (bottom) it is observed that the most distribution and dispersion indices are bi-directional and influential variables.

Figure 8. Status map of direct (above) and indirect (bottom) impact of socio-cultural factors affecting the formation of smart rural development.



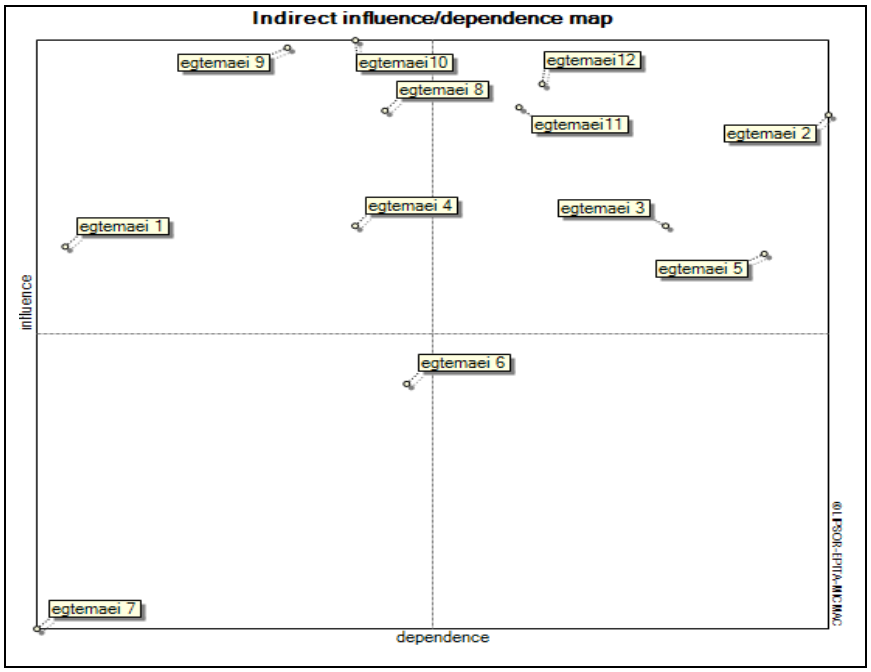


Table 7. *Analysis of the Status of Direct and Indirect Impact of Socio-cultural Factors Affecting the Formation of Smart Rural Development*

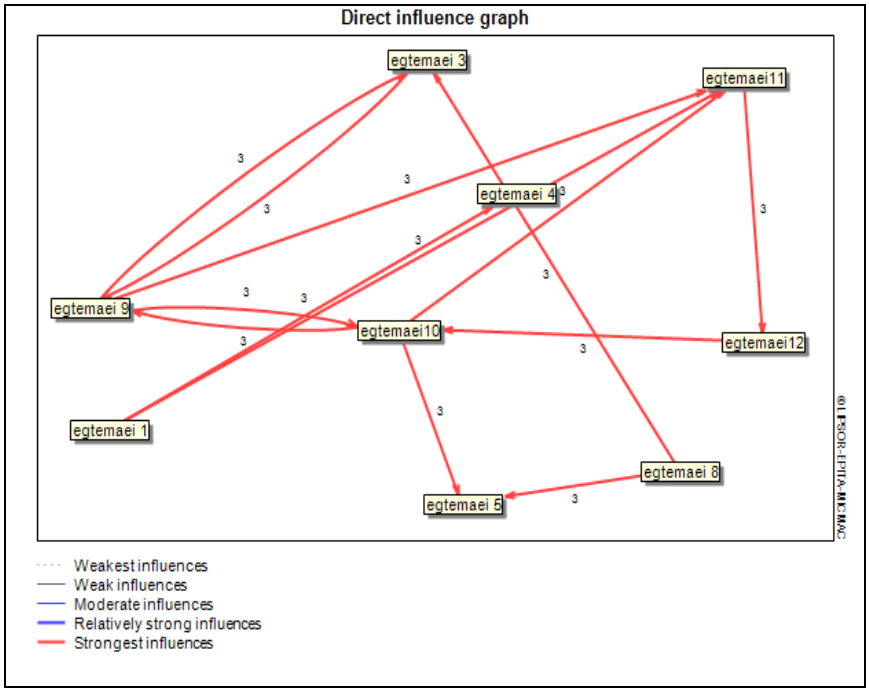
Variable Type	Indices
Impact Variables	Increasing net and gross population and household density in rural areas (1), preserving unique cultural, historical, traditional resources, etc., in the village (4), increasing the percentage of students enrolled in rural education (8), increasing the number of people with higher education and the tendency to stay in the countryside (9), access to higher education institutions and non-native knowledge in rural production for villagers (10).
Impacted Variables	
Independent Variables	Providing welfare in rural textures and roads by enhancing the quality of furniture (chairs, awnings, etc.) and upholding social justice in rural areas (7)
Bi-directional Variables	
Risk Variables	Increasing literacy rates among the villagers (2), improving the quality of life, social security, and environmental health in the countryside (3), increasing the spirit of participation among villagers (5), improving the information and communication technology infrastructure (internet, etc.) in the village (11), the development of village-outsourcing (links with businesses and enterprises, labor market flows and capital movements, especially large and mid-size cities (12).
Target Variables	Balancing public-private partnerships in rural development activities (6)

The amount of impact that each of these factors has on the others has been raised to various powers by MICMAC structural equation model: the sum of which includes the quantitative values of impact or being impacted. Based on the results in Figure 9 (above), the key propellant forces can be presented in terms of impact as follows. In this regard, of the 12 variables examined for socio-cultural index, the variables of increasing literacy percent among the villagers (30), increasing the participation among the villagers (29), promoting quality of life, social security and environmental health in village (28) had the most impacted by other variables. In other words, the most important characteristic of these variables is receiving low impact and having high impact. In the indirect impact of the variables on each other, the software raises these variables to the powers of 2, 3, 4, 5, etc., and on

this basis the respective impacts are measured. Meanwhile, the variables of increasing literacy percentage among the villagers (16,629), increasing the spirit of participation among the villagers (16,086) and promotion of quality of life, social security, and environmental health in the village (15,252) have the most calculated and highest pillar values. Other variables were influenced by figure 9 (bottom).

According to the matrix of direct and indirect impact, it can be said that the indices of (a) increasing numbers of people with higher education, (b) a tendency to stay in the countryside, (c) access to higher education institutions, and (d) non-native knowledge in rural production for villagers have the first and second impact rates respectively. According to the matrix of direct and indirect dependency, it can be said that the indices of increasing the literacy percentage among villagers and increasing the spirit of participation among villagers have the first and second rates of direct dependency and the highest share in relation with the issue of smart rural development. The variables of literacy percentage among villagers and increasing the spirit of participation among villagers have the first and second rates of indirect dependency.

Figure 9. Map of direct (above) and indirect (bottom) relationship between variables-very low to very high impacts.



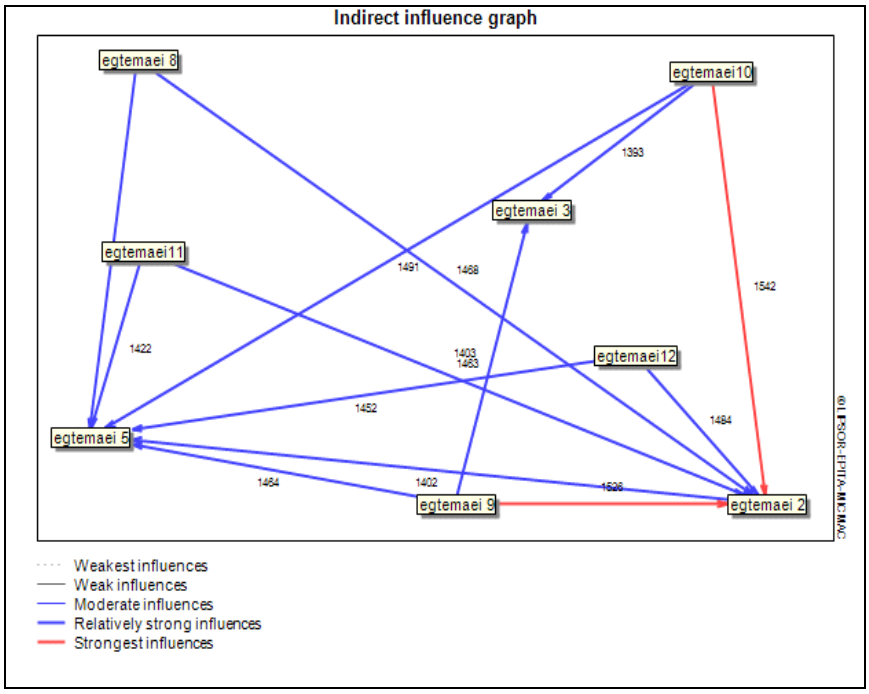


Table 8. *Key Socio-cultural Factors Affecting the Formation of Smart Rural Development*

Rate	Direct Impact	Indirect Impact
1	Increasing people with higher education and tendency to stay in the village	Access to higher education institutions and non-native knowledge in rural production for villagers
2	Access to higher education institutions and non-native knowledge in rural production for villagers	Increasing people with higher education and tendency to stay in the village
3	the development of village-outsourcing (links with businesses and enterprises, labor market flows and capital movements, especially large and mid-size cities	the development of village-outsourcing (links with businesses and enterprises, labor market flows and capital movements, especially large and mid-size cities
4	Increasing literacy percentage among villagers	Improving information and communication infrastructure (internet, etc.) in the village

5. Discussion and Conclusion

In sum, after examining each of the indices, all the key factors impacting—directly and indirectly—the formation of smart rural development are presented in three components: rural creative, physical-spatial, and socio-cultural economy (see Table 9). In the creative rural economy component, factors such as (a) creation and development of better job opportunities—consequently increasing employment, (b) reduction of burden on rural population, (c) creating cross-industry activities such as tourism, food and cultural production, (d) reducing costs and efficiency of transportation in the village, and (e) increasing the entrepreneurial spirit among the villagers have direct impacts and factors—such as creation and development of better job opportunities and consequently increasing employment, along with reduction of burden on rural population, creating cross-industry activities such as tourism, food and cultural production, Increased access to creative workers—based on skill and knowledge—in the village, increased entrepreneurial spirit among the villagers, having indirect impact.

In the physical-spatial component, factors such as increasing (a) share and per capita service uses (commercial and mixed commercial, educational, cultural, religious, health and therapy, recreational tourism, administrative and law enforcement, etc.) in the village,(b) increasing per capita green space and parks in the village, (c) protection of agricultural lands and increasing per capita crops, (d) access to outdoor and natural diverse landscapes in the village have direct impacts and factors such as (a) increasing the share and per capita service uses (commercial and mixed commercial, educational, cultural, religious, health and therapy, recreational-tourism, administrative and law enforcement, etc.) in the village, (b) increasing per capita green space and parks in the village, (c) protection of agricultural lands and increasing per capita crop yields, (d) access to outdoor and natural diverse landscapes in the village have indirect impacts.

In the socio-cultural component, factors of (a) increasing numbers of people with higher education and a tendency to stay in the countryside, (b) access to higher education institutions and non-native knowledge in rural production for villagers, (c) the development of village-outsourcing—links with businesses and enterprises, labor market flows and capital movements, especially large and mid-size cities, and (d) improving information and communication (internet, etc.) infrastructure in the village have indirect impact.

Finally, the key propellants affecting the formation of smart rural development derived and presented in Figure 9 are:

- Creating and developing of better job opportunities and consequently increasing employment has a net impact value of (0)
- Reduction of the burden on rural populations, has a net impact value of (0)
- Creating cross-industry activities such as tourism, food and cultural production has a net impact value of (+3)
- Increasing entrepreneurial spirit among villagers has net impact value of (0)
- Increasing the share and per capita service uses—(a) commercial and mixed commercial, (b) educational, (c) cultural, (d) religious, (e) health

and therapy, (f) recreational-tourism, (g) administrative and law enforcement, etc.in the village has net impact value of (+2)

- Increasing per capita green space and parks in the village has net impact value of (+2)
- Increasing people with higher education and tendency to stay in the village has net impact value of (+5) and,
- The development of village-outsourcing (links with businesses and enterprises, labor market flows and capital movements, especially large and mid-size cities has net impact value of (+1).

It is worth mentioning that considering the researcher's knowledge about the conditions and situation of the studied region, the items that have been extracted as key propellants of smart rural development, were important and necessary issues in the region and had to be examined and given special attention. To explain this, the index (creating and developing better job opportunities and thus increasing employment) is mentioned as a key propellant; unfortunately, in the study area, due to the lack of job opportunities, the rural youth migrate to metropolises and work as workers in buildings or workshops, living on the margins of metropolises in poor conditions. Also, educated youth migrate to cities and work in jobs unrelated to their specialty due to lack of capital, infrastructure, and many obstacles in their path to entrepreneurship. Therefore, the items that have been extracted as key propellants affecting smart rural development in this study, if considered, planned, and addressed, could become an integral part of government policies and strategies, and to a great extent may pave the way to achieve sustainable development.

Table 9. *The Final Key Propellants Affecting the Formation of Smart Rural Development Based on Structural Analysis Model*

Row	Propellant	Direct Impact	Indirect Impact
1	Development of better job opportunities and consequently increasing employment along with reduction of burden on rural population	0	+127
2	Creating cross-industry activities such as tourism, food and cultural production	+3	+2269
3	Increasing entrepreneurial spirit among villagers	0	+10
4	Increasing the share and per capita service uses (commercial and mixed commercial, educational, cultural, religious, health and therapy, recreational-tourism, administrative and law enforcement, etc.) in the village	+2	+880
5	Increasing per capita green space and parks in the village	+2	+859

Table 9 continued

6	Access to outdoor and natural diverse landscapes in the village	+2	+790
7	Increasing people with higher education and tendency to stay in the village	+5	+2567
8	The development of village-outsourcing (links with businesses and enterprises, labor market flows and capital movements, especially large and mid-size cities)	+1	+109

In order to compare the present study with the previous studies, we can address the Annabestani and Javanshir (2016) study, "Investigating and analyzing smart rural development in rural areas of Binaloud-Iran City (Abardeh-e Olya, Jaghargh, Hesar-e Golestan and Virani villages)" in which we can identify the indices of smart rural development and leveling of rural areas. This paper, however, analyzes and identifies the key propellants affecting the formation of smart rural development in the study area.

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