



The Impact of Rural Information and Communication Technology on Indicators of Development of Creative Villages in Iran (Case Study: Mashhad Suburban Settlements)

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Abstract

Purpose- The use of Information and Communication Technology (ICT) has an effect on development of Creative Villages as a new approach in using the existing rural capabilities and capacities to revive the rural areas. This study seeks to analyze the impact of RICT on the indicators of development of Creative Villages in suburban settlements in Mashhad County.

Design/methodology/approach- A descriptive-analytical research method was employed in this fundamental study, and documentary and survey methods have been used for collecting the data. The study population included households in 8 villages around Mashhad (N = 20813). These villages had a rural ICT office and a population of over 1,000 households. The sample was estimated using Cochran's formula; accordingly, 194 households were selected by systematic random sampling.

Finding- Spatial analysis of the main variables was performed using Combined Compromise Solution and fuzzy gray analysis. The result showed that the villages of Gorji Sofla, Hosseinabad Gharghi, Dostabad and Dehroud have the highest, and the villages of Kal Zarkash and Chahar Borj have the lowest level of use of RICT services and the indicator of the Creative Village. Using the partial least squares (PLS) technique, among the research indicators, "promoting and training" with the coefficient of 0.591 had the most direct effect on the dependent variable. Also, variable dimension of "awareness of RICT services", considering the direct and indirect effects, with a coefficient of 0.816, has had a greater impact on the indicators of development of Creative Villages in rural settlements. Given the value of R² (0.998), we concluded that RICT has a high-level impact on the indicators of development of Creative Villages.

Keywords- Information and Communication Technology (ICT), Rural settlements, Creative Village Indicators, Rural development, Iran.

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1. Introduction

For centuries, rural areas have been critical centers of habitation and production. However, in today's conditions and due to events and government interventions and lifestyle changes, in the transition period from productivism, many villages, instead of enjoying the benefits of sustainable development, have faced retrogression and while losing their population in the migration process, are dealing with population evacuation and physical destruction (Rastghalam et al., 2016). To address spatial imbalances, some approaches are presented including economic approaches (agricultural development, green revolution, land reform, industrialization), social approaches (meeting basic needs, participation in rural development, development of local communities), physical-spatial approaches (planning for rural centers, rural-urban development, urban functions in rural development) and comprehensive approaches (comprehensive and integrated rural development, sustainable development) (Estalaji & Jafari, 2014). However, most of the past development strategies such as industrialization and agricultural development have failed to provide the necessary conditions for economic and social sustainability of rural areas. Today, many developing countries still face numerous challenges in the rural development process, which unfortunately have been exacerbated by the immature requirements and approaches of the industrial period in these countries. Therefore, most countries sought to identify or create new ways and means to achieve rural development, and the development of creative activities was proposed as one of the influential factors in rural development (Einali et al., 2019).

The concept of "creative city" was founded almost two decades ago by Richard Florida's theories (Landry & Bianchini, 1995). The concept of Creative City provided the basis for the development and progress of some capable cities. In this regard, reviving the process of development, and recalling the flow of life and production in new structures into the rural environment also requires the definition of a new efficient approach adapted to rural context and environments (Rastghalam et al., 2016). Although the concept of creativity has been studied mainly in urban areas rather than rural ones, the Creative Village as a new concept can be considered in the

postmodern context against the urban demands in areas such as ICT, handicrafts, tourism and music. Creative Village is a sustainable living space that relies on ecological processes of lifestyle, clean environment and desirable facilities, to attract the creative classes in low-tech industries, especially in the fields of culture and arts and provide a platform for creativity, and a win-win situation for the rural communities, the creative classes and the consumers of rural creative products (Rastghalam et al., 2016). The concept of creative village has a cultural dimension and a set of possibilities and opportunities. The creative village is an intercultural place where the focus is on combining different cultures and experiences and exchanging ideas and programs with each other (Mitchell & Waal, 2009).

Generally speaking, the creative village approach, by utilizing the talents, natural resources, lifestyle and experience of the village and fostering creativity in the resident and rural community, will provide the ground for the revitalization of rural settlements. The establishment of creative villages leads to more employment, economic wealth, favorable population birth rate, and the prosperity of rural life based on the cultural industries of the host ecosystem (handicrafts, tourism, traditions, music, visual arts, etc.). The growth of communication technologies and high demand for various forms of information, have made way for a new period in which the life of human societies is highly dependent on the circulation of information and timely information. The most important feature of this period is higher speed and reliance on information, as a raw material needed for agriculture, industry and development. In this period, a kind of holistic view gradually dominates every aspect (Ghazavi, 2003). Therefore, in many ways, Information and Communication Technology (ICT) is viewed as an important factor of sustainable development and plays a key role in public services, rural and urban development, transportation and road communications, healthcare, special needs of human populations, education, environment and agriculture (Borhani & Mirzaee Fashalami, 2015); Even the knowledge of using ICT is now considered as one of the criteria for assessing the literacy of the population to use ICT services and search, organize, evaluate and communicate

information (Hollifield & Donnermeyer, 2008). The most important functions of Rural ICT that can play an effective role in the development process are: social development, higher decision-making power of villagers, higher rural extension, promoting products, expansion of local and rural markets, expansion of e-commerce activities in rural areas, development of e-learning activities for rural residents, promotion of rural tourist attractions, transfer of knowledge from urban to rural areas and vice versa, making contacts, receiving government services (to pay taxes, banking matters, etc.), GIS for the management of natural resources in rural areas (Akca et al, 2007), mitigating the effects of natural disasters and plant pests, preserving the environment, empowering the rural poor, increasing the quality of life, decentralization and the possibility of working remotely.

Nevertheless, the benefits of this technology can be reaped only if this technology spreads across all sections of the society. We live in a digitally fragmented world where half the world's population is deprived of access to telephone calls. However, the agreed argument is that the decade of globalization improves the ability of rural people to use this technology, and the capabilities of developing countries. Therefore, in intellectual paradigms and new approaches to rural development, the use of knowledge and information, together with tools and technologies of its transfer and exchange, are important and have a special place (Fathi and Motlagh, 2010); And IT centers are believed to be a new concept in rural development that help villagers access social, economic, educational and training opportunities through the use of information and remote information technology (Suzuki and Shankariah, 1998). In fact, by providing such services, these centers provide low-cost opportunities for local communities (Falch and Anyimadu, 2003). In this regard, a new and wide wave of information technology development has been formed in the third world countries, especially in their rural areas. Currently, there are few countries in the world that do not have experience in the development of information technology in their rural areas (Shakeel, 2000). In Iran, providing services using ICT to the villagers is one of the strategies on the agenda of rural development authorities that help to narrow

information gaps and remove barriers caused by 'geographical isolation' (Motiee Langroudi, 2010); The predominant form of access to information technology in rural areas is the establishment of a telecommunications center, which in Iran is known as the Information and Communication Technology Center or 'Rural ICT'. There is no doubt that if ICT is used effectively in rural areas, these technologies can act as a driving force for development and fill some gaps in rural development.

In this study, rural ICT offices in Mashhad have been studied. The rural areas of this city, like other rural areas of Iran, are facing the same issues we enumerated and the results of the 2006, 2011 and 2016 censuses verify this fact. One of the solutions is to use ICT services and move towards a creative village. Given the wide impact of this technology in different societies and its novelty in our country, applied and field studies about its effects on rural development and development of creative villages, could be useful for the proper use of this technology in rural areas of Iran. Therefore, the present study seeks to answer the question to what extent the development of information technology through rural information and communication technology (RICT) has affected the indicators of development of creative villages in the study area?

2. Research Theoretical Literature

Richard Florida introduced the concept of 'creative city' almost two decades ago. Landry and Bianchini in 'The Creative Cities' also propose this concept in response to urban issues in the face of the urban crisis that has occurred in the transition to post-industrial culture and global economy (Landry & Bianchini, 1995). Although there are many differences between urban and rural areas; using and citing the literature of the creative city, we made attempts to lay the right foundation for explaining the concepts and theories of the creative villages. With an overview of the concepts of the creative cities, assuming the common aspect of urban and rural residential performance, the theoretical foundation of creative villages is explained. Many settlements around the world are currently facing difficult transition periods. The process of transformation from old to modern industries is taking place based on earning added values (Kuhmonen & Kuhmonen, 2015).

Exploring the literature on creativity shows that ‘creative village’ is a new concept that has been created in contrast to the concept of ‘creative city’, and no internationally unified definition has been made. However, a brief definition of this concept is given. A creative village is a space that relies on ecological processes of lifestyle, clean environment and desirable facilities to attract the creative class in low-tech industries, especially in the fields of culture and arts, and provide a win-win platform for the rural community, creative class and audiences and consumers of the creative products outside the countryside. The production of wealth in this village is due to the payment of ownership interest of rural space to the villagers and the production of economic added values resulted from the creativity of the creative class, which complements the intrinsic activities of the village in production, especially in agriculture (Rastghalam, Seidaee and Nouri, 2016). Meanwhile, the creative class, which is seen as part of social capital in rural areas, is an essential resource in rural areas, as it affects their actions and improves the quality of life of rural communities in every way. Evidently, the villagers who have higher social capital can easily access the source of knowledge and awareness to improve production and have access to added values, create new economic activities and also protect and even improve their existing economic activities (Batjargal, 2007). The members of a creative class also tend to have differing views on the quality of a particular place, and they are not always concentrated in cities (McGranahan and Wojan, 2007; Noack & Federwisch, 2020), as they believe that the creative class also accumulates in rural areas, and in such cases, they will be the driving force of the economic development. They support this theory with many arguments. They believe that one of the main reasons for attracting the creative class to rural areas of Iran is the wealth of the country, low population

density and a special relationship with Dehyars (rural administrators) (Stolarick et al, 2011). Nevertheless, in the meantime, rural areas face many issues in losing human capital (young people migrating to cities, students going to university, graduates going to cities to find work); A good alternative to solve these problems is to attracts people who are interested in living in rural areas (Jarábková & Hamada, 2012). However, the creative rural class are not the only immigrants to rural areas, and the main inhabitants of the rural areas are also creative and part of the creative class. In general, the creative rural class consists of two groups: the first group includes creative rural residents (creative villagers) and the second group includes creative people who, according to the characteristics of a creative village, have chosen it for living and have migrated to it. The members of a creative class tend to gather in creative communities and form a network for themselves. The creative class of a village does not necessarily include only the educated or experts with high-level knowledge, as is often observed in cities. The creative class of rural communities add new elements to the economic, social, cultural and managerial aspects of a village and provide new opportunities for the development of the village at national and transnational levels (Rastghalam et al., 2016).

In the period of transition from liberal to neoliberal school, the rural areas have also moved from productivism to post-productivism. In fact, with the collapse of micro and traditional agricultural structures, some opportunities have arisen to meet new urban demands for the new nature of the rural areas, such as tourist resorts and the supply of organic food and handicrafts (Bell & Jayne, 2010). Table 1 summarizes the studies that have the highest relevance to our research topic.

Table 1. Studies with the highest relevance to the research topic

Researcher (year)	Research results
Kalami & Hosseini (2017)	The results show that the states can encourage creative industries with the participation of the inhabitants, and creative industries should be considered in all areas including culture, religion, arts, agriculture and industries.
Rastghalam et al. (2016)	Theoretical structure derived from the first part consisted of 15 items and 49 indicators. The highest score belonged to the creative class ‘Immigrants to rural areas’ with 0.087452 percent and the lowest score (0.035478) belonged to ‘communication with relatives.
Einali et al. (2019)	According to regression fitting, about 0.83 percent of the positive impact of tourism on sustainable rural development has been made by creativity in tourism.
Kamarudin et al. (2018)	The results show that the creative villages of the study, using new advertisements tools such as Facebook, YouTube and Bazar, have played an important role in the development of

Researcher (year)	Research results
	entrepreneurship.
Can & Ngo (2017)	The results indicate that Dong Lam village has the potential necessary for creative tourism. Therefore, a variety of tourism packs including tourism, eco-tourism, and rural tourism should be available in this area.
Citarella and Maglio (2014)	The results showed that the foundations of the creative tourism success lie in strengthening the local economy based on creativity in a logical system.
Doncean (2013)	To achieve creative rural tourism, it is necessary to pay careful attention to the combinations of color, harmony and order in the arrangement between residence and health management and quality.
Lee & Wall (2012)	The results show the making use of the advantage of rural areas to make local cuisine can help achieve creative economy of the rural tourism.
European Union (UN) (2011)	In the framework of the General Studies of Agricultural Policy Outlook in Europe, it examines the role of rural creativity in public agricultural development policies, the issues facing rural areas in agricultural development, and responsive policies and innovations in rural development. How to improve agricultural production in rural areas, how to prioritize policies and how to allocate funds for rural development are reviewed and comprehensive policies for sustainable development are listed for all regions of Europe.
Stolarick et al. (2011)	In this study, tourism and economic development have been introduced as areas of creativity in rural communities, and visual arts, culture and historical heritage have been mentioned as tools for generating wealth and reviving traditional economic processes.
Brüntrup & Messner (2007)	The results show that creative industries in areas such as music, literature, tourism and arts have a strategic position to intelligently promote sustainability, and raise local, regional and national growth in Europe. Having a continuous research approach and process in the distribution of innovative activities such as festivals, music concerts, rural eco-museums and rural theaters is a useful step in local and rural development.

A review of the experiences of the developed and developing countries in employing IT in rural and agricultural development shows that in proportion to the capabilities of these countries, in almost all of them, the use of IT has received significant attention. In this regard, there are many examples of macro-measures and policies, such as strategies for the development of this technology. At the same time, innovations, initiatives and specific programs have been realized as a subset of macro-policies (Riahi Vafa and Hedayati, 2006). In Iran, more than any other countries, the use of RICT in various fields is inevitable, as the young population of the country imposes very high costs on the government. Due to the fact that a large part of the Iranian population are villagers, not paying attention to this group will cause irreparable damage to the country (Suzangar, 2003). In general, ICT is the result of the interaction of three distinct areas: computers, information and telecommunications (Alexandru et al, 2007). In rural areas, ICT seeks to provide rural residents with central government and non-government agency services (Rao, 2004).

Over the past few decades, with the emergence of ICT as an important tool and its positive effects on

various activities, many studies have been conducted in Iran and abroad on ICT and its effects. Nevertheless, a main part of these topics has been in the form of theoretical discussions about the concepts and necessities of the subject. Among these studies are: Rezaee (2006), Motiee Langroudi et al. (2010), Barghi and Ghanbari (2010), Azizi et al. (2009), Sarami and Bahari (2010), Anabestani and Vaziri (2011), Mohammadi and Pirkhazraeian (2012) and Molaei Hashtjin et al. (2012) on the socio-economic effects of ICT and rural development in Iran; The studies of Khajeh Shahkoochi (2013) and Rostami Ghobadi et al. (2014) on the quality of life and social capital showed that ICT can empower the villagers as they can have a conscious impact (as the founding sources of production and growth of the national economy). Although the use of ICT as one of the technological advances of the modern age cannot be seen as a miracle to solve the fundamental problems of rural areas, making use of its tools namely e-government, e-commerce, e-learning, marketing, tourism, etc., along with proper management of its use, can accelerate rural development and provide significant assistance in providing public welfare in these areas, and in various dimensions it can be

effective in rural development. However, studies have shown that the effect of ICT offices on various aspects in rural areas has not been comprehensive and there is a significant relationship between the background variables of education, income, occupation, marital status and gender with the ICT indicator. A significant difference was also observed between the amount of social capital of users and non-users of rural ICT offices. Access to the services of rural ICT offices, including Internet access, has led to better acceptance of differences among individuals, and these individuals are more involved in the local community. According to Ceylan et al. (2009), ICT contributes to social development by bridging the gap between urban and rural areas, households, occupations, and geographical areas, and reducing the economic and social differences between regions. Chen (2006) argues that ICT development in rural and urban areas creates new opportunities for economic, social and political empowerment and improves the quality of life indicators in rural areas (Chen, 2006).

Evidence from the literature shows that so far, few studies have been conducted on creative villages and due to the diversity, complexity, breadth and novelty of the subject, few attempts have been made to formulate a theory that can explain the whole phenomenon. A review of relevant papers showed that each of the theories and papers have examined

only parts of the subject from certain angles. What has been widely covered so far is the ‘creative city’ and the factors associated with it. In the meantime, some Iranian and foreign experts have paid attention to creative villages and its relevant factors and have studied issues related to entrepreneurship, creative villages and creative rural tourism. As a result, we can argue that so far, no study has been conducted on the effectivity and spatial analysis of the indicators of creative villages. Therefore, given the importance of ICT in rural areas of Iran, this study seeks to analyze the impact of information technology on the indicators of development of Creative Villages in Mashhad County. In fact, the importance and value of this research lies in opening a theoretical framework based on defining the complementary approaches to development which can be implemented in rural areas. Accordingly, the indicators of development of creative villages can include participation, leadership, risk-taking, promotion and education, innovation and flexibility.

3. Research Methodology

3.1. Geographical Scope of the Research

The metropolis of Mashhad with a population of 3,001,184 people is located in northeastern Iran and with a Periphery (Harim) of 867 km has 132 rural settlements with a population of 185,000 people (Anabestani and Kharazmi, 2018).

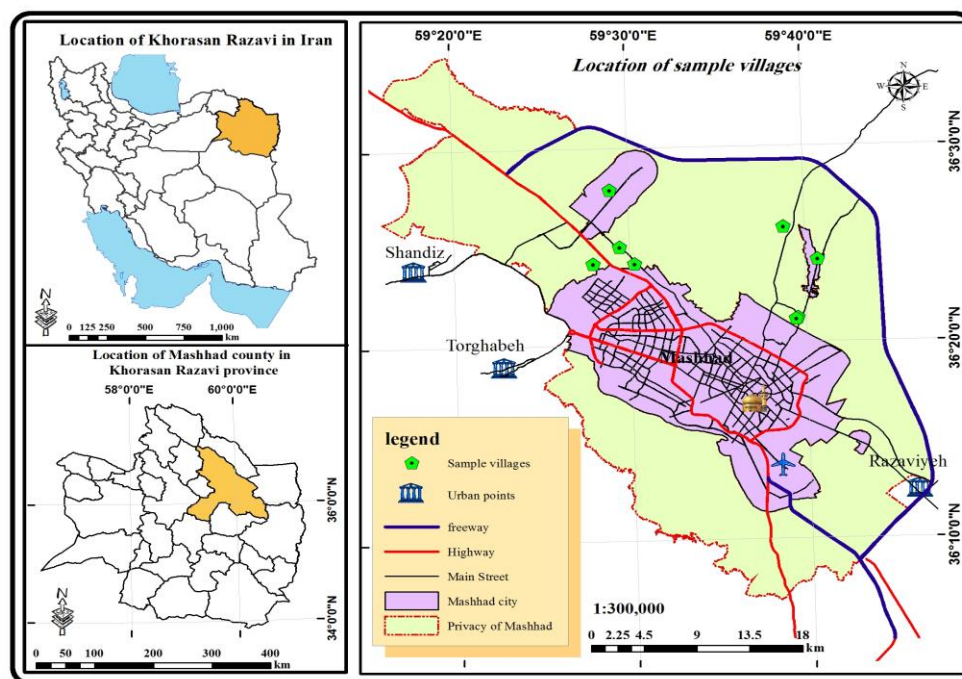


Figure 1. Geographical location of the study area

Accordingly, for better evaluation of the indicators, in villages with more population and closer to the city, the statistical population of the study includes villages that have a RICT office, a population of over 1000 households and are located near Mashhad. With this conditions, 8 villages of Gorji Sofla, Dehroud, Doostabad, Hosseinabad Gharghi, Manzalabad, Kal Zarkesh, Farokhad and Chahar Borj in the central district of Mashhad were selected as the population of the study. Then, given the total number of households in the sample population (N = 20813 households), the sample size of 194 households was estimated with the Cochran's formula (with an error rate of 0.07%). The samples were selected in a systematic random sampling method (Table 4).

3.2. Methodology

The research was conducted in a descriptive-analytical method with a geographical approach and is based on quantitative and qualitative techniques. The assessment tool is a researcher-made questionnaire. To verify the validity of the questionnaire, several copies were given to a group of

experts, including university professors and relevant experts, and the necessary corrections were made according to their suggestions. Using the KMO test, the validity of the items explaining the use of information technology with the score of 0.762 and the indicators of development of creative villages with the score of 0.835 were confirmed. In addition, based on the results of Cronbach's alpha coefficient for the use of information technology which is 0.856, the indicators of development of creative villages is 0.781. To select the research indicators, at first, drawing on the critical analysis of the literature the indicators were listed and in the second step, the initial indicators were screened to identify the items related to the effects of information technology and the indicators of development of the creative villages and they were limited to the main indicators. After finalizing the indicators and items, the questionnaire was completed by the villagers in the form of 5-point Likert scale (very low, low, medium, high and very high) and the results were extracted (Tables 2 and 3).

Table 2. Monitoring the dimensions and indicators of RICT use and their Cronbach's alpha coefficients

(Sources: Akbari et al., 2016; Khajeh Shahkouhi, 2013; Rostami Qobadi et al., 2014; Motiee Langroudi et al., 2010; Azizi et al., 2009; Sarami & Bahari, 2010; Anabestani & Vaziri, 2011; Mohamadi & Pirkhazraiean, 2012; Barghi & Ghanbari, 2010; Sourani et al., 2014; Fathi & Motlagh, 2010; Falch & Anyimadu, 2003; Suzuki & Shankariah, 1998)

Dimensions	Item descriptions	Cronbach's alpha coefficients
Level of awareness of RICT services (12 questions)	Familiarity with RICT offices; Familiarity with telecommunication services in RICT offices; Familiarity with Post Bank services; Familiarity with various types of services provided by RICT offices; Familiarity with postal services; people's attitudes towards establishing RICT offices in their villages; Awareness of the benefits of using RICT office services; Satisfaction with the services provided in RICT offices; Awareness of the facilities and equipment available in rural RICT offices; Skills in using a computer; Familiarity with various Internet services; Awareness of the Pishkhan government services	0.898
Level of using RICT services (12 questions)	To pay service bills (water, electricity, gas); telecommunication and telephone services; Post Bank services; computer and office services (copy, print, etc.); various Internet services of RICT offices; postal services; services provided in the framework of e-government; e-health services; services provided for e-business and e-commerce; high speed internet access for home users; use of home internet for any of the above services	0.887

Table 3. Monitoring the indicators of development of creative villages and their Cronbach's alpha coefficients

(Source: Rastghalam et al., 2016; Kalami & Hosieni, 2017; Zarrabi et al., 2014; Mohammadi & Majidfar, 2010; Zarrabi et al., 2012; Maleki et al., 2015; Baeker & Murray, 2008; Khaleefa, 1996; Robinson, 2001; Pinto-Correia et al, 2006; Dos Santos & Laurencin, 2006; Dissart & Marcouiller, 2012; Mitchell, 2013; Bell and Jayne, 2010; McGranahan et al., 2011)

Indicators	Item descriptions	Cronbach's alpha coefficients
Flexibility (6 questions)	Flexibility in different dimensions of the organization, ways of thinking, trading; Innovation in turning a cost into a revenue; to turn government employment costs into proceeds of privatization; Ability to adapt to the environment and people; Tendency to accept new ideas and values (less clinging to the past); (Age, gender, education, needs and financial abilities)	0.814
Innovation (4 questions)	The level of innovation and doing tasks in an innovative way among the villagers; Ability to apply innovative solutions to rural issues and achieve goals (modernity, courage) among villagers;	0.864

Indicators	Item descriptions	Cronbach's alpha coefficients
	Innovation of villagers in economic activities (new marketing methods, etc.); Innovation in the design of rural housing and accommodations (with emphasis on sustainability and eco-friendly materials, etc.)	
Promotion & education (6 questions)	Promotional and training activities for acquiring various skills in rural areas; Status of public education (education and culture) in the village; To teach and transfer the old rural arts and skills to new generations in the village; To organize training workshops for villagers and entrepreneurs; To motivate villagers by introducing top rural entrepreneurs in various fields; Distribution of publications (daily, weekly and special issues) in rural areas.	0.832
Risk-taking (5 questions)	Appropriate financial capacity and risk-taking ability of the villagers; Education level of villagers and their risk-taking ability; Meeting the needs of villagers and residents' risk-taking ability; Age and gender of rural people and increasing the ability to accept the consequences of a failure; The rate of using product insurance plans.	0.743
Leadership (6 questions)	The need for leadership and decision-makers in rural areas; Success of rural managers in coordinating relevant centers and authorities; Identification and selection of graduates and human resources for job plans; Age and education appropriate for rural management; Appropriate management personality traits; The performance of rural managers in using the communication process in a specific situation to influence people and direct them to specific goals	0.876
Participation (6 questions)	To involve villagers in social, economic, cultural and political affairs in order to increase social harmony; Social participation; To increase rural participation rate (both men and women); Self-sufficiency and cooperation in supplying products; The level of public participation in environmental issues; The effect of individual characteristics of rural people (age, gender, education) on participation; teamwork among the villagers	0.887

After collecting and clustering the data, descriptive and inferential statistics including Pearson correlation and one-sample T tests in SPSS were used. Smart PLS was used to extract the structural equation model and determine the effects of villagers' use of RICT on the indicators of development of creative villages. Among weighting methods, Fuzzy Delphi Analytical Hierarchy Process (FDAHP), Combined Compromise Solution (CoCoSo) and Fuzzy Gray Analysis (FGRA) were used for spatial analysis and ranking of the sample villages.

Gray planning is one of the methods of analyzing gray systems for decision making under uncertainty. A number whose true value cannot be stated with certainty, but it is known by an interval is a gray number. One solution to present the uncertainty is to combine the two methods of fuzzy programming and interval parametric programming. This method takes into account the uncertainty of the right and left sides of the model at the same time. The combination of fuzzy programming and gray programming has led to gray fuzzy programming solution (Anabestani & Javanshiri, 2018) and has increased the efficiency of both models.

As mentioned earlier, the Combined Compromise Solution (CoCoSo) method has been used to rank the villages in terms of indicators of development of creative villages. The proposed combined approach is based on an integrated model of simple weight addition method and weight multiplication model. This model can be a set of compromise solutions. The

CoCoSo model has 5 main steps to solve a decision problem which are (Yazdani, 2019):

- 1- The initial decision-making matrix is determined:
- 2- Normalization of indicators is accomplished based on the following equations. The first relation is used for indicators with positive direction and the second relation is used for indicators with negative direction. Based on this normalization, all indicators are placed between 0 and 1.

$$r_{ij} = \frac{x_{ij} - \min_i x_{ij}}{\max_i x_{ij} - \min_i x_{ij}}; \text{ for benefit criterion,}$$

$$r_{ij} = \frac{\max_i x_{ij} - x_{ij}}{\max_i x_{ij} - \min_i x_{ij}}, \text{ for cost criterion.}$$

- 3- The total of the weighted comparability sequence (Si) and the whole of the power weight of comparability sequences for each alternative as Pi and Si is achieved based on grey relational generation approach:

$$S_i = \sum_{j=1}^n (w_j r_{ij}),$$

In this model, the weight is calculated using the fuzzy Delphi hierarchical analysis method.

Pi is also obtained according to the multiplication mode of WASPAS:

$$P_i = \sum_{j=1}^n (r_{ij})^{w_j},$$

4- Relative weights of the indicators using the following aggregation strategies are

$$k_{ia} = \frac{P_i + S_i}{\sum_{i=1}^m (P_i + S_i)}, \quad k_{ib} = \frac{S_i}{\min_i S_i} + \frac{P_i}{\min_i P_i}, \quad k_{ic} = \frac{\lambda(S_i) + (1-\lambda)(P_i)}{\left(\lambda \max_i S_i + (1-\lambda) \max_i P_i\right)}; \quad 0 \leq \lambda \leq 1.$$

Equation (Ria) expresses the arithmetic mean of sums of WSM and WPM scores, while Equation (Rib) expresses a sum of relative scores of WSM and WPM compared to the best. Equation (Ric) releases the balanced compromise of WSM and WPM models scores. In Equation (Ric), λ (usually $\lambda=0.5$) is chosen

$$k_i = (k_{ia} k_{ib} k_{ic})^{\frac{1}{3}} + \frac{1}{3} (k_{ia} + k_{ib} + k_{ic}).$$

computed. In this step, three appraisal score strategies are used to generate relative weights of indicators, which are derived using formulas (R_{ia} , R_{ib} , R_{ic}):

by decision-makers. However, the flexibility and stability of the proposed CoCoSo can rely on other values.

5- The final ranking of the alternatives is determined based on R_i values, as more significant as better:

Table 4. Characteristics of the study villages and the number of samples in each village

Row	Village	Dehestan	Population	Household	Sample
1	Gorji Sofla	Tabadkan	15163	4321	34
2	Dehroud	Tabadkan	11869	3317	28
3	Doostabad	Toos	8969	2576	24
4	Hosseinabad Gharghi	Tabadkan	13644	3759	31
5	Manzalabad	Toos	8520	2494	23
6	Kal Zarkesh	Toos	6134	1836	20
7	Farakhad	Tabadkan	3977	1203	17
8	Chahar Borj	Toos	4524	1307	17
Total			72800	20813	194

4. Research Findings

According to the results, about 34.5% of the respondents are between 20 and 30 years old and 31.6% are between 41 and 50 years old; In terms of gender, 68.2% were male and 70.3% were married. In terms of education level, 5.3% of the respondents are illiterate, 18.6% have primary education and 61.3% have a high school diploma, bachelor's degree or higher. Examining the job status of the respondents, revealed that out of 377 people who answered the question related to their occupation, 21.2% are farmers, 10.9% are stockbreeders, 31.8% are engaged in service activities (grocery stores, etc.).

4.1. Monitoring the use of RICT in rural settlements

The use of RICT services in rural settlements in the study area was assessed from two dimensions of the 'level awareness of RICT services' (with 12 items) and the Level of using RICT services (with 12 items) in a 5-point Likert scale. These services include four categories: 'Computer and e-government services', 'Communication services', 'Banking and e-commerce services' and 'Home

Internet'. The results show that, according to the villagers, the level of villagers' awareness of RICT services with 3.55 in general was higher than the theoretical median of the research (i.e., 3); However, their level of using RICT services with 2.76 is less than main. These results were confirmed by the one-sample t-test with a theoretical median of 3, while ensuring the normal distribution of data using Kolmogorov-Smirnov test. Considering the value of t-statistic and the value of significance level of 0.000, with 95% confidence, we conclude that the villagers equate the whole level of RICT with a value of t equal to 7.64 which is above the theoretical median (Table 5).

As Table 5 shows, although villagers have a high level of awareness of RICT services, the level of using RICT services has been lower than median in the sample villages. This could be due to lack of access to full services or the low quality of services in rural areas, as the short distance of these villages to the metropolis of Mashhad, encourage the villagers to go to downtown to access high quality services. Clearly, providing

appropriate services in the villages, especially in higher rural areas, can make way for more use of

RICT services and development of indicators and infrastructure of creative villages.

Table 5. An assessment of the importance of the dimensions of RICT from the villagers' view (test standard = 3)

Dimension	Indicators	Main	T value	Sig	Mean difference	95% difference in confidence interval	
						Lower	Upper
Level of awareness of RICT services	Communication services and e-government	3.608	19.036	0.000	0.608	0.545	0.671
	Banking and e-commerce services	3.245	8.442	0.000	0.245	0.188	0.302
	Home Internet	3.851	28.601	0.000	0.851	0.792	0.909
	Awareness of services	3.548	23.496	0.000	0.548	0.502	0.594
Level of using RICT services	Computer services and e-government	2.846	-6.095	0.000	-0.154	-0.203	-0.104
	Communication services	3.286	9.582	0.000	0.286	0.227	0.345
	Banking and e-commerce services	2.529	-14.04	0.000	-0.471	-0.537	-0.405
	Home Internet	2.379	-13.49	0.000	-0.621	-0.712	-0.530
	Awareness of services	2.762	-9.674	0.000	-0.238	-0.286	-0.189
	Rural digital technology	3.155	7.638	0.000	0.155	0.115	0.195

Fuzzy gray analysis (FGRA) was used for spatial analysis and determining the level of ICT in rural areas. After determining the status quo matrix (fuzzy mean of awareness and the level of using RICT services in the sample villages), first the indicators were weighted by Shannon entropy method. In the next step, to standardize the state quo matrix, given the direction of the indicators (positive or negative), the norm normalization was used. Then the variance of the initial normalized values is estimated; In the next step, the positive and negative fuzzy ideal solution is determined and the degree of fuzzy gray relationship of each alternative is obtained according to the importance determined by the decision makers; Eventually, the ratio of positive and negative ideal

fuzzy solution is calculated and finally the relative fuzzy relation of the positive solution was identified. After defuzzification of fuzzy numbers, the sample villages were arranged in a descending order of priority. According to the results of the model, the villages of Gorji Sofla, Hosseinabad Gharghi and Dehroud had the highest, and the villages of Kal Zarkesh and Chahar Borj had the lowest level of using RICT services (Table 6). The indicators such as distance from the metropolis of Mashhad and the main roads in the villages have a significant effect on access of rural areas to RICT services; and the villages closer to Mashhad, thanks to more access to services and facilities, are at a higher level than the more distant villages.

Table 6. Initial fuzzy matrix and fuzzy balanced normalized matrix at the sample villages

Village	Initial fuzzy matrix						Fuzzy balanced normalized matrix (Y)						
	Level of awareness of RICT services			Level of using RICT services			Level of awareness of RICT services			Level of using RICT services			
Chahar Borj	4.0	3.4	2.8	3.1	2.3	1.9	0.241	0.205	0.169	0.669	0.509	0.416	
Hosienabad	4.3	3.7	3.3	3.3	2.9	2.7	0.259	0.223	0.199	0.723	0.638	0.578	
Doostabad	4.0	3.5	3.0	3.3	2.8	2.3	0.241	0.211	0.181	0.705	0.612	0.506	
Dehroud	4.3	3.6	3.3	3.3	2.9	2.4	0.259	0.217	0.199	0.705	0.621	0.524	
Farokhad	4.00	3.32	2.75	3.08	2.58	2.08	0.241	0.200	0.166	0.669	0.559	0.452	
Kal Zarkesh	3.67	3.25	2.83	3.08	2.45	1.92	0.221	0.196	0.170	0.669	0.531	0.416	
Gorji Sofla	4.25	3.78	3.42	3.42	2.95	2.67	0.256	0.228	0.206	0.741	0.640	0.578	
Manzelabad	4.00	3.45	2.83	3.25	2.77	2.25	0.241	0.208	0.170	0.705	0.601	0.488	
Cj (max)	4/3			3/42			Y ⁺	0.221	0.196	0.166	0.669	0.509	0.416
Shannon Weight	0/259			0/741			Y ⁻	0.259	0.228	0.206	0.741	0.640	0.578

Table 7. Degree of fuzzy gray relation of each alternative and relative fuzzy relation by positive fuzzy ideal and De-fuzzified values

Village	E_i^+			E_i^-			Γ (Fuzzy positive ideal)			Defuzzied	Rank
Chahar Borj	0.042	0.037	0.034	0.074	0.082	0.094	0.362	0.312	0.268	0.314	7
Hosienabad	0.083	0.087	0.087	0.037	0.035	0.036	0.694	0.710	0.709	0.706	2
Doostabad	0.051	0.059	0.049	0.049	0.045	0.052	0.506	0.568	0.482	0.531	4
Dehroud	0.075	0.068	0.067	0.042	0.040	0.040	0.643	0.631	0.623	0.632	3
Farokhad	0.042	0.041	0.036	0.074	0.068	0.085	0.362	0.374	0.300	0.353	6
Kal Zarkesh	0.033	0.035	0.035	0.100	0.087	0.090	0.250	0.289	0.278	0.276	8
Gorji Sofla	0.093	0.100	0.100	0.034	0.033	0.033	0.731	0.750	0.750	0.745	1
Manzelabad	0.051	0.054	0.042	0.049	0.049	0.067	0.506	0.521	0.385	0.483	5

4.2. An evaluation of the indicators of development of creative villages from the villagers' perspective

To assess the development of creative villages in the study area, the indicators of "flexibility", "innovation", "promotion and education", "risk-taking", "leadership" and "participation" were used. Based on the results, from the villagers' perspective, the mean of development of creative villages is 3.77 which indicates a high level of development of creative villages in the study villages. The indicator of risk taking with a mean of 4.13 had the highest and the indicator of leadership with a mean of 3.1 had the lowest values in the sample villages (Table 8). Using one-sample t-test and the theoretical median of 3,

while ensuring the normal distribution of data by Kolmogorov-Smirnov test, villagers' opinions about the indicators of development of creative villages were examined. The results show that villagers' risk taking with a T-statistic of 39.99 has the highest value and the value of the T-statistic for the variable of development of creative villages is higher than the theoretical median and equals 31.72. Therefore, from the villagers' perspective, the status of indicators of development of creative villages in the sample villages has been evaluated as appropriate and the mean of the respondents' opinions in the T test have been higher than the theoretical median.

Table 8. An evaluation of the indicators of development of creative villages from the villagers' perspective (Test standard = 3)

Indicators	Main	T value	Sig	Mean difference	95% difference in confidence interval	
					Lower	Upper
Flexibility	3.570	24.066	0.000	0.570	0.524	0.617
Innovation	3.968	29.251	0.000	0.968	0.903	1.033
Promotion & education	4.033	29.582	0.000	1.033	0.964	1.101
Risk-taking	4.133	39.994	0.000	1.133	1.077	1.189
Leadership	3.102	2.706	0.007	0.102	0.028	0.177
Participation	3.822	24.291	0.000	0.822	0.755	0.889
Creative village	3.771	31.719	0.000	0.771	0.723	0.819

Concerning the spatial distribution, the indicators of development of creative villages in the sample villages, Hosseinabad Gharghi, Gorji Sofla and Dostabad villages with 3.98, 3.97 and 3.92, had the highest means respectively, and Chaharborj village had the lowest mean. Then, Combined Compromise Solution (CoCoSo) was used to rank the study villages in terms of the indicators of development of creative villages. In this model, the weight of research indicators has been calculated using fuzzy Delphi hierarchical

analysis method. The highest weight obtained, according to the experts, belongs to two indicators of participation (0.265) and innovation (0.210). After performing the 5 main steps of the CoCoSo method, the Ri value for each of the study villages was obtained in indicators of flexibility, innovation, promotion, risk-taking, leadership and participation. According to what can be seen in Table (9), the highest rank belongs to the villages of Hosseinabad Gharghi, Gorji Sofla and Dostabad.

Table 9. Spatial analysis of the development of creative village indicators in the study villages based on CoCoSo method

Village	Former Matrix						si	pi	Ri	Rank
	Flexibility	Innovation	Promotion & education	Risk-taking	Leadership	Participation				
Chahar Borj	3.56	3.87	4.03	3.92	2.78	3.34	0.30	3.60	3.47	6
Hosienabad	3.67	4.18	4.19	4.43	3.30	4.09	0.98	5.98	9.31	1
Doostabad	3.68	4.18	4.21	4.22	3.24	3.99	0.89	5.88	8.62	3
Dehroud	3.49	3.78	3.96	3.89	3.01	3.72	0.44	5.17	5.03	5
Farokhad	3.31	3.51	3.54	3.87	2.88	3.39	0.07	2.54	1.37	7
Kal Zarkesh	3.33	3.46	3.60	3.82	2.81	3.42	0.05	2.60	1.19	8
Gorji Sofla	3.65	4.17	4.17	4.42	3.28	4.14	0.97	5.97	9.28	2
Manzelabad	3.67	4.16	4.21	4.07	3.15	3.92	0.80	5.75	7.89	4
Wi	0.065	0.210	0.165	0.128	0.167	0.265				

4.3. The effects of RICT on indicators of development of creative villages

The results of Pearson correlation test (ensuring the normal distribution of data) show that there is a positive and significant correlation between the dimensions of RICT and the indicators of development of creative villages at a significance level of less than 0.01. Therefore, with the

increasing use of RICT and its dimensions, the indicators of development of creative villages have also improved. In addition, the correlation coefficient in the dimension of the level of using RICT services and the indicators of development of creative villages with a coefficient of 0.641 at the confidence level of 99% is higher than the dimension of awareness of RICT services (Table 10).

Table 10. The relationship between RICT, its dimensions and the indicators of development of creative villages

Dependent Independent	Indicators of development of creative villages		
	Person value	Sig	Result
Level of awareness of RICT services	0.625**	0.000	There is a significant relationship
Level of using RICT services	0.641**	0.000	There is a significant relationship
Rural digital technology	0.746**	0.000	There is a significant relationship

Structural equation modeling (SEM) and Smart PLS were used to test the conceptual model of the study and the effects of RICT on the indicators of development of creative villages. Structural equation modeling consists of two parts: measurement model and structural model; its variables are divided into two categories of implicit and explicit variables; implicit variables are used in different levels (Amaro & Duarte, 2016). In the present study, RICT variables and the indicators of development of creative villages are the main structures (and implicit variables). Based on the research conceptual model, each of these structures is composed of different dimensions and each dimension is assessed by a number of items or questions. The external model examines the relationship between the items or questions of the questionnaire and the structures. In fact, the relationships cannot be tested until the

items (questions) of the questionnaire have proven that the implicit variables are well measured. An external model was used to show that the implicit variables were measured appropriately. In order to investigate this, the construct validity of the model is examined, which is measured by Convergent Validity and Discriminant Validity. Convergent validity refers to the ability of the indicators of a dimension to explain that dimension, and discriminant validity implies that the constructs of a research model should be more correlated with their questions than with other constructs (Hulland, 1999). In convergent validity, each of the factor loads (regression coefficients) must be significant and greater than or equal to 0.4. Otherwise, the optimal and acceptable limit of combined reliability (CR) and Average Variance Extracted (AVE) should be considered. In this study, some items were excluded from further analysis due to low factor loading or

unfavorable characteristics of the constructs. After excluding the items and examining the desirability of

the structures in terms of CR and AVE indicators, the results are presented in Table 11.

Table 11. Indicators for evaluating the validity and reliability of the RICT concept and the indicators of development of creative villages

Component	Convergent validity	Point validity			Reliability	
	AVE	Fornel & Larker	Cross-factor loads	HTMT	Cronbach Alpha>0/7	Combined reliability CR>0/7
Level of awareness of RICT services	0.557	Confirmed	Confirmed	Confirmed	0.838	0.881
Level of using RICT services	0.630	Confirmed	Confirmed	Confirmed	0.788	0.794
Flexibility	0.783	Confirmed	Confirmed	Confirmed	0.816	0.716
Innovation	0.668	Confirmed	Confirmed	Confirmed	0.739	0.861
Promotion & education	0.758	Confirmed	Confirmed	Confirmed	0.838	0.833
Risk-taking	0.649	Confirmed	Confirmed	Confirmed	0.866	0.732
Leadership	0.568	Confirmed	Confirmed	Confirmed	0.753	0.821
Participation	0.668	Confirmed	Confirmed	Confirmed	0.881	0.814
Creative village	0.675	Confirmed	Confirmed	Confirmed	0.886	0.907

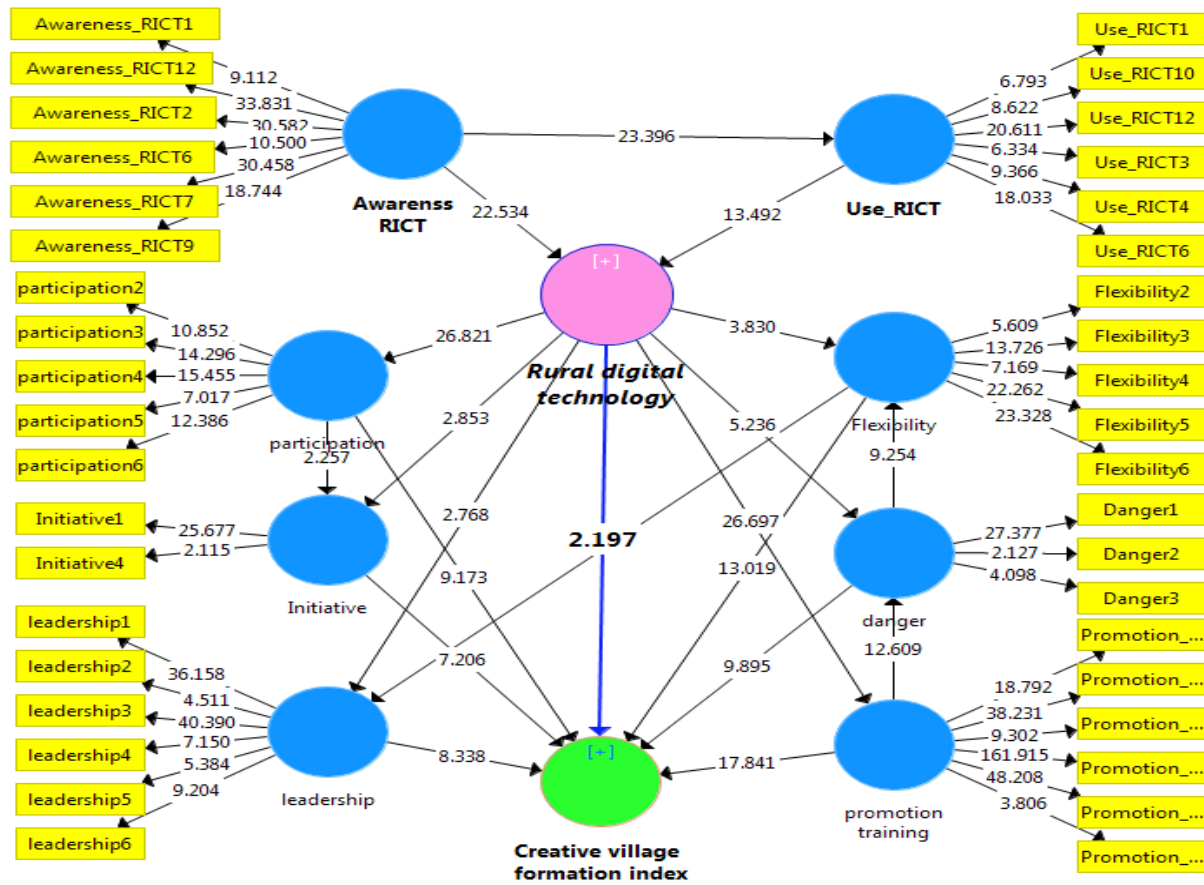


Figure 2. Structural model of the relationship between RICT and the indicators of development of creative villages

The value of the criterion for the acceptance level of AVE is 0.5, which means that the implicit variable explains at least 50% of its observable variance. In the present study, all AVE values related to structures were greater than 0.5 and this confirms that the convergent validity of the present questionnaire is acceptable.

Composite reliability and Cronbach's alpha are used to measure the reliability of the model. The Cronbach's alpha coefficient verifies the ability of the questions to properly explain their dimensions. The composite reliability coefficient also determines the degree of correlation between the questions of a dimension with each other for a sufficient fit of the measurement models. Given that the appropriate value for Cronbach's alpha and composite reliability is 0.7 (George & Mallery, 2003) and based on the research findings, these criteria have adopted a

suitable value for latent variables, one can confirm that the research has an appropriate reliability.

After testing the external model, it is essential to examine the internal model, which shows the relationship between the latent variables of the research. In order to investigate the effects of RICT on the indicators of development of creative villages using the variance-based structural equation modeling approach, independent and dependent variables of the research were entered into the structural equation model as latent variables in the form of first-order factor models. In Figure 2, the numbers on the lines are the T values of the Bootstrap test and are interpreted as the T test; That is, if T values are more than 1.96, they are significant at the level of 0.05, and if values are more than 2.58, they are significant at the level of 0.01 (Vinzi et al, 2010).

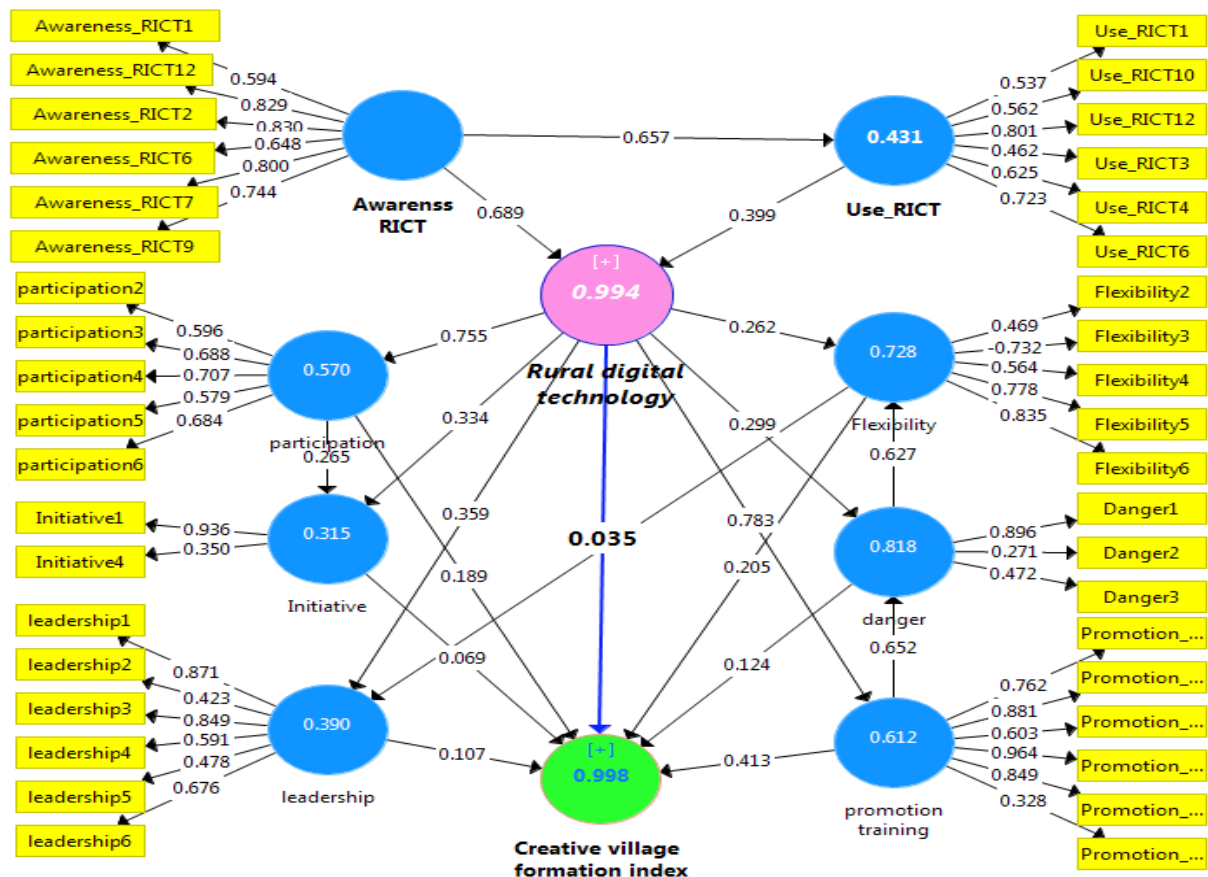


Figure 3. An evaluation of the structural model of the impact of RICT on the indicators of development of creative villages

As shown in Figure 2, the T-coefficients between RICT and the indicators of development of creative villages are greater than 2.58, that is, the relationship

between the variables in the sample population is confirmed at the confidence level of 99%. Given the results of T and P of the path coefficient and

confirmation of the direct relationship between the variables, we also investigated the coefficient of direct and indirect impact of RICT on the indicators of development of creative villages. The cause-and-effect relationship between latent variables and the indicators of development of creative villages has been measured in the form of a structural model. The acceptable factor load for each variable is 0.4 and the significance level is 0.1. All indicators of the present study have a factor load of more than 0.4 and have a high validity and reliability for measuring variables and there is an acceptable correlation between the indicators (Figure 3).

The relationship between the indicators of "flexibility", "innovation", "promotion and education", "risk-taking", "leadership" and "participation" and the variable of the "indicators of development of creative villages" is significant and direct, as 41.3% of the variations in the level of indicators of development of creative villages are directly predicted by the indicators of **promotion and education** (Figure 3). Based on the results, the high mean of 'promotion and education' in rural areas, and the positive effects of 'level of awareness of RICT services' and 'the level of using RICT services' on the promotion and education and thus the development of creative villages and rural development are quite evident. Besides, the indicators of "flexibility" and "participation" with a coefficient of impact of 0.237 and 0.207, respectively, have had a significant effect on improving the indicators of

development of creative villages. Therefore, promotion and education, flexibility and participation can be introduced as the main indicators of development of creative villages.

As mentioned earlier, the RICT variable directly and indirectly affects the variable of "indicators of development of creative villages" through the mediation of research indicators ($p > 0.05$). Based to Table 12, "level of awareness of RICT services" with direct and indirect effects, and a coefficient of 0.816, had a greater impact on "indicators of development of creative villages". This relationship between the main constructs of the research at the 95% confidence level is also statistically significant ($p > 0.05$). 'Level of using RICT services' with a coefficient of 0.342 has had a significant effect on the indicators of development of creative villages. The variable of RICT, directly and indirectly affects the variable of 'indicators of development of creative villages. According to the standard coefficients, 85.9% of the changes in the level of indicators of creative villages are predicted by RICT variable. The results show that although 'the level of awareness of RICT services' does not directly affect the indicators of development of creative villages, it has an indirect significant effect on the dependent variable. Therefore, increasing the awareness of villagers about RICT services will help a lot in development of creative village indicators in the sample villages.

Table 12. An estimation of total, direct and indirect effects of research components on the indicators of development of creative villages

Independent variable		Dependent variable	R	Direct		Indirect		Total	
				Effect	P	Effect	p	Effect	p
Indicators	Flexibility	indicators of development of creative villages	0.998	0.205	0.000	0.033	0.000	0.237	0.000
	Innovation			0.069	0.000	-	-	0.069	0.000
	Promotion & education			0.413	0.000	0.178	0.000	0.591	0.000
	Risk-taking			0.124	0.000	0.149	0.000	0.273	0.000
	Leadership			0.107	0.000	-	0.000	0.107	0.000
	Participation			0.189	0.000	0.018	0.000	0.207	0.000
Dimension	Level of awareness of RICT services			-	-	0.816	0.000	0.816	0.000
	Level of using RICT services			-	-	0.342	0.000	0.342	0.000
Variable	Rural digital technology					0.035	0.000	0.190	0.000

The effect size of the endogenous (dependent) latent variables of the model is determined by a coefficient of R^2 . According to Figure 3, the value of R^2 for the variable of 'the indicators of

development of creative villages' is 0.998; that is, the effect of independent variables on "indicators of development of creative villages" is significant and at a strong level, and 99.8% of the changes in

"indicators of development of creative villages" in the study area is predicted by the level of using RICT services. That is, as level of using RICT services increase in rural areas, the level of 'indicators of development of creative villages' has also increased significantly. The evaluation criteria of the structural equation model as a

whole also confirm the results. The value of Q² indicates the very good predictive power of the model regarding the endogenous constructs of the research, and given the value of GOF (0.877), the fit of the general model is confirmed as very good and shows that all indicators verify the desirability of the structural equation model (Table 13).

Table 13. Indicators for evaluating the totality of the structural equation model

GOF ⁴	R ²	Communality	NFI ³	SRMR ²	Q ² (=1-SSE/SSO) ¹	Indicators value
0.877	0.898	0.771	0.937	0.098	0.613	
<p>1. The value of Q²: the predictive power of the model shows how capable the model is in predicting the dependent variable. The closer the value of indicator to 1, the more predictive the model is. Three values of 0.02, 0.15, and 0.35 have been introduced as weak, medium, and strong values for predictability.</p> <p>2. The values of this indicator in the optimal state, should be less than 0.10.</p> <p>3. The optimal values for this indicator are values greater than 0.90.</p> <p>4. As of the GOF indicator, values less than 0.10 shows a weak fit, 0.25 is a moderate fit and above 0.36 is a good fit. This criterion is calculated using the following formula:</p> <p>Relation 1</p> $GOF = \sqrt{\text{Communalities} \times \bar{R}^2}$						

5. Discussion and Conclusion

According to the research findings, from the villagers' perspective, the villagers' awareness of RICT services was higher than the theoretical median of the research; however, the level of using RICT services is less than theoretical median. Bavle & Shekar Research (2020); Leng et al. (2020); Min et al. (2020); Rashid & Rashid (2020); Stillman et al. (2020) have shown that the level of villagers' awareness of RICT and its services plays an important role in rural development. As it makes way for the entry of small businesses, increases the retention of young people in rural areas and increases the creative class in rural areas.

According to the villagers, the indicators of development of creative villages in rural settlements have been at a relatively high level. However, there have been different results in various studies. In some studies, the indicators of development of creative villages are at a strong level (Anderson et al., 2016; Akgün et al., 2016; Horiuchi, 2017; Strasiulis, 2017; Herslund, 2019; Xiong et al., 2020), and in some studies, these indicators have been at a weak level (Rastghalam et al., 2017). Therefore, depending on the society, culture, development status, etc., they may have an effect on indicators of development of creative villages.

The results showed that the dimension of "awareness of RICT services" had a greater impact on the

indicators of development of the creative villages. Among the research indicators, "promotion and education", "risk-taking" and "flexibility" are the most influential one in development of creative villages. Studies such as [Wojan & Nichols, \(2018\)](#); [Rastghalam et al. \(2017\)](#); have examined the characteristics of creative villages and concluded that a variety of constructs may have an effect on developing a creative village, one of which is RICT. They also argued that practical training and design flexibility accelerate the process of developing creative villages.

The realization of sustainable rural development is directly related to the movement of that village towards creative villages. 'Creative and innovative villages' is one of the new topics in the field of rural studies emphasized by geographers, economists and sociologists who try to realize a Knowledge Community and knowledge-based development. Therefore, rural areas are seen as a place for development of creativity, knowledge, creative industries and knowledge economy in a composite approach. Moving towards the realization and creation of creative villages is the basic solution to solve the crises of rural settlements. In this theory, it is believed that rural areas can encourage economic growth by attracting people to creative professions. It can be concluded that the creative village approach is a facilitator for the growth and development of creativity and dynamism in the rural environment.

The realization of the creative villages is effective in creating a balance in the rapid changes of the settlements, and the creative villages can provide the ground for attracting the creative class in contrast with the creative cities and strike a balance between these two settlements. Therefore, it is essential to make way for the revitalization of rural life through endearing proper rural life among the creative class and providing them with the facilities of sustainable life. The creative rural class is able to add new sectors to the economic, social, cultural and managerial dimensions of rural areas and create new opportunities for their development on a national and transnational scale. Therefore, it is necessary to examine the indicators of development of creative villages in rural areas. The present study analyzed the impact of RICT on the indicators of development of creative villages in rural settlements.

Eventually, given the significance of RICT and its impact on the indicators of development of creative villages in suburban settlements, the following suggestions are presented:

- To establish Internet service centers for large villages and those near cities (if it is not possible to set up such centers for all villages). This would be possible with the planning and assistance of the Telecommunication Company of Iran and the cooperation of relevant officials.
- To make the latest information available to the villagers and receive their feedbacks, prepare and broadcast TV and radio educational programs in the fields of agriculture and animal husbandry in accordance with the products of each region and take measures to increase information sharing and promote the use of the services. The measures may include holding English language classes for rural youth, raising awareness about the benefits and services of RICT, and providing free training courses on the use of the Internet and computer in agriculture and animal husbandry, whose implementation require more attentive attention of the planners, which can be possible through promotional programs.
- To localize global experiences, especially those of the countries with more cultural and infrastructural similarities in upgrading and developing the services of RICT centers and improving the indicators of development of creative villages.
- To improve the level of information literacy of the villagers in order to get them acquainted with the

services of RICT center and teach them how to do various tasks such as e-banking services, and so on.

- To provide high speed Internet services in rural areas; to reduce the cost of Internet access and mobile calls for the villagers; to donate computers to RICT centers to encourage villagers' use of RICT services. For creating proper institutional environment, rural development planners should design web sites to provide the villagers with up-to-date and essential information, and encourage governmental and non-governmental organizations to provide services through the Internet, establish coordination between local and national organizations to develop RICT services and provide appropriate conditions necessary for the development of creative villages.
- In terms of indicators of development of creative villages, the sample villages do not have many active workforces. To attract young people, government incentives, such as tax cuts and housing and employment facilities can be used to motivate young people to start their businesses. Therefore, the first step is to attract and prepare human resources to adopt new roles and create a suitable platform for producing creative ideas.
- To take communication and development plans into account in rural development plans and tourism boom, for example by creating a communication network between rural areas, common tourism markets (which connect several villages).
- To take into account creative industries in all fields such as cultural, ritual, artistic, agricultural and industrial ones. Programs such as ritual celebrations, branding and eco-tourism can be a way to attract tourists to rural areas. In addition, natural and geographical features can underlie some industries, such as pisciculture, ecotourism programs and natural tourism hubs.
- To explain the villagers, local and regional officials the proposed indicators through holding appropriate training workshops. It should be noted that after all these steps, government support must continue until the rural economy becomes dynamic and self-sufficient.

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Authors' contributions

The authors equally contributed to the preparation of this article.

Conflict of interest

The author declares no conflict of interest.

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تحلیل اثرگذاری فناوری دیجیتالی بر شاخص‌های شکل‌گیری روستای خلاق در ایران (مطالعه موردی: سکونتگاه‌های پیراشهری کلانشهر مشهد)

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چکیده مبسوط

۱. مقدمه

در جهان حاضر، باتوجه به تغییرات سریع تکنولوژی و رقابت بین‌المللی، توجه به نیروی انسانی خلاق در روستاها از اهمیت ویژه‌ای برخوردار است. استفاده از فناوری دیجیتالی نیز بر شکل‌گیری روستای خلاق به‌عنوان رویکردی نو در استفاده از قابلیت‌ها و ظرفیت‌های موجود روستا جهت احیای آن، تأثیرگذار است. در ایران ارائه خدمات با استفاده از فناوری‌های اطلاعاتی و ارتباطی به روستاییان یکی از راهبردهای است که در راستای کاهش و حذف شکاف دیجیتالی و رفع موانع ناشی از «انزوای جغرافیایی» در دستور کار متولیان توسعه روستایی قرار گرفته است. با توجه به تأثیرات گسترده این تکنولوژی در جوامع مختلف و نوپا بودن این موضوع در کشور ما، مطالعات کاربردی و میدانی در زمینه آثار آن در توسعه روستاها و شکل‌گیری روستای خلاق، می‌تواند در جهت به‌کارگیری صحیح این فناوری در روستاهای ایران، مفید واقع شود. از این‌رو تحقیق حاضر در پی پاسخ به سؤال زیر است: توسعه فناوری دیجیتالی از طریق فناوری اطلاعات و ارتباطات روستایی (RICT) به چه میزان بر شاخص‌های شکل‌گیری روستای خلاق در منطقه مورد مطالعه تأثیر داشته است؟

۲. مبانی نظری تحقیق

کنکاش در بین متون و پژوهش‌های مختلف در زمینه خلاقیت نشان می‌دهد که روستای خلاق مفهوم جدیدی است که در مقابل مفهوم شهر خلاق و به تبعیت از آن ایجاد شده و تعریف واحد و بین‌المللی در این باره تا به حال صورت نگرفته است. با این حال به تعریفی مختصر از این مفهوم اشاره می‌شود. روستای خلاق فضایی است که با اتکا بر فرآیندهای بوم‌مدارانه سبک زندگی، محیط زیست پاک و امکانات مطلوب زمینه جذب طبقه خلاق در صنایع با فناوری غیر سطح بالا، به‌ویژه در بخش فرهنگ و هنر را مهیا و بستر انتفاع برد -

برد جامعه روستایی و طبقه خلاق و همچنین مخاطبان و مصرف‌کنندگان محصولات خلاقانه در بیرون از محیط روستا را فراهم می‌آورد. مروری بر تجارب کشورهای توسعه یافته و در حال توسعه در به کارگیری فناوری اطلاعات در توسعه روستایی و کشاورزی، نیز نشان می‌دهد که به تناسب توانایی این کشورها، تقریباً در همه آنها استفاده از فناوری اطلاعاتی مورد توجه است. در این زمینه، نمونه‌های بسیاری از اقدامات و سیاست‌های کلان مانند راهبردهای توسعه این فناوری وجود دارند و در عین حال، نوآوری‌ها، ابتکارات و برنامه‌های خاص نیز به صورت زیرمجموعه سیاست‌گذاری کلان تحقق یافته است. در ایران بیش از سایر کشورها به کارگیری ICT روستایی را در زمینه‌های مختلف اجتناب‌ناپذیر می‌پندارند، زیرا جوان بودن بافت جمعیت کشور هزینه‌های بسیار بالایی را بر دولت تحمیل می‌کند؛ با توجه به اینکه بخش عظیمی از جمعیت کشور ما را روستاییان تشکیل می‌دهند، عدم توجه به این قشر صدمات جبران‌ناپذیری به کشور وارد خواهد کرد.

۳. روش تحقیق

روش تحقیق در پژوهش حاضر با رویکرد جغرافیایی، روش‌شناسی توصیفی-تحلیلی و مبتنی بر شیوه‌های کمی و کیفی است. ابزار سنجش را پرسشنامه محقق ساخته، تشکیل می‌دهد. میزان روایی گویه‌های تبیین‌کننده پرسشنامه با استفاده از آزمون KMO در میزان استفاده از فناوری دیجیتالی با مقدار ۰/۷۶۲ و شاخص‌های شکل‌گیری روستای خلاق با مقدار ۰/۸۳۵ مورد تأیید قرار گرفت. همچنین پایایی پرسشنامه برای میزان استفاده از فناوری دیجیتالی برابر ۰/۸۵۶ و شاخص‌های شکل‌گیری روستای خلاق برابر ۰/۷۸۱ مورد تأیید قرار گرفته است. پس از جمع‌آوری و دسته‌بندی داده‌ها، از روش آمار توصیفی و استنباطی (آزمون‌های همبستگی پیرسون و T تک نمونه‌ای) در محیط نرم‌افزار SPSS و همچنین برای استخراج

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ترکیبی) نشان داد که ضرایب T بین دو سازه اصلی پژوهش، بالای ۲/۵۸ بوده و رابطه معنادار و مستقیم بین دو متغیر برقرار است؛ بُعد "آگاهی از خدمات RICT" با ضریب ۰/۸۱۶، تأثیر بیشتری بر شاخص‌های شکل‌گیری روستای خلاق در سکونتگاه‌های نمونه داشته است. در بین شاخص‌های پژوهش نیز "ترویج و آموزش" با ضریب ۰/۵۹۱، "خطرپذیری" با ضریب ۰/۲۷۳ و "انعطاف‌پذیری" با ضریب ۰/۲۳۷ بیشترین تأثیرگذاری را در شاخص‌های شکل‌گیری روستای خلاق می‌باشد. در کل با توجه به مقدار ضریب تعیین (R2) برای متغیر شاخص‌های شکل‌گیری روستای خلاق (۰/۹۹۸) مشخص گردید تأثیرگذاری فناوری دیجیتال روستایی (RICT) بر شاخص‌های شکل‌گیری روستای خلاق در سطح قوی است؛ بنابراین فرضیه تحقیق مبنی بر اینکه، توسعه فناوری دیجیتالی از طریق فناوری اطلاعات و ارتباطات روستایی (RICT) تأثیر زیادی بر شاخص‌های شکل‌گیری روستای خلاق در منطقه مورد مطالعه داشته است، تأیید می‌شود؛ و ۹۹/۸ درصد تغییرات شاخص‌های شکل‌گیری روستای خلاق در منطقه مورد مطالعه به وسیله استفاده از فناوری دیجیتال روستایی پیش‌بینی شده است. در انتها ذکر این نکته ضروری است که به دلیل نبود مطالعاتی در رابطه با تأثیر فناوری دیجیتالی (RICT) بر شاخص‌های شکل‌گیری روستای خلاق، امکان مقایسه نتیجه تحقیق با تحقیقات قبلی وجود نداشته و این مطالعه، یک پژوهش اکتشافی به شمار می‌رود.

کلیدواژه‌ها: فناوری دیجیتالی، سکونتگاه‌های روستایی، شاخص روستای خلاق، توسعه روستایی، کلان‌شهر مشهد.

تشکر و قدردانی

پژوهش حامی مالی نداشته و حاصل فعالیت علمی نویسندگان بوده است.

مدل معادلات ساختاری و تعیین میزان اثر استفاده روستاییان از فناوری (دیجیتالی) بر شاخص‌های شکل‌گیری روستای خلاق از نرم‌افزار Smart PLS استفاده گردید. همچنین از روش‌های وزن دهی روش تحلیل سلسله مراتبی دلفی فازی (COCOSO) و تحلیل خاکستری فازی (FGRA) جهت تحلیل فضایی و رتبه‌بندی روستاهای نمونه استفاده گردید.

۴. یافته‌های تحقیق

بر اساس یافته‌های پژوهش حاضر باید عنوان کرد از نظر روستاییان میزان آگاهی روستاییان از خدمات فناوری دیجیتالی در کل با میانگین ۳/۵۵ بالاتر از میانه نظری تحقیق (یعنی ۳) بوده است؛ ولی میزان استفاده از خدمات با میانگین ۲/۷۶ کمتر از میانه نظری است. نتایج تحلیل فضایی سطح فناوری دیجیتالی نشان داد که روستاهای گرجی سفلی، حسین‌آباد قرقی و دهرود دارای بالاترین، و روستاهای کال زرکش و چهار برج دارای پایین‌ترین سطح استفاده از خدمات فناوری دیجیتالی (RICT) بوده است. همچنین شاخص‌های شکل‌گیری روستای خلاق در سکونتگاه‌های پیراشهری برابر با میانگین ۳/۷۷ و نشان‌دهنده سطح نسبتاً بالای شاخص‌های شکل‌گیری روستای خلاق در روستاهای مورد مطالعه است. نتایج آزمون T تک نمونه‌ای نیز مشخص کرد که شاخص "خطرپذیری" با آماره T برابر ۳۹/۹۹ بالاترین مقدار را به خود اختصاص داده است و مقدار آماره T برای متغیر شاخص‌های شکل‌گیری روستای خلاق نیز بالاتر از میانه نظری و معادل ۳۱/۷۲ است. نتایج رتبه‌بندی روش راه حل ترکیبی سازشی (COCOSO) نشان داد که روستاهای حسن آباد قرقی، گرجی سفلی و دوست‌آباد در رتبه اول تا سوم و روستای چهاربرج در رتبه آخر قرار گرفته است.

۵. بحث و نتیجه گیری

نتایج به‌دست‌آمده از نرم‌افزار Smart PLS نیز ضمن تأیید آزمون بیرونی مدل (مقدار روایی واگرا و همگرا، آلفای کرونباخ و پایایی

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