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Full Length Research Paper

The role and function of small towns in rural development using network analysis method case: Roniz rural district (Estahban city, province Fars, Iran)

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Problems resulted from the development of the large cities, population density and also immigration of rustics to these cities made planners to pay more attention to reinforcement and development of small towns. It is believed that by strengthening small towns we can change the way of immigration of rustics to larger cities and solve many problems of rural regions resulted from the lack of proper access of rustics to services centers. In Iran by performing the policy of changing villages to cities, many rural regions have been changed to cities especially during the last two decades. The current town of Roniz in Estahban city, Fars province, is one of the towns which have been changed into a town in 1990. The purpose of this paper is to study the role and function of Roniz town as a small civic center in the development of rural regions in its surrounding. In this direction by choosing 5 functions in the form of 20 variables and using network analysis method we have studied and compared the current affairs and relations in the understudied village in two intervals before and after Roniz becomes a town. The results of studies indicates that Roniz town as a central place, have played an important role in giving services to the regions in its surrounding which has consequently caused to reduce the dependence of rural regions to city center.

Key words: Small town, rural development, network analysis, urban-rural relations, Roniz town.

INTRODUCTION

Today with extensive economic-social and technological changes such as changes in transportation and communication systems, there has been a great development in urban-rural relationships. These relations are shown as the flow of population, goods, beliefs, capital, information and innovation. For this reason many of changes and revolutions in cities and villages are resulted from the quality and quantity of relations among the above mentioned matters. So it is necessary to consider urban-rural relations in the process of planning (Clayton et al., 2003; Bromley, 1984). Moreover, during the last decades different procedures have been brought forth to discuss forth to discuss rural development; One of these procedures which has spatial approach is the procedure village-towns. In general, the role of cities in rural development is achieved by means of rural relations and connections. New paradigms of development consider networks and flows because the connections and flows between rural and urban regions are important. Some of these rural-urban flows and connections can be helpful to each of these regions but we should pay attention to the point that net benefits can be flowed in different ways. As the result it changes after passing of time and from place to place (Lynch, 2005).

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In this regard small town centers are considered as the first urban centers and a part of rural regions and also considered as a link between rural regions and larger cities. Any activity in these centers will first directly influence rural areas (Fanni, 2003). Hinderdink et al. (1998) state that the role of small towns is very important in urban-rural relations but these relations are mainly ignored. Especially Randinly (1983) emphasizes the developmental role of these towns in providing a range of services for the area under their control (Hinderdink and Titus, 1998).

On this basis, one can not ignore the strengthening and development of small towns in the process of rural development planning because these centers provide utilizations and services for their rural area and can play an important role in development of the rural regions. In general, small towns can be considered as centers which play an important role in reinforcing developmental stimulants and also in developing rural regions under their control.

In Iran by performing the policy of changing large villages to city, many rural regions have been changed to cities during past decades, for this reason the number of cities in the country has been increased to more than 1000. In Fars province also the number of cities has been increased to 74 urban centers that many of them had been rural centers before that time, Roniz town (the center of Roniz rural district) is one of these rural centers which has been changed to city in 1990. Concerning the goals of changing large villages to towns, the present paper has been brought forth for discussion to study the function of Roniz city in the development of surrounding villages and also to give an answer to this question: Could Roniz city, as a small town, play a key role in providing services for the rural regions in its surrounding and consequently reduce the dependency of these regions to the center of township?

In this direction, the function of Roniz city in providing services for villages of rural district has been analyzed by using network analysis method and comparing the results before and after that.

SMALL TOWNS AND DEVELOPMENT OF RURAL REGIONS

In principle, to determine and define small towns we basically emphasize the size of population, because our information about other characteristics and specifications of these towns are limited. The definition of small town is different in variant countries and regions because of different social, economic and population conditions and circumstances.

In developmental projects of Iran there are different definitions for small towns based on population criteria. In Setiran report, spatial planning of the Islamic Republic of Iran and during the first program of development after the revolution (1983 - 1987) which was not put into practice, cities with population between 5000 - 25000 people have been considered as small towns. Also in the national fundamental plan, following the criteria offered by National Organization, cities with population less than 50000 people are considered as small towns.

During recent years, because of the fast development of large cities in developing countries, the emergence of problems related to inadequacy of residential units and the increase in the rate of unemployment, some researchers suggested that development planning should be made on the basis of putting emphasis on the activity of small towns. Because of the employment possibilities, education and other basic needs, large cities are the final destination of most rustics and migrants to small towns. Supporters of the theory about the role of small towns in development believe that in case of providing these needs in small towns the migration paths will be changed and instead of large cities, small towns will become the final destination of rural migrants (Shekouei, 2001).

The idea and subject of study about “The Functions of Cities and Small Towns in the Local and Regional Level” began with Janson’s work (1970) for the first time and discussion on “Center of Rural Development”, which was almost the newest subject in regional development, was initiated and brought forth by Fanni (2003). Janson (1970) considered the matter of small towns and their relations with rural development in the area of regional planning and stated that the existence of small towns is essential to merge the economy of villages with cities and large cities (Zebardast, 2004). Undoubtedly Dennis Randenili is one of the most persistent supporters of this approach who discussed this matter deeply and extensively with cooperation of Rodel in 1987 by writing the book, “Urban Functions in Rural Development” (Fanni, 2003).

In clarifying the role of small towns in national development, Nill Hanson considered city dwelling emerged from down which includes development of small and medium towns as a possible and practical means for growth of developing countries and its purpose is to provide the small needs of rural regions in their surrounding (Bagheri, 1996).

Small towns play a very important role as “Rural Development Centers” in the growth process of villages and provide services in different fields of marketing, providing agricultural inputs such as fertilizer and agricultural machinery, civic services such as educational facilities, medical care and so on for rural region in their surrounding (Amakchi, 2004). Welfare facilities are usually distributed heterogeneously in developing countries and they are usually centered in large cities. According to the theory of social justice, all the citizens even those who live in rural regions should have access to public facilities such as education and health care facilities. For those who have been inspired by central place theory and their unconditional executives, small towns are considered as

proper places for providing these services to rural regions (Tuerah, 1997; Weitze, 1965; Dehaghani, 2004).

MATERIALS AND METHODS

Network analysis method

In regional science different methods have been used and suggested for analyzing patterns, relations and hierarchies of human residential places. One of these methods is the method of social network analysis. Statistical models based on network analysis are used by researchers for about 1,360 years. The purpose of these models is a quantitative testing of the specifications of social relations among factors and components of a specific network. The range of these applications is from the studies on action and reaction among personalities, internal relations, friendship and leadership, studying the relations among groups and also the studies of societies, political behavior and power sector.

This method is used to determine the key residential place among different kinds of residential places by considering the number of internal dependencies in one system. This method should:

1.) Describe the dependence and relations among residential places in one region.
2.) Determine the degree and importance of a residential place or a set of residential places.
3.) Indicate the sensibility of the structure of a residential place in the absence of some specific residential places.

It seems that network analysis method is proper for all three above-mentioned points.

The network analysis method is widely used in social sciences and transportation researches, but it has been rarely used in determination of key or vial residential places.

The foundation of network analysis is based on analytical data framework which is dependent to information and hypothesis. Data may include data in the relations as well as action and reaction among people or individual or group attitude. The connection and dependence of two pair is called “relation”. The relations of data are selected by means of personal studying and negotiating the action and reaction with others. The relations are just between factor pairs and these pairs or binaries are proper units for the analysis of relations.

For example, two cities connected with a road between them and a shop with the customer, are kinds of pairs. The data in social transaction are put in a matrix which is called social matrix. The social matrix indicates sender factors to receiver factors. A social matrix is not a close frame, however the sender and receiver may be different or the same.

There are two basic kinds of relations in network analysis:

1.) Bilateral or evaluated
2.) Direct and indirect

Bilateral relation (0 - 1) is the existence of non-existence of relation between two factors or residential places in a residential complex and a value relation concerns intensity and abundance of a relation besides its presence or absence.

A direct relation has a clear origin and end. An indirect relation is not clear in relation with the origins of flow. An indirect relation is usually indicated as an arrow. A line between related factors is not specified by arrowhead. An arrow usually indicates a direct relation which is a line between factors with an arrowhead at the end. For example if village A sends its student to village B, the direction of education relation is from A to B which reflects the educational dependency of A to B.

Diagraphs

The related data can be indicated by means of graphs as well as matrix. If the related nodes have direction (arcs), the graphs will be called directed graphs or diagraph. The vertexes of diagraphs are called node and the relation between them are indicated by arcs.

A diagraph is a non-empty finite set of N. $n_i = \{n_1, n_2, \ldots, n_g\}$ whose member are called node along with a set of

A= $\{a_{12}, a_{13}, \ldots, a_{1g}, .., a_g\text{-}1, g\}$ from classified pairs a_{ij} that are called arc and n_i , n_j are separate members of N.

Graphic shape indicates that how one factor relates to other factors of the same system. If the numbers of factors is not too many, a graph is a proper way of indicating what factor relates to other factors and which factors are isolated and distinct and which one is sender and which one is receiver.

Adjacency in one analysis based on graph hypothesis indicates the fact that two factors specified by nodes have direct relation or node connection or are connected to each other. Formally n_i , n_j factors from N factors set and arrows A = $\{a_{ij}\}$ indicates the relation from factor i to factor j, factors i and j are adjacent if there is one of the arrows a_{ij} or a_{ij} .

In a diagraph D-(N, A), adjacency matrix is defined as follows: A (D) = $\{a_{ij}\}$ in which a_{ij} =1 if there is a_{ij} or a_{ji} , otherwise it will be zero. If all factors of the system are bilateral nodes we will have a complete graph. In a complete graph all the factors have bilateral nodes with other factors in other words a complete graph has the density of 100%. From mathematical point of view, the density (D) of a graph is the ratio of real arrows to the possible arrows.

The power of a node as a sender or receiver in a system can be easily calculated by means of social matrix or data of adjacency matrix. The number of arcs originated from a node is called external degree of node or in a social matrix, the external degree of a node is the linear adding of it and the numbers of arcs which are ended to a node are called external degree of that node. The internal degree is calculated by columnar adding of that node to double social matrix. Or in other word we can say that external degree is the total of table’s rows that indicate the dependency of the place to other places and internal degree of a place is the total of the columns of the table that indicates the number of the places which refer to this residential place and are dependent to it.

Based on social network analysis, nodes are very important. There are some criteria to measure the importance of a node which includes: Local centralization, Local Credit and General Centralization.

Local centralization: Reflects the number of direct transfers and therefore is basically measured by the external degree of each factor.

Local credit: Indicates the number of direct receiving and is measured by internal degree for each factor.

As these criteria are based on node degree, they also called centralization degree and credit degree. Regarding the way, a factor can be a transferor (arrow comes out of the node), a vector (there are at least 2 arrows: one coming out and the other coming in) or a receiver (the arrow comes in to the node).

Whenever the internal degree is zero the and external degree is

not zero, a factor is called origin or transferor; which means the total of rows is zero but the linear total has a non-zero factor. If external degree is zero and internal degree is not zero the factor is called receiver. An isolate factor is the one with both internal and external degree of zero. Following diagraph and matrix are a clear example that specifies the relations among four nodes:

A→B→C

D

As we see, A is transferor, B is vector, C is receiver and D is As we see, A is transferor, B is vector, C is receiver and D is isolated factor. When there is no arc to attach a node to other nodes of the network, the node is called isolated one. The adjacency matrix for this diagraph is as follows which indicates that A is in relation with B, B is in relation with C and C has no relation with outside and D has no relation with others and is an isolated node (Tables 5a and b)

General centralization: If a factor has the shortest distance from other factors, it is called central factor. The distance between factors is measured by nearness. Playing the role of being central, it is measured by the mean.

Nearness is the opposite of distance. The less the distance of i with other factors is, the more it is near to centre, from mathematical point of view we have:

$$C(n_i) = [\sum_{j}^{n} d(n_i, n_j)]^{-1}$$

In which d (n_i , n_j) is the shortest distance between i and j in the network and N is the size of network. This criterion depends on the size of network. So the scales should be standardized before being compared. We can standardize the estimation by diving it to (N-1).

Being between is to measure the probability of resting of one factor in the way of other factors. The more the number is, the more the factor has centrality.

Considering the objectives of research, the research method is based on the network analysis method by comparing the situation before and after. To gather information and required data, documental and library methods have been used and for gathering those information which could not be gathered through library method, field method has been used. Field method is based on questionnaire. In questionnaire method, questionnaires were provided for each villages of rural district in two sections before and after Roniz become a town (before section is the section before 1990 and after section is the present time). To study the flows and relations in two mentioned sections and to achieve the considered goals we have used the network analysis method. In this research to study the flows and relations, we have considered the operations which have the most usage in rural district, it includes 20 variables in the form of 5 operations such as health care operations (physician, health center, dentist, and pharmacy), cultural-educational operations (high school, pre-university, library), fundamental-service operations (post office and gas station), agricultural and animal affairs operations (selling surplus of the agricultural products, veterinary medicine and animal affairs, store of agricultural implements, repair shop of agricultural machinery), commercial-service operations (bank, household appliances store, constructional materials store, stationary store, electrical devices store, transportation company, foodstuff store). It should be mentioned that in order to analyze service relations among factors or residential places, in this research the relations have been considered in binary (0-1) in network analysis method.

The studied zone

Roniz is one of the rural districts of Roniz district located in Estahban city; the center of which is Roniz town. According to the census of 1996, the rural district of Roniz has had a population of 11651 people; 6469 in Roniz town and 5182 in other rural places (Iran Statistic Center, 1996). Based on the last population studies in 2004, this rural district has 20 residential rural places and 52 vacant rural places; among them seven of these residential rural places can be mentioned as village (planning and management organization of Fars province). Map (1) indicates the under study region.

RESULT

In order to study the functional role of Roniz (as a small urban center) in giving services to rural regions of the under study rural district, using network analysis method we have studied the flows and service relations which are under study (health, cultural-educational, fundamental-services, agricultural and animal affairs and commercial-services) in Roniz rural district in two sections before and after Roniz becomes a town. The sum up of all present flows and service relations of the under study region in two chronological sections of Tables 1 and 2 and Figures 1 and 2 indicates that:

- Unlike the first section in which Roniz had been dependent to Estahban for under study services, during the second section it had no dependency to Estahban (the external degree is zero after becoming a town).
- Considering flows and relations, Roniz city receives no services from rural points during first and second sections.
- During the first section considering the centralization of all services in Estahban, rural regions of the rural district of Roniz had the most dependency to this city and only one village (Dehooyeh) had been dependent to the present town of Roniz besides Estahban city. But during the second section by centralizing these kinds of services in Roniz (unlike first section), the dependency of the residential places in rural district to Estahban has been decreased and only the village of Gardeh is dependent to Estahban city besides Roniz town considering its equal distance to Roniz and Estahban (it has external degree of 2) and other rural regions are only dependent to Roniz (Figures 1 and 2). In other words before becoming a town the internal degrees of Roniz and Estahban have been accordingly 1 and 8. After becoming a town, it is observed that the internal degree of Roniz and Estahban are accordingly 7 and 1.
- During the second section (after Roniz becomes a town), the villages of Aliabad and Roniz Sofla have attained the capability of rendering some services (educational-cultural). For this reason the rural regions accordingly have the most dependency to Aliabad (with internal degree of 4) and village of Roniz Sofla (with internal degree of 3) to other residential places.

Table 5a. The amounts of utilities and public services in Roniz in two periods, before and after becoming a town.

Animal and agricultural services						Fundamental services						Cultural – educational services					
Repair shop of machinery		Store of farming equipment n		Veterinary pharmacy		Shopping center of production		Gas station		Post office		library		Per-university		gymnasium	
Roniz after be-coming a town	Roniz before be-coming a town	Roniz after be-coming a town	Roniz before be-coming a town	Roniz after be-coming a town	Roniz before be-coming a town	Roniz after be-coming a town	Roniz before be-coming a town	Roniz after be-coming a town	Roniz before be-coming a town	Roniz after be-coming a town	Roniz before be-coming a town	Roniz after be-coming a town	Roniz before be-coming a town	Roniz after be-coming a town	Roniz before be-coming a town	Roniz after be-coming a town	Roniz before be-coming a town
												*					
*		*		*		*		*		*		*		*		*	*
										*		*					
										*						*	

Table 5a. Contd.

Hygienic								Population		Residence
pharmacy		remedial		dentistry		physician				
Roniz after becoming a town	Roniz before becoming a town	Roniz after becoming a town	Roniz before becoming a town	Roniz after becoming to a town	Roniz before becoming a town	Roniz after becoming a town	Roniz before becoming a town	Roniz after becoming a town (1996)	Roniz before becoming a town (1986)	
								62	51	Abbasabad
								615	506	Aliabad
								669	568	Dehooyeh
*		*		*	*	*	*	6469	5437	Roniz
						*		1499	1212	Gardeh
								81	49	Kordikhani well
								1759	1433	Roniz Sofla
								387	319	Shamsabad

Table 5b. The relations between residences of assumed nodes.

	A	B	C	D
A	0	1	0	0
B	0	0	1	0
C	0	0	0	0
D	0	0	0	0

Table 1. Summation and analysis of all flows and relations in the studied zone before Roniz becoming a town.

Residential places	Abbasabad	Aliabad	Dehooyeh	Roniz	Gardeh	Kordikhani well	Estahban	Roniz Sofla	Shamsabad	External degree
Abbasabad	0	0	0	0	0	0	1	0	0	1
Aliabad	0	0	0	0	0	0	1	0	0	1
Dehooyeh	0	0	0	1	0	0	1	0	0	2
Roniz	0	0	0	0	0	0	1	0	0	1
Gardeh	0	0	0	0	0	0	1	0	0	1
Kordikhani	0	0	0	0	0	0	1	0	0	1
Estahban	0	0	0	0	0	0	0	0	0	0
Roniz Sofla	0	0	0	0	0	0	1	0	0	1
Shamsabad	0	0	0	0	0	0	1	0	0	1
Internal degree	0	0	0	1	0	0	8	0	0	9

Table 2. Summation and analysis of all flows and relations in the studied zone after Roniz becoming a town.

Residential places	Abbasabad	Aliabad	Dehooyeh	Roniz	Gardeh	Kordikhani well	Estahban	Roniz Sofla	Shamsabad	External degree
Abbasabad	0	1	0	1	0	0	0	0	0	2
Aliabad	0	0	0	1	0	0	0	1	0	2
Dehooyeh	0	0	0	1	0	0	0	0	0	1
Roniz	0	0	0	0	0	0	0	0	0	0
Gardeh	0	0	0	1	0	0	1	0	0	2
Kordikhani	0	1	0	1	0	0	0	1	0	3
Estahban	0	0	0	0	0	0	0	0	0	0
Roniz Sofla	0	1	0	1	0	0	0	0	0	2
Shamsabad	0	1	0	1	0	0	0	1	0	3
Internal degree	0	4	0	7	0	0	1	3	0	15

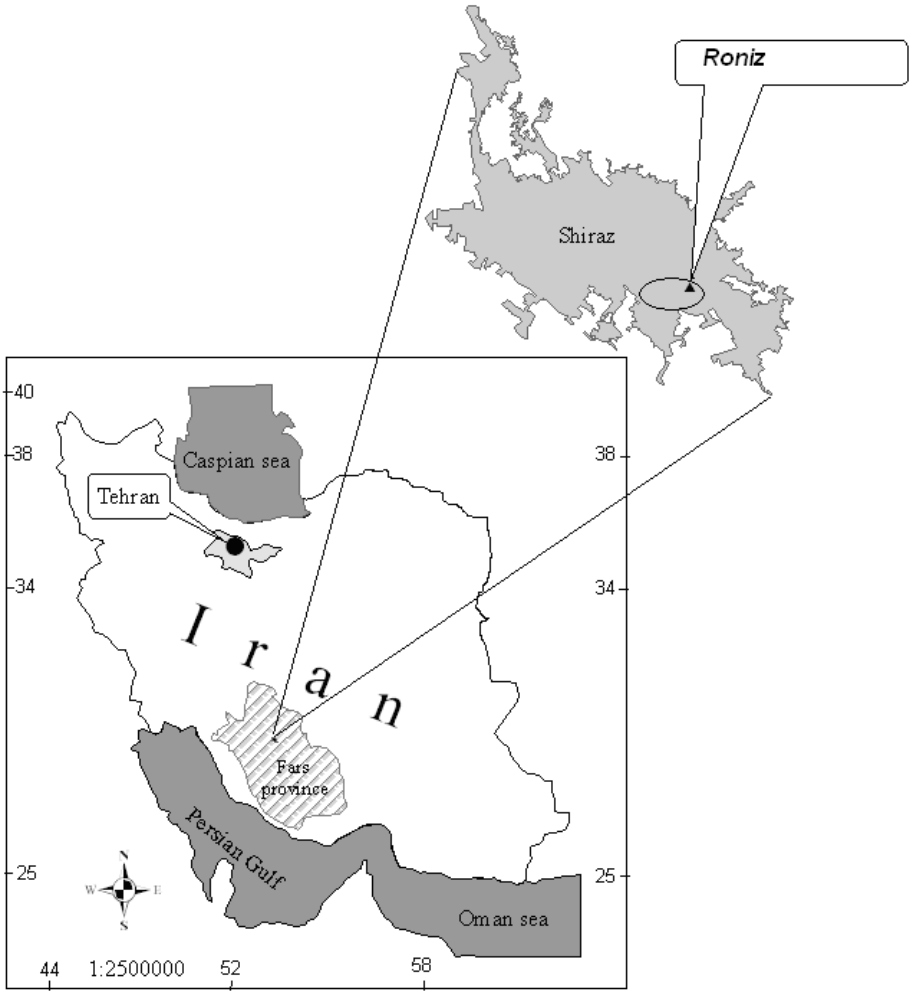

Figure 1. The area of the under-study rural district. Source: Iran statistic center 1996.

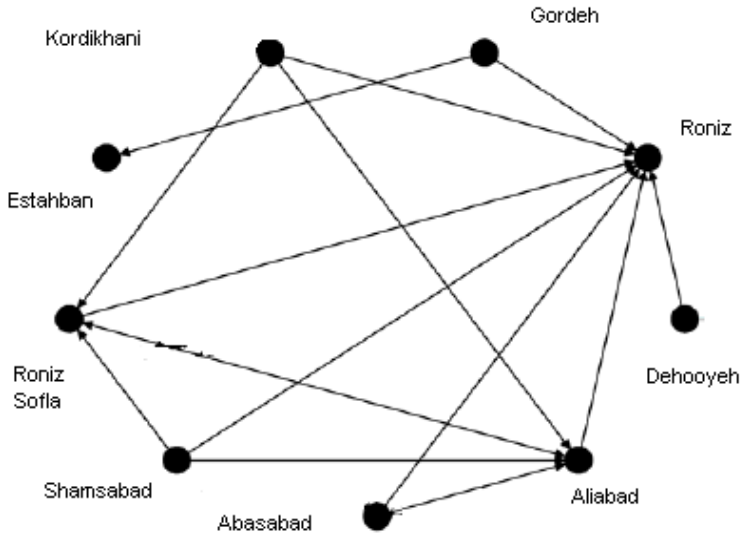

Figure 2. Diagrams of flows and relations in the studied zone before Roniz became a town.

Table 3. The Density of operations in the studied region before and after Roniz becoming a town (Iran's statistics center 1996).

Operations	Total of rows		Total of possible relations		Density (percent)	
	Before becoming a town	After becoming a town	Before becoming a town	After becoming a town	Before becoming a town	After becoming a town
Health care	8	8	72	72	11.11	11.11
Cultural-educational	8	15	72	72	11.11	20.8
Fundamental-service	8	11	72	72	11.11	15.28
Agricultural and animal affairs	8	8	72	72	11.11	11.11
Commercial-service	9	12	72	72	12.5	16.66
All flows	9	15	72	72	12.5	20.8

- During the first section except for Roniz that had given services to one village, the rest of villages in the studied rural district not only give services to other residential places but were not capable of providing services even to their inhabitants (having internal degree of zero). But during the second section villages of Roniz Sofla and Aliabad besides providing services for their inhabitants, have given services to the villages in their area and have played role of central places.
- Also, considering that the total of rows and columns of tables (internal and external degree) is not zero during both sections before and after becoming a town, it is observed that there is no isolated and distinct place during each section in the studied zone and these residential places are the sender of services to other regions or receive services from other regions.
- Studying the percentage of density of all flows in two sections before and after Roniz becoming a town shows that the density of flows in the first section is 12.5% and in the second section is 20.8%. Therefore the comparison of density in both sections indicates the improvement of density of flows and the increase of relations between residential places of the studied region (Table 3).
- Studying the percentage of density in each operation based on Table 3 indicates that before Roniz becoming a town due to the establishment and centralization of all services in Estahban city, the density of operations (except for commercial-service operation) has been the same and in general the density of operations has been in an undesirable situation. But in the section after Roniz becoming a town, since these services has been established in Roniz, just the density of agricultural and health care operation has been similar to the one before it becomes a town and the reason is the presence of these services in Roniz city. But the density of other operations in comparison with the previous section has been improved to some extent and the reason is the establishment and dispersion of these services in rural regions of the rural district and consequently the relations among residential places has been increased in comparison with the previous section.
- studying the value of centralization (nearness) in the section before and after Roniz becomes a town based on Table (4) indicates that in both sections in the studied region, Dehooyeh village has had a more closeness to other residential places.
- studying the case of being between among the studied residential places based on Figure (1) indicates that in the level of rural district, Roniz Sofla village has a greater centralization. Gardeh and Abbasabad villages because of being connected to the main road from the secondary road and Kordikhani village because of its situation, no village is passing through them (Table 4).

DISCUSSION

In this paper in order to study the role and function of Roniz town in the development of its surrounding villages, we used network analysis method to analyze the present flows and relations in rural district of Roniz during two sections of before and after becoming a town. In this direction by choosing 5 functions in the form of 20 variables and using network analysis method we have studied and compared the current affairs and relations in the understudied village in two intervals: before and after Roniz becomes a town.

Roniz is one of the rural districts of Roniz district located in Estahban city; the center of which is Roniz town. According to the census of 1996, the rural district of Roniz has had a population of 11651 people; 6469 in Roniz town and 5182 in other rural places (Iran Statistic Center, 1996). Based on the last population studies in 2004, this rural district has 20 residential rural places and 52 vacant rural places; among them seven of these residential rural places can be mentioned as village (planning and management organization of Fars province). Map (1) indicates the under study region.

Table 4. Studying and comparing internal and external degree, nearness and being between in the level of rural district before and after Roniz become a town. (Management and Planning Organization of Fares Province, 2004).

Residential places ↓	External degree		Internal degree		Total of distances to other residential places (before and after Roniz become a town)	Nearness (before and after Roniz becomes a town)	Being between (before and after Roniz becomes a town)
	Before Roniz becoming a town	After Roniz becoming a town	Before Roniz becoming a town	After Roniz becoming a town			
Abbasabad	1	2	0	0	9.562	0.105	0
Aliabad	1	2	0	4	9.937	0.1	5
Dehooyeh	2	1	0	0	8.687	0.115	4
Roniz	1	0	1	7	10.06	0.099	2
Gardeh	1	2	0	0	19	0.053	0
Kordikhani	1	3	0	0	12.375	0.08	0
Estahban	0	0	8	1	29.94	0.033	0
Roniz Sofla	1	2	0	3	10.188	0.098	7
Shamsabad	1	3	0	0	10	0.1	5

The results of the studies and examinations indicate that changing of Roniz to a town has had a positive effect on giving services to rural regions of Roniz rural district, because before this change all rural region of the studied rural district referred to Estahban city (centre of township), 25km away from Roniz city, and were dependent to it to provide the required services; but after Roniz becoming a town and after locating facilities and services in Roniz town, the number of refers and the degree of dependency of rural region to Estahban city has significantly decreased. In this section just village of Gardeh besides referring to Roniz refers to Estahban to provide some services because of having the same distance from both Roniz and Estahban. Other rural regions of the rural district refer to Roniz to get access to the required facilities and services concerning their short distance from Roniz (the average distance of villages from Roniz is 8.9km and from Estahban is 26.6km). After changing of Roniz to a town and location of some services in Aliabad and Roniz Sofla, these villages have attained the capability of giving services to their surrounding villages. Thus after the change of Roniz to a town, this small town (central place) has played a key role in giving services to rural regions surrounding it which has resulted in reducing the refers of these regions to the center of the city.

Also the study and comparison of the density of flows and relations at the level of rural district indicates that the amount of density is 12.5% before the change of Roniz to a town and 20.8% after this change which shows the most relations of residential places in rural district during the second section.

Considering the factors such as insufficiency of servicing facilities and lack of good access to them which results in reluctance of villagers to stay in rural regions and consequently results in their migration to cities on the one hand and factors such as limitation of capital which prevents giving services to all rural regions on the other hand, the development of small towns in hierarchical residential system is essential which can play an important role in regional and rural development and solve many of the problems involved in rural regions today.

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