

Relationship between Geographical Bases and Distribution of Rural Settlements in Arid Areas: A case study of the Khour-Biabanak District, Naein Township

A.R. Estelaji^{a*}, H. Barghi^b

^a *Department of Geography, Islamic Azad University of Shahr_e_Rey Branch, Tehran, Iran*

^b *Department of Geography, University of Isfahan, Isfahan, Iran*

Received: 19 November 2011; Received in revised form: 10 September 2013; Accepted: 23 September 2013

Abstract

Geographical bases have significant function in human settlements in terms of distribution and sustainability. This study attempted to provide an insight into the role of geographical bases in rural settlement distribution in arid areas. Accordingly, this study was done in the rural area of Khour-Biabanak, Naein city in Esfahan province. The methodology was that of a correlative research, to realize the study objectives through analysis of field, library and documentary information. Generally speaking, geographical bases fall into two main categories; natural and human, with a number of variables. This study applied 49 variables classified according to natural, economic, social and infrastructure related themes. Some natural and infrastructure bases such as water resources and road networks are assumed as important in terms of rural settlement distribution. However, the findings of this study reveal that some human based factors, such as the ratio of working people to total population and number of job opportunities, had a greater role in distribution and sustainability of rural settlements in arid areas. Other factors, including size of population, number of households and number of secondary schools were also significant variables that influenced service ranking in rural settlements in arid areas. The study concludes that such factors need to be given due consideration in planning for rural development in arid areas.

Keywords: Geographical bases; Rural settlements; Arid regions; Khour- Biabanak; Naein

1. Introduction

Geographical bases have recently experienced major shifts from descriptive geography to the more analytical and applied themes. The approach to applied geography is to deal with the spatial legislation. Unlike the traditional approach, this new approach assumes that the spatial issues and the related disparities can not be studied unless the roles of the developers and socio-economic mechanisms involved are adequately studied and understood. Accordingly, qualitative models coupled with behavioral and environmental perception geography have proved to be basic elements in development planning process (Corr, M.,

1994:14).

This study is thus an attempt to deal analytically with the relationship between geographical bases and the distribution of rural settlements. To do this, the credibility level of the interaction of geographical bases have been evaluated through various statistical tests.

The approaches to development planning at regional level (urban and rural areas) may generally be divided into following categories:

a. physical approach

The strategy resulted from this approach is named the strategy for "improvement and development of infrastructures".

b. economic approach

This approach results in four interrelated strategies: 1) Green Revolution; 2) agrarian

* Corresponding author. Tel.: +98 912 5130274,
Fax: +98 21 66055838.
E-mail address: a.estelaji@iausr.ac.ir

reforms; 3) rural industrialization; 4) basic needs.

c. Socio-cultural approach

This approach leads to two strategies, namely "community development" and "popular participation in rural development".

d. area and regional - spatial approach (estelaji, 2008)

Under this approach, following strategies are formed: site/place analysis (rural-urban/agropolitan development); UFRD (urban function in rural development (Hagget, p., 1994:64); settlement hierarchical system and rural central planning (Corr, M.,1994:14); integrated regional development (DHV Consultation Engineers Group, 1999:42); habitat development (Sarraf, M., 1991:37); and sustainable development.

Drought is a generally occurring phenomenon which its effects gradually (m.t.2011). The development of semi-arid regions of the world is encountering huge challenges. 35% of earth's people live in arid and semi-arid lands. Dry lands cover 41% of the planet and closely follow the world's map of poverty. Exposed to climate extremes, land degradation and desertification and poverty. This study aims to develop an analytical framework on the vulnerability of rural development in semi-arid area of Northern China make a general assessment of the vulnerability of rural development of a village. Vulnerability of rural development is the

Also, the research hypotheses are as follows:
H0- It seems that there is a significant correlation between geographical bases and rural settlements distribution in arid areas.

H1- It seems that there is a significant correlation between geographical areas and service-providing hierarchies in rural settlements in arid areas.

2. Material and methods

This study is an applied research which follows a correlative methodology. Villages of khour- Biabanak (a suburb of Naevin city, Isfahan province) have been selected as the cases for the study. Covering 10850 km² area, it is located at among Central Desert to the north, Rig Zarrin to the south and salt Desert (Kavir-e-namak) to the east.

Studies show that there are a variety of factors involved in formation of settlement systems. These factors that either individually or collectively influence the formation of settlements are known as geographical bases and fall generally into two categories: a) natural

attribute of the integrated rural system of nature, economy and society, which is of poor stability, sensitive to external disturbance, and hard to recover from external disturbance (Zhand and etal, 2010).

Theoretical frameworks well reveal that planning process have witnessed major shifts from descriptive methodologies toward analytical issues. In the 1960s, mathematical models and quantitative techniques were dominant. In the 1970s, the focus was on the human behavior and action toward environmental changes. Clear concepts in spatial planning theories supported by qualitative techniques, lay emphasis on the well-defined hierarchies in central areas that best fit human reciprocal behaviors. This type of planning that has taken a very gentle approach is considered a regional development strategy in practice (Estelaji, A.R., and Ghadiri, M., 2005:121-135).

As the theoretical frameworks suggest, qualitative techniques stem from a spatial approach applicable at all rural, area, regional and national planning levels. Out of different questions raised in this study, the following two are core questions:

- what relationship is there between geographical bases and the distribution of settlements in arid areas;

- Is there any significant correlation between geographical bases and service-providing hierarchies in rural settlements in arid areas; geography bases; and b) human geography bases. Climate, topography, water and soil sources, the means and ways of subsistence, reliance on other sections of mines and industry (e.g.mines, factories, ...),tourist attractions, roads and routes, terms and conditions prevailing cross- border exchanges, including ethnic, cultural, political and the like issues are generally known as the most important geographical bases (Assayesh, H., 2000: 67; Saeidi, A., 1998:44)

It can thus be said that geographical bases (including different natural, social, cultural, political, economic, religious, military, infrastructural, Communication, ... aspects and issues together give any rural settlement a spatial-place identity. Any shift or change in any of these factors may directly influence the functions of others. Natural factors have relatively stable and static features and morphologically lend themselves to observation and study. But cultural and social factors are dynamic in nature and are thus subject to constant changes (Clock, P.J., 1983:67).



Fig. 1. Landscape of khour area

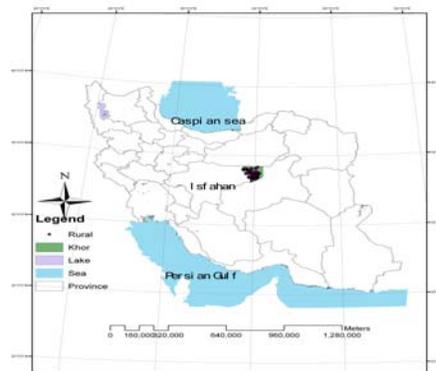


Fig. 2. Khor Position

3. Results and Discussion

A study of the current situation (status quo) reveals that the structure of settlement system is influenced by both natural and human geographical bases or factors.

With regard to the significant influences of geographical bases on the population settlement system and the distribution of settlements in khour-Biabanak district, the correlation between the dependent variable (distance of settlements from central district) and 49 independent variables (as mentioned in table 1) were determined, the results of which can be seen in tables 1 and 2.

As shown in Table 1, correlation coefficient between variables 'junior high school', 'sanitary house', 'dispensary', 'farmland size per household', 'use of spring water', 'use of piped-well water', 'number of poultry farms', 'factory and 'ratio of employed people to total population', and the dependent variable 'rural settlement distribution' in the selected area were determined as significant at 5% level probability ($p \leq 0/05$).

Results determined a significant relationship between the variable 'rural settlement

distribution' and the above-mentioned variables. Accordingly, H_0 proved true and H_1 was rejected. And this presents a warning for planners in the region. Because a lack of correlation between settlements and geographical bases will result in rural depopulation and migration. Also, Table 2 shows findings of the regression analysis for the correlation between the dependent variable and independent variables, out of which, the variable 'ratio of employed people to total population' proved highly significant.

As demonstrated by multiple regression (Table 2), out of the 49 variables, the variable 'ratio of employed people to total population' was determined as significant. According to R^2 , some 30% of the ratio of employed people to total population in the selected villages can be explained by the variable 'rural settlement distribution'. Also, significance of F in multiple regression ($p \leq 0/01$) showed that regression can be generalized for application to other arid areas.

As a result, although it seems that natural bases, or factors such as water resources, climate and soil type, have an important role in rural settlement distribution in arid areas, the

findings of this research indicate that in practice, economic functions and service facilities such as employment opportunities are

more important in terms of having an influence on distribution and sustainability of rural settlements in arid areas (Tables 1 and 2).

Table 1. Coefficient of correlation between independent variables and distribution of rural settlement distribution in the selected area

Independent variables	Coefficient of correlation®	Level of significance(p)
Population (1996)	0/078	0/683
Population (2006)	0/080	0/676
Number of households (1996)	0/076	0/689
Household aspects (1996)	0/158	0/405
Number of households (2006)	0/013	0/945
Household aspects (2006)	- 0/120	0/528
Growth rate (1986 - 1996)	0/243	0/196
Growth rate (1996 - 2006)	0/183	0/372
Growth rate (1976 - 2006)	0/164	0/378
Population age (0 - 14)	0/075	0/692
Population age (15 - 64)	- 0/139	0/645
Population age (above 65)	- 0/268	0/152
School age population (6+)	0/069	0/718
Number of literate males& females	- 0/202	0/285
Access roads(paved, dirt & gravel)	- 0/269	0/150
Filtrated water	- 0/309	0/097
Non-Filtrated water	- 0/170	0/369
Electricity/power	- 0/118	0/534
Rural service center	- 0/326	0/079
Mail box	0/050	0/794
Post office	- 0/123	0/516
Telephone	- 0/123	0/516
Primary school	- 0/044	0/819
Junior high school	- 0/287	0/124
Senior high school	- 0/547	0/002*
Rural cooperative	0/025	0/896
Public bath	- 0/326	0/079
Sanitary house	- 0/587	0/001*
Dispensary	0/507	0/004*
Access to TV channel 1	0/265	0/158
Access to TV channel 2	0/265	0/158
Access to TV channel 3	0/265	0/158
Access to TV channel 4	0/265	0/158
Access to TV channel 5	- 0/402	0/128
Access to F.M. radio wave	0/005	0/980
Access to natural gas pipeline	- 0/243	0/196
Ratio of farmland use to household	- 0/003	0/989
Ratio of livestock users to household	- 0/311	0/094
Petty animal per head	- 0/282	0/132
Big animal per head	0/172	0/364
Number of poultry per household	- 0/017	0/929
Cultivated land size to total land area	- 0/324	0/081
Farmland size per household	- 0/516	0/004*
Aqua duct water	- 0/301	0/107
Fountain water	- 0/447	0/013*
Tube-well water	- 0/379	0/039*
Number of poultry farms	- 0/459	0/011
Factory	- 0/450	0/014*
Ratio of the employed people to population	0/522	0/003*

Sources: - national population and housing census (1976, 1986, 1996, 2006) - Iranian statistics Center

- khour-Biabanak District_ governor office, 2006

- Sanitary houses at the selected villages, 2006

- Findings obtained from the questionnaire and field studies

- Agricultural database (2003)- Iranian statistics Center

* : significant at $p \leq 0/05$

Table 2. multiple regression of correlation between the dependent variable and independent variables

P	F	Std. Error of the Estimate	Adjusted R square	R ²	R	Sig	T Test	Standardized Beta coefficient	Beta coefficient	Dependent variable
0/003	10/57	14/74	0/277	0/306	0/553	0/003	3/25	0/553	40/14	Ratio of the employed people to total population

At present, in the selected area there are three major population centers with slight differences, that comply with the administrative-political divisions of the Khour-Biabanak district. The northern part, as the first of these population centers, included the Jandaq township and its satellite villages. Farahzad and Mesr were the only two villages with considerable sized populations; because the other 9 villages in this center had either small populations or were depopulated and entirely deserted.

The second most populated center was mid-center (central part) which included villages of the Biabanak sub-district. In 1996 and 2006, this center harbored 4781 and 4762 residents, respectively that constituted about 59.3% and 64.7% of the total population in the selected areas. There were 19 villages in this center, with an average population of 250. The village of Farrokhi with 2389 and 2626 residents and Chahmalek with 1517 and 1415 residents in the years 1996 and 2006 respectively were the more highly populated centers of the region.

The third most highly populated center in the area under study was the southern part, that mostly covered villages of the Nakhlestan sub-district. With 19 villages, this center harbored populations of 2989 and 2390 in the years 1996 and 2006 respectively. The villages of Mehrjan and Iraaj each with a population of more than 500 were among the most populated villages in the region.

Analysis of the field study clearly demonstrated that residents of the urban areas (Khour and Jandaq) and rural areas in the selected region generally provided their services from either Naein township (central city) or Esfahan city (center of the province). The reason was that these two centers offered better services and as a result, no service links were evident between the district and urban centers such as Semnan, Tabas, Ardakan and Yazd as the nearby cities. Thus, service links show entire

compliance with the political divisions in the selected area. Service links within the area may be depicted as follows:

- The township of Khour was the district's political and administrative center and the main provider of healthcare services (excluding the hospital), commercial and educational services (up to high school level), and administrative and disciplinary services for people living in the district.

- The long distance between the townships of Jandaq and Khour (95 km) service links meant that they services were limited to administrative and disciplinary services and thus service needs of the people in Jandaq were mostly met by the cities of Esfahan and Naein. However, the township of Jandaq provided some services to meet the needs of residents of Mesr village and peripheral hamlets.

It can thus be determined that the township of Khour ranked first in the district in terms of service hierarchy. And the township of Jandaq as an urban center, was important in terms of its administration position, its importance was not equal to that of Khour in terms of administrative and service structures.

Findings from field studies also revealed that some rural centers such as Farrokhi, Mehrjan and Iraaj were close to the above- mention townships in terms of service hierarchy, due to having a senior high school, telecommunication facilities and trading service centers.

The third rank in the service hierarchy was assigned to Garmeh, Mesr, Ardib, Aroussan and Haftooman village centers that each had a junior high school, a cooperative society and telecommunication facilities that provided some of the services for people living in their peripheries.

According to the general findings of this study, as mentioned above, rural settlements in the Khour-Biabanak district can be ranked in terms of service hierarchy, this is shown in Table 3.

Table 3. Ranking of rural settlements in Khour-Biabanak districts in terms of service hierarchy

Rank	settlements	Services offered
1	Khour , Jandaq	Administrative, healthcare (other than hospital), commercial, educational and disciplinary (police) services
2	Farrokhi, Mehrjan, Iraaj	Commercial, telecommunication, and educational (up to senior high school level) services
3	Garmeh, Mesr, Ardib, Aroussan, Golestan, Haftooman, Chahmalek	Telecommunication service, educational services (up to junior high school level) and cooperative societies
4	Other settlements	-----

Sources:

- National population and housing census (1976, 1986, 1996, 2006)- Iranian statistics center
- Khour-Biabanak District-Governor office, 2006.
- Sanitary Houses at the selected villages, 2006.
- Findings obtained from the questionnaire and field studies

In order to determine how geographical bases and service hierarchy in the rural settlements of the Khou-Biabanak district were correlated, the relationship between the dependent variable (rank in service hierarchy) and the 49 independent variables was investigated using statistical tests (Table 4). The results are provided in Table 5.

Analysis of the relationship between independent variables and the dependent variable 'hierarchy of services provided by settlements in the selected area' shows that out of 49 independent variables, only three variables (population, household and high school) proved to be significant at $p \leq 0/05$. In other words, only these three variables showed a correlation to the hierarchy of services provided by settlements in the selected area. Accordingly, other than the five starred cases in which H0 was rejected and H1 was accepted, H0 and H1 were accepted and rejected respectively. These findings are cause for concern, because they indicate a future that is not promising for the selected area (Table 5).

According to the findings of multiple regression (Table 5), out of the 49 variables, the only variable that had a significant correlation with the hierarchy of services provided by settlements in the selected area was 'population in 2006'. Also, according to R^2 , some 22% of variable 'population in 2006' was explained by the variable 'hierarchy of services provided by settlements'. Also, significance of F in multiple regression ($p \leq 0/05$) for results determined by this study provide a clear indication that the study could be generalized and applied to other arid areas (Tables 4 and 5). As a result, number of population was an important factor in ranking for hierarchy of services provided by rural settlements in arid areas that should be taken into consideration when planning for rural development in arid areas.

4. Conclusion and suggestions

Findings of this research study reveal that amongst the 4 studied variables, those related to 'senior high school level', 'sanitary house', 'dispensary', 'farmland size per household', 'spring water', 'piped-well water', 'number of poultry farms', 'factory', and 'ratio of employed

people to total population' had significant correlation with rural settlement distribution in the selected area. According to regression analysis, the variables 'ratio of employed people to total population', 'employment opportunities' were the most significant factors in forecasting rural settlement distribution in arid areas, and as R^2 shows, 30% of the variable 'ratio of employed people to total population' in the selected rural area was explained by 'rural settlement distribution'.

Part (22%) in forecasting the dependent variable. Accordingly, as shown by research findings, in addition to natural factors, there were some human factors that clearly affected distribution patterns in rural settlements of arid areas. 'Number of employment opportunities' that affect rural settlement distribution and 'number (size) of population' that influenced the service hierarchy in rural settlements of arid areas were among the influential human factors that need due consideration in planning processes for rural development. In order to maintain existing populations in the area under study, it is recommended that provision be made for rural people with low incomes by stimulating employment opportunities. Rural industries and mines in the selected area had the capacity to support this recommendation.

Also, analysis of the relationship between geographical bases and hierarchy (ranking) of services in rural settlements in the selected area, demonstrated that the variables 'number of population' (population size), 'number of households' and 'senior high school' were significantly correlated with hierarchy of services. Findings of multiple regression demonstrated the variable 'population in 2006' had the greatest Establishment and development of appropriate rural industry, such as carpet weaving and other crafts and manufacturing industries such as small processing factories under the direction of rural industrialization, can be effective measures to facilitate and accelerate the process of rural development through improving job opportunities, and provision of a sense of well-being and to raise levels of income for inhabitants of the area; as these were the determinant factors identified in the study to reduce rural-urban migration and regional inequality.

Table 4. coefficient of correlation between independent variables and hierarchy of services provided by settlements in the selected area

Independent variables	Coefficient of correlation®	Level of significance(p)
Population (1996)	- 0/574	0/001*
Population (2006)	- 0/561	0/001*
Number of households (1996)	- 0/569	0/001*
Household aspects (1996)	- 0/239	0/204
Number of households (2006)	- 0/425	0/019*
Household aspects (2006)	- 0/078	0/681
Growth rate (1986 - 1996)	- 0/122	0/52
Growth rate (1996 - 2006)	0/145	0/479
Growth rate (1976 - 2006)	0/100	0/600
Population age (0 - 14)	0/174	0/359
Population age (15 - 64)	0/084	0/658
Population age (above 65)	- 0/050	0/793
School age population (6+)	0/170	0/370
Number of literate males& females	0/075	0/694
Access roads(paved, dirt & gravel)	- 0/060	0/752
Filtrated water	- 0/069	0/717
Non-Filtrated water	0/067	0/726
Electricity/power	0/113	0/553
Rural service center	- 0/112	0/556
Mail box	0/146	0/443
Post office	0/067	0/726
Telephone	0/067	0/726
Primary school	0/150	0/428
Junior high school	- 0/006	0/975
Senior high school	0/370	0/044
Rural cooperative	0/210	0/266
Public bath	- 0/112	0/556
Sanitary house	0/222	0/239
Dispensary	- 0/032	0/866
Access to TV channel 1	- 0/146	0/443
Access to TV channel 2	- 0/146	0/443
Access to TV channel 3	- 0/146	0/443
Access to TV channel 4	- 0/146	0/443
Access to TV channel 5	- 0/022	0/909
Access to F.M. radio wave	0/192	0/310
Access to natural gas pipeline	0/025	0/894
Ratio of farmland use to household	0/195	0/302
Ratio of livestock users to household	- 0/094	0/620
Petty animal per head	- 0/051	0/789
Big animal per head	- 0/144	0/447
Number of poultry per household	0/150	0/430
Cultivated land size to total land area	- 0/079	0/678
Farmland size per household	0/137	0/471
Aqua duct water	0/212	0/262
Fountain water	0/183	0/333
Tube-well water	0/149	0/432
Number of poultry farms	0/184	0/330
Factory	0/210	0/266
Ratio of the employed people to population	- 0/035	0/855

Sources:

- National population and housing census (1976, 1986, 1996, 2006)- Iranian statistics Center
- Khour-Biabanak District_ governor office, 2006.
- Sanitary houses at the selected villages, 2006.
- Findings obtained from the questionnaire and field studies.
- Agricultural data-base (2003)- Iranian statistics Center.
- : Significant at $p \leq 0/05$

Table 5. multiple regression of correlation between independent variables and hierarchy of services provided by settlements in the selected area

P	F	Std. Error of the Estimate	Adjusted R square	R ²	R	sig	T Test	Standardized Beta coefficient	Beta coefficient	Dependent variable
0/015	6/89	3/17	0/191	0/223	0/472	0/015	- 2/62	- 0/47	- 0/003	Ratio of the employed people to total population

References

- Assayesh, H., 2000. Rural planning in Iran., Payam-e-Nour University. Tehran.
- Agricultural Data-Base, 2003. Iranian Statistics Center. Tehran.
- Badrifar, M., 2006. Rural studies Project. Geographical Research, 26: 71-78.
- Barghi, H., A. Ghadiri Massoum, and M. Mahdavi, 2005. Statistical review of employment growth trends in rural Isfahan. Geographical Research, 54:157-172.
- Clock, P.J.1983. Introduction of rural settlement planning. Kindle Edition.
- Corr, M. 1994. Toward Ecophilosophical Approach to community and regional planning. Abioregional framework, Planning paper No.2, Vancouver.
- Dastorani, M.T., 2011. Application of artificialneural networks on drought prediction central IRAN. DESERT, 16: 39-48.
- DHV consultation Engineers Group in Netherland. 1992. Guidelines to planning for rural centers. Translated version, Rural Development Studies center. Ministry of Agriculture.
- Estelaji, A.R. 2008. Approaches to sustainable development of arid regions a case study in arid regions of Iran. DESERT, 13: 53-58.
- Estelaji, A.R. and A. Ghadiri Massoum, 2005. Quantitative techniques in analyzing settlement establishment system. Geographical Research, 53: 121-136.
- Ghadiri Massoum, M., 2000. Different concepts and aspects of development. Scientific and Research Journal, 159:1-17.
- Hagget, P., 1994. New combined Geography. SAMT Press Tehran.
- Iranian statistics Center. National population and housing census (1976, 1986, 1996, 2006).
- Islamic Revolution Housing Foundation at Isfahan province, 1999. Rural settlements organizing plan, Isfahan.
- Khour-Biabanak District Rural sanitary Houses Data, 2006.
- Mahdavi, M., 1994, Geographical Review of water Resources in rural Iran. Majid Press. Tehran.
- Mahdavi, M., 1998. Essentials of rural geography. SAMT Press, Tehran.
- Rondinellie, D., 1985. Applied methods of regional analysis; the spatial Dimensions of Development policy Boulder go, Westview press.
- Saeidi, A., 1998. Essentials ofrural geography, SAMT Press, Tehran.
- Sarrafi, M., 1992. Planning theory and development. Discussion paper No,32. Vancouver, UBC school of Regional planning.
- Star, J. and J. Estes., 1990. Geographic Information System: An introduction. Englewood Gliffs.
- Taherkhani, M. and M. Mahdavi, 2000. Application of Statistics in Geography, Ghoms Press. Tehran.
- Yaghmaei Hekmat, A.K., 1990. On the coast of Kavir-e-Namak, Toos Press.