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Rural hierarchy cleavage analysis based on development indicators

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Abstract: Some of the most important characters in convenience are economic, social equity and optimal distribution of facilities of development among people in societies. Planners are, in different societies in direction for decreasing inequity and poverty, designing many plans. Fundamental steps in design' planning for capturing these goals is paying more attention to plans with an approach to reality in society. With a sufficient knowledge and diagnosis about real situation, we cannot be successful in planning. The goal of this paper is analysis of the Iran spatial organization with formation of classification for development. The kind of research is developmental and our method is analytical-description. This research used many important Indexes and various elements with statistical analysis. The technique used is in the form of multidimensional statistics that is cluster analysis. The conclusion with 14 in indexes show that 46 rural Areas are developed in Iran, 130 provinces of rural areas are in the process of development, and 63 provinces of rural Areas from Iran are underdeveloped. These conclusions could help the planners and managers for strategic planning in facing with problems in rural Areas in Iran.

Keywords: Classification, Rural Area, Under developing, Cluster analysis, Iran

Introduction

Implementing land reforms in association with other reforms in 1960's aiming at releasing villagers from the yoke of landowners, while collapsing the social, economic and even cultural structures of villages, resulted in emergence of 2.5 million family operation units. Hence, the people who were farmers in the past, as the result of the reforms became landowners, and so peasant operation system with new features entered into country's operation system. After land reforms, from the beginning, this governing system of the country confronted with problems due to inability in providing agricultural inputs. Therefore, its results were decreasing agricultural products, converting farmers to factory workers, increase of foreign goods consumption and absorption of rural youths in assembling factories, so that the produced changes in 1961's, instead of saving the villages resulted in destruction of them. This paved the way for rural backwardness from cities more than before.

After the victory of Islamic revolution, just from the beginning of the establishment of construction

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Jihad in 1979, fundamental changes started in different economic, social, and cultural areas of the country's villages and because of strategic importance of agricultural and rural issues, they were at the top of the agenda of government plans to achieve the development of majority of the villages in addition to decreasing the inequality and eradication of poverty. In spite of huge investment on infrastructures, services and welfare facilities in rural areas during past years in order to decrease poverty, now there is irregular immigration, widespread poverty, growing inequality and even negative labor force, high loss of agricultural products, etc in rural areas. The origin of these problems can be found in not allocating optimum resources to more undeveloped villages and inattention and unfamiliarity with essential and real needs of villages (Mahdavi,2002: 95).

The first reason which makes the present research important is using a new and practical method in classification of country's geographical regions from the under development viewpoint. In this connection, cluster analysis helps the researchers in determining the under development degree of country's different regions (regardless of level) just by classifying them on the basis of their homogenous degrees. It needs to mention that the government is in the midway of implementing the fourth plan of economic, social, and cultural development of the country. Knowing the status of different regions of the country especially rural areas and including them in plans (short and long term) are issues that will contribute greatly in effectiveness of the plan and moving in the direction of Prospective Document of Iran 2020.

Regarding the unpleasant picture of the country's rural areas, it seems necessary to provide a new analysis and revise the previous views (in order to better prioritize the resources), so that while reidentifying the areas from the viewpoint of under development levels using new methods based on the merely rural statistics and data be considered. In this connection, the researcher tries to achieve it by the assistance of key indices of different economic, social and cultural sections and by using different statistical software (Excel. SPSS). In this research by using different development indices within the population, economic, infrastructure of education and cultural framework , the rural areas of different cities of the country will be classified using "multivariate statistical analysis" within the framework of "cluster analysis".

In this direction, rural areas of different cities of the country will be classified into four different groups within the framework of the following levels:

1. Undeveloped
2. Less developed
3. Developing
4. Relatively developed

The article aims at classifying the status of rural inhabited places during the three decades after the victory of revolution, so that it specifies the status of each of the rural areas of the country's cities regarding the different developmental indices of the year 2007. In addition to that the results of the research can play a role in short term plans (operation of annual budgeting).

Also, the special situation of the Islamic republic of Iran from the territory extent and climate diversity viewpoint requires that more attention be paid to different areas. Classification of different areas of the country causes the required investment is made for the abilities and capabilities of each area of the country (in short and long term).

Methodology

The kind of research is developmental and the method of study is descriptive-analytic. The initial statistics was provided with direct Library study, statically reports, and reports published by related governmental centers and departments including statistics center of Iran, management and planning organization, and the ministry of agriculture.

Explanation of research and methodology of the plan became possible by using library documents

which include the archived documents in libraries of research, academic and governmental centers and also internet websites.

In this research, to determine the levels of the development of rural areas of the country's cities, at first step 23 indices were selected, all of which had a positive relation with development and each of them involved specific aspects of the issue being studied. By scrutinizing, some of the indices were abandoned due to the lack of data about all cities or lack of coordination with developed ones or due to being bidirectional. The study was performed by 14 indices that seemed to have positive and direct relations with development of country's cities. These indices represent different aspects of development such as economic, social and cultural and other dimensions of development. The complete list of the used indices is shown here. It needs to explain that the used statistics and data are related to the year 2008, which was provided on the basis of available statistical reports (table no. 1).

Applied model (cluster analysis)

After collecting all needed statistics and data for rural areas of 334 cities of the country, it is necessary to use a statistical method which classifies the intended data on the basis of similar features.

In this connection, based on the intended purposes, the cluster analysis method was selected from among different multivariate statistical analyses. Cluster analysis is a kind of multivariate analysis technique which organizes the related data to indices in relatively similar groups or in clusters. Features of the cluster members formed by this technique must greatly be similar in internal aspects and dissimilar in external aspects to each other. In other words members within the cluster must greatly be similar to each other and on the other hand members of two different clusters must not be of uniform and similar features. (THC, 2006:1).

Clustering methods are classified into two general groups of "hierarchical "and "non- hierarchical ".Hierarchical clustering is used when there is no definite classification in researches, and conversely, non- hierarchical method is used in researches when there is initial classification. In the following, hierarchical methods are mentioned which have been used in this research. (Janson and et al., 2001: 685).

Clustering method is performed with a series of successive combinatory by a series of successive classifications. The method itself is done in two forms, including:

1. Agglomeration hierarchical clustering method
2. Divisive hierarchical clustering method

In the first method, clustering starts from single things. Hence, at first there are clusters as the same number of things. First, the things having the most similarity with each other are classified. Finally, once the similarities decrease, all groups become a cluster. But in divisive hierarchical clustering method, it is done reversely, i.e., first, a group of things is divided into two sub-classes in such a way that things in one group be "farther "than things of the other group. Then these sub-classes are divided into similar groups so that there are as many groups as the number of things. (Raveh & Lipshits, 1998: 32).

Here, considering the subjects of most of the projects, it seems better to focus on agglomeration hierarchical methods, which can be performed in four methods, Including:

1. Nearest neighbors method (single linkage)
2. Furthest neighbor's method (complete linkage)
3. Average distance method (average linkage)
4. Ward's minimum variance method (Ibid, 1998: 699).

Here, it needs to mention that before description and attempt to clustering (performing above-mentioned methods), doing some initial works on data and preparing them to clustering operation is necessary. In this connection, the intended cases are presented as follows, including:

First step: forming data matrix

The first step in factorization of clusters is forming data matrix in which each one of its lines allocates to one case and each column to one variable. For this reason, considering n field, each of them has m index. Therefore, the vectors can be described as the following:

$P_1(X_1, X_2, ...X_m)$
$P_2(X_1, X_2, ...X_m)$
….
….
$P_n(X_1, X_2, ...X_m)$

Given the above-mentioned vectors, we form a matrix of n line and m column as the following:

$$X = \begin{bmatrix} X_{11}, X_{12}, ..., X_{1m} \\ X_{21}, X_{22}, ..., X_{2m} \\ \vdots \\ X_{n1}, X_{n2}, ..., X_{nm} \end{bmatrix}$$

In the above matrix, Xij characteristic is the j the index of i the field, where:

i=1,2,3,...,n
j=1,2,3,...,m
(Ziari, 2009: 176).

The second step: forming standard data matrix (Z)

Often, in the formed matrix, the indices being studied and used are not of uniform scales and units; this will make the performing algebraic operation on indices difficult. To remove the different scales of indices we need to standardize the data. In other words, the different variables existing in one line must be measured in terms of unit and standard deviation to the original average. (When we subtract an average from a variable and divide by "standard deviation", it is said we have standardized it.)

To standardize matrix X, first we measure the average of each column of it.

$$\mu_j = \frac{\sum_{i=l}^{n} X_{ij}}{n}$$

Then we calculate the standard deviation of each column of matrix X:

$$\sigma_j = \sqrt{\frac{\sum_{i=1}^{n} \left(X_{ij} - \mu_j\right)^2}{n}}$$

Having the average and standard deviation of each column of matrix X, we form the matrix X with n*m dimensions as the following:

$$Z_{ij} = \frac{X_{ij} - \mu_j}{\sigma_j}$$

Zij = standardized data
Xij = initial data
μj = average of variables related to i th sample.
δj= standard deviation related to i th sample
Then, matrix Z will be as the following:

$$Z = \begin{bmatrix} Z_{11}, Z_{12}, ..., Z_{1m} \\ Z_{21}, Z_{22}, ..., Z_{2m} \\ \vdots \\ Z_{n1}, Z_{n2}, ..., Z_{nm} \end{bmatrix}$$

The third step: forming distance matrix

After standardization of initial data, the distances between two samples are determined. To determine the distance of two samples from each other in terms of multiple variables being studied, different methods of distance determination should be applied which regarding to easiness of calculations and accuracy in distance determination; the Euclidean distance is commonly used. (Ibid 2009:184). To determine the distance between two points (two fields) of A and B in each set with m variable, the following formula is used:

$$D_{ab} = \sqrt{\sum_{j=1}^{m} (Z_{aj} - Z_{bj})^2}$$

Where, a and b represent two fields, and D_{ab} represents the distance between the two points.

From the above formula, it can be concluded that:

1. Distance of field **a** from field **b** is equal to **b** from **a**: $D_{ab}= D_{ba}$
2. Distance of each field from itself is equal to zero: $D_{aa}=D_{ab}=0$
3. The distance of field **a** from field **b** is equal or less than the distance of the field **b** from **a** plus **c** from **b**: $D_{ab} \leq D_{ba} + D_{bc}$

From what was said, a matrix named distances matrix can be formed and showed as the following:

$$D = \begin{bmatrix} D_{11} & D_{12} & \cdots & D_{1n} \\ D_{21} & D_{22} & \cdots & D_{2n} \\ \vdots & & & \\ D_{n1} & D_{n2} & \cdots & D_{nm} \end{bmatrix}$$

Matrix D is n*m symmetric matrix which its main diagonal is zero. This matrix explains the distance of each field from the other field.

The final goal in distance determination is that we want to know how much close the two samples in terms of multiple variable are (Manli, 1995: 58).

Forth step: agglomerative hierarchical factorization method

As mentioned before, this step can be performed with one of the following methods:

1. Nearest Neighbor Method (Single Linkage Method) = SLINK
2. Furthest Neighbor Method (Complete Linkage Method) = CLINK
3. Average Distance Method (Average Linkage Method) = UPGMA
4. Ward's Minimum Variance

Fifth step: drawing cluster tree

The principal output of cluster analysis is dendrogram which is also called "tree Figure".(figure no.1).

Sixth step: determination of the number of the final groups

Determination of the number of groups which results from cutting the cluster tree is very important. Regarding the project's aim, the cluster tree can be cut from a distance that provides the number of the project's groups. But, if the initial number of groups is not definite, the cluster tree is cut from the most distant point between groups, so that it results to the number of groups completely different from one another (with most similarity in inter- groups and most difference or distance between groups) (Construction Jahad Iran, 2001)(Figure no.2)

Data analysis

The basis of calculations in this group is separating geographical areas into four groups of relatively developed, developing, less developed, undeveloped. This separation, as mentioned before, has been performed due to gross inhomogeneous existing between features and facilities of different groups of areas of the country.

In this connection, the above-mentioned six steps were performed for rural areas of 334 cities. In these steps each one of the four hierarchical analysis methods was used but with the exception of Ward method, the other ones did not fulfill the expectations for a balanced classification of the cities of the country.

Conclusion

As mentioned before, in order to classifying the rural areas of the country's cities on the basis of enjoyment level or their undeveloped rate, the cluster analysis is used. Based on the hierarchical clus-

ter analysis and by using Ward's minimum method, the cities were classified on the basis of 14 developmental indices and dendrogram resulted from the above factorization.

The results of this classification show that four different development spaces are distinguishable throughout the cities of the country. These spaces can be classified as indicated in table no.2.

*Remarks: in order to identify each of the determined groups in terms of undeveloped levels, we need to determine the deviation percentage from the average of each cluster in each index of total average of each index, so that by studying it we would be able to determine the undeveloped of each of the produced groups.

A. Results for each city separately: in order to achieve more accuracy from the study, the produced results in the framework of cities are presented in terms of undeveloped levels as following (Figure no. 3).

B. Results for area under occupation separately: area under occupation by each of the groups resulted from cluster factorization is shown in table no. 3.

C. Results for population under occupation separately: the population under occupation of rural areas of country's cities in the framework of undeveloped is presented in table no. 4.

In a general view, given the findings of this research, four kinds of regions throughout the country's rural areas were identified. These areas, in each of undeveloped levels have created similar features with homogenous and continuous environments regarding the rural collection. In this connection:

-Relatively developed rural areas: have strong potential and actual capability in terms of human resources, population density and villages, infrastructures, natural and economic resources.

-Developing rural areas: have considerable potential capabilities and to some extent actual capability in terms of human resources, population density and villages, infrastructures, natural and economic resources and fairly good relation with more developed areas.

-less developed areas: have potential and actual capabilities in terms of human resources, population density and villages, infrastructures, natural and economic resources that are weaker compared to the above areas. Relation of these areas with developed centers is fairly weak.

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Table no. 1: the list of used indices for determining undeveloped rate of rural areas of country's cities by cluster analysis classification

Row	Index	index code	Studied Index for rural area in Iran's Provinces	Measurement unit
1	demographic	X1	Family Dimension reverse	person
2		X2	Urbanization coefficient	percentage
3	economical	X3	Rate of force work	percentage
4		X4	Rate of general activity	percentage
5		X5	Employment coefficient	percentage
6		X6	Relation women employed to whole employed	percentage
7		X7	Rate of Literacy	percentage
8		X8	Per capita Income	Thousand Rial
10	Infrastructural	X10	Percentage of rural that prosperous of water	percentage
11		X11	Percentage of rural that prosperous of electricity	percentage
12		X12	Rate of prosperous of main way	percentage
13	health	X13	Per capita doctor to 10000 rural population	person
14		X14	per capita of midwifery rural to 10000 women population in 15-64 years old	person

Table No.2: Results of classification of rural areas of country's cities on the basis of enjoyment level or their undeveloped rate

Develop Space	Classification	Count
Undeveloped	(Cluster 1)	63
less developed	(Cluster 2)	95
Developing	(Cluster 3)	130
Relatively developed	(Cluster 4)	46

Table No.3: Area of rural regions under occupation of Iran' province in the frame of development

Develop Space	Area (km^2)	Per-cent
Relatively devel-oped	58.181	3.6
Developing	347.052	21.4
less developed	788.101	48.7
Undeveloped	426.486	26.3

Table No.4: population of rural regions under occupation of Iran' province in the frame of devel-opment

Develop Space	Popula-tion	Per-cent
Relatively devel-oped	3696444	16.1
Developing	95 86314	41.6
less developed	5222544	22.7
Undeveloped	451961	19.6

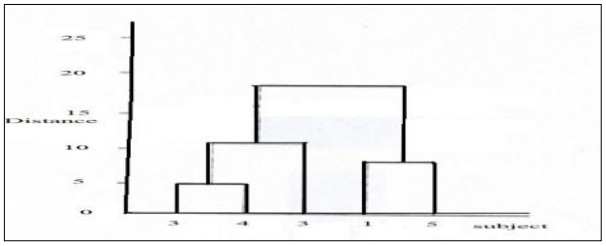

Figure No. 1: a sample of dendrogram resulting from cluster factorization for 5 odds

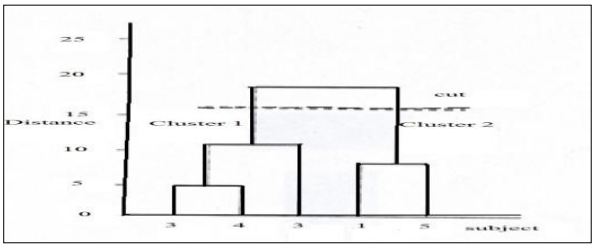

Figure No.2: View Mode of how dendrogram cut from cluster analysis for the 5th person to create

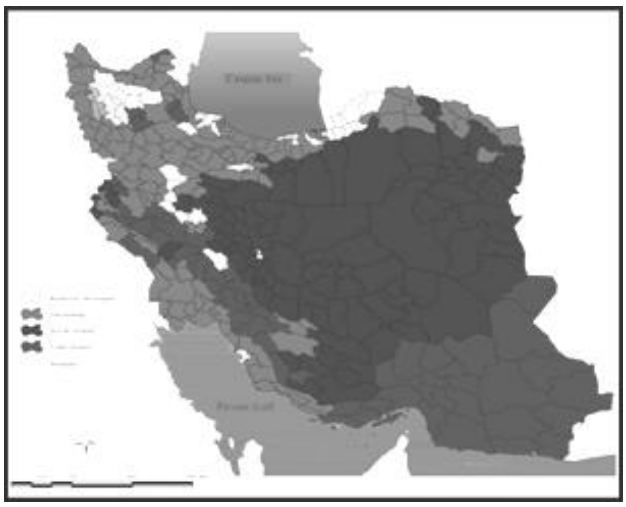

Figure No.3: Classification of rural Areas with a view of undeveloped and developed rang

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