

Full Length Research Paper

Cities dealing with space structure analysis of Lorestan State (Iran) using entropy model at urban, province, township, district and national levels

Mansoreh Mehrgan^{1*} and Bijan Rahmani²

¹Geography and Urban Planning, Islamic Azad University of Sciences and Researches, Tehran, Iran.

²Shahid Beheshti University, Tehran, Iran.

Accepted 3 April, 2011

The purpose of this article is to evaluate urban population distribution and number of cities distribution at the urban levels in one zone. By using this model, we can understand space balance rate of population settlement, and the number of cities at the urban system level, state, zone and country. By using entropy, coefficient model has been tried to understand the balance rate of population settlement and cities number at the urban, district, township system levels of Lorestan. So, dwellings and population general censuses' results of 1986, 1996 and 2006 have been used to define changes and alterations of state dealing with space structure for the past 30 years. This study shows that there is unbalance trend to urban movement levels at space structure. There is less unbalance movement at township levels compared to the urban levels. States trend to the space organization balance at the national level.

Key words: Space organization (structure), entropy model, population distribution, lorestan State, Iran.

INTRODUCTION

In academic world, it is believed that everybody has scientific education, especially in statistic and mathematics field, which are more reliable for social reality studies (Kalantari, 2008, p109). Size, dealing with space organization and urban hierarchical order has been a noticeable source for researcher for a long time. It is a subject that has been discussed by geographers for a long time.

Space organization and hierarchical order means cities classification according to their applied importance in that it represents different aspects of reciprocal actions between urban zones and relations between different parts of a hierarchical order system. There are different models for space organization analysis such as manufacture model of urban hierarchical profile, grade rule model, size and statistical models in geography science.

Entropy index coefficient model is one of these models that is used to analyze space organization or organizing space. In this article we want to analyze space structure

and organization of Lorestan State at city, town ship, district and national levels organization of the country. This model is according to the thermodynamic science, information theory and programme that have been entered in this field by revolution of quantity of geography science. By using entropy index we can answer a lot of questions about dispersion. This study wants to answer the following questions (Malek, 2006, p 22).

1. Population distribution as an important phenomenon, how is it an urban programme in township, cities and districts of Lorestan?
2. Is the Lorestan population distribution procedure balance or unbalance?
3. Is this model usable in the social, economical and geographical condition of Iran country or not?

RESEARCH GENERALITIES

Research purpose

We want to organize urban hierarchical order balance in

*Corresponding author. E-mail: Mansore.Mehrgan@yahoo.com.
Tel: 09166673365.



Figure 1. Lorestan States location in the year 2006.

Lorestan by studying its urban system, and by using entropy index model, we try to have an ideal analysis of space organization state in different period of census. That is how space organization was in 1986, 1996, 2006 and how it is now (2006) and how will it be in future? Is it going to be on a balance or unbalance routine? Do all urban levels (urban, town ship, district) have the same procedure? Or do they have individual reasonable results? Finally in Lorestan space organization, we tried to understand the effective factors of balance or unbalance of space organizing and to find the best solution (in unbalance case) (Figure 1 and 2).

Research questions

Space organizing of Lorestan cities includes alternative natural process by human. It leads to production of social condition and work division in organized system in the Lorestan State. In fact, space expansion and its distribution are not permanently stable at the state level. But, is also dependant on relatively conditions that are changeable over the time. The purpose of geography is to study these changes.

In this article, attempts have been made to answer the following questions and what can we do to make stability in this organization.

Does the population distribution organization have similar process in state at the urban, township, district, levels or does everyone have special or independent process?

In which levels is the balance improving or which one has unbalance improvement?

At the national levels, do provinces have unbalance procedure or balance procedure?

Research record

This model is one of the geographical models with district and civil programme, emphatically. And it is used in thermodynamic science. This model was used for the first time in Isfahan District by Mr Asghar tala Minaee in Iran. Then Mr Mojtaba Rafieean has used this model to consider Isfahan State space organization.

And Dr Abas Malek Hosseini has used this model in the analysis of space organizing in Markazi State in 2006 (Malek, 2006. p.23)



Figure 2. 1, Tehran; 2, Ghom; 3, Ghazvin; 4, Markazi; 5, Gilan; 6, Mazandaran; 7, Golestan; 8, Azarbaijane sharghi; 9, Ardebil; 10, Azarbaijane gharbi; 11, Kermanshah; 12, Khozestan; 13, Fars; 14, Kerman; 15, Khorasane Razavi; 16, Khorasane Shomali; 17, Khorasane jonobi; 18, Esfahan; 19, Sistan va Balochestan ;20, 21, Hamedan; Kordestan;22, Charmahale Bakhtiyari; 23, Lorestan; 24, Eilam; 25, Kohkiloye va Boyer Ahmad; 26, Boshehr; 27, Zanjan; 28, Semnan; 29, Yazd; 30, Hormozgan;

ENTROPY MODEL

By using this model, we can understand space balance rate of population settlement and the number of cities at the urban system level , state , zone and country. Total structure of model is:

$$H = -\sum p_i \ln p_i \quad \sigma = \frac{H}{\ln K}$$

H: frequency sum of frequency Napierian logarithm; P_i : Frequency; $\ln p_i$: Frequency Napierian logarithm; K: Level number, and G: Entropy rate.

If entropy has trend of zero, it will show more centralization or increase of centralization or unbalance in population distribution between cities, and movement toward one or higher than shows unbalance distribution in zone level (Mousavi-Hekmatnia, 2006: 189-190). This

index has been used for centralization degree definition or geographical phenomenon. Distribution separation in small districts is called centralization index (Tolaei, 1996: 225).

In this article we want to calculate population of cities, number of cities space distribution at urban, district, township of Lorestan State by using coefficient entropy and we consider using coefficient of entropy at the states of the country.

Napierian frequency and frequency analysis of urban space organization of Lorestan State by using coefficient of entropy

In this part of the research, we analyze cities of Lorestan by using coefficient of entropy. This research has used some variables such as population and some statistics such as general census of population and dwellings in three alternative periods of 1986, 1996, 2006.

Table 1. Frequency entropy coefficient and Napierian frequency of Lorestan cities in 1986.

Cities name	Khorramabad	Borojerd	Dorod	Aligodarz	Kohdasht	Nour abad	Azna	Alashtar	Poldokhtar	Oshterinan	Sum
Entropy coefficient											
City population (p)	208592	183879	62517	53843	44653	29188	25824	14274	11409	4859	639038
Frequency p_i	33	29	9.9	8.4	7	5	4	2	2	0.8	100
Napierian logarithm $PiLnPi$ frequency	0.37	0.36	0.23	0.21	0.19	0.15	0.13	0.08	0.08	0.04	1.84

Source: Dwelling and Population Census of Lorestan State in 1986.

$$G = \frac{H}{Lnk} = \frac{1.84}{Ln10} = \frac{1.84}{2.3} = 0.8$$

Table 2. Frequency entropy coefficient and Napierian frequency of Lorestan cities in 1996.

Cities name	Khorramabad	Borojerd	Dorod	Aligodarz	Kohdasht	Nour abad	Azna	Alashtar	Poldokhtar	Oshterinan	Sum
Entropy coefficient											
City population (p)	272815	217804	88152	42105	69447	65654	44934	23022	16675	7516	878124
Frequency p_i	31	25	10	8	8	7	5	3	2	0/9	100
Napierian logarithm $PiLnPi$ frequency	0.37	0.35	0.23	0.2	0.2	0.19	0.15	0.1	0.08	0.04	1.91

Source: Dwelling and Population Census of Lorestan State in 1996.

$$G = \frac{H}{Lnk} = \frac{1.91}{Ln10} = \frac{1.91}{2.3} = 0.83$$

Tables 1 to 3 show coefficient of entropy in Lorestan cities at first and then in townships of Lorestan, and finally in the three districts of north, east, centre, south and west.

Analysis of Lorestans cities space structure by using entropy coefficient of frequency and Napierian frequency

We want to study space existence process in cities of Lorestan State. To achieve better result, we use entropy coefficient model in Lorestans population space structure. We also want to understand how population is distributed in the Lorestans cities, and which procedure (balance,

unbalance) is shown.

In this article, three alternative censuses of dwelling and population of Lorestan State in 1986, 1996, 2006 years were used (Tables 4 to 6).

Analysis of Lorestan's district levels space organization by using of entropy coefficient of Napierian frequency and frequency

There are three natural geographical districts in Lorestan as follows:

1. High and elevated cities of Lorestan that are in some parts of North and east of Oshterinan

Borojerd ,Dorod, Selseleh, Delfan, Azna and Aligodarz.

2. Central city of Lorestan: Has a mild geographical situation. This city is Khorramabad. It has a geometrical centre and it is the official and political centre for Lorestan State.

3. West and south cities have similar weather and structure with special unity, such as: Kohdasht and Poldokhtar.

In this article, we did space organization and structure analysis of Lorestan State by using population statistics of three consecutive populations and dwelling censuses in 1986, 1996, 2006 (Tables 7 to 9).

Table 3. Frequency entropy coefficient and Nopierian of Frequency of Lorestan cities in 2006.

City name	City population (p)	Frequency p_i	Napierian logarithm $P_i \ln P_i$ frequency
Khorram abaed	328544	33	0.37
Borojerd	227547	23	0.435
Dorod	100528	10	0.23
Kohdasht	85519	8.5	0.21
Aligodarz	78690	7.5	0.195
Nour Abad	56404	5.6	0.16
Azna	37645	3.7	0.12
Alashtar	28306	2.8	0.1
Poldokhtar	22588	2.2	0.08
Mamolan	7633	0.8	0.04
Oshtorinan	5264	0.5	0.03
Chaghabal	4801	0.5	0.03
Konani	3746	0.4	0.02
Garab	3270	0.3	0.02
Sepidasht	3197	0.3	0.02
Firozabad	2857	0.3	0.02
Zaghe	2839	0.3	0.02
Darbagonbad	2119	0.2	0.01
Mahmodvand	1817	0.1	0.006
Chaghalvandi	1544	0.1	0.006
Sarabedore	1312	0.1	0.006
Momenabad	1230	0.1	0.007
Chalancholan	1094	0.1	0.007
Sum	1008494	100	2.05

Source: www.ostan-lr.ir.

$$G = \frac{2.05}{\ln 23} = \frac{2.05}{3.14} = 0.65$$

Table 4. Napierian of frequency and entropy coefficient calculation in town ship of Lorestan State in 1986.

Cities name	Population (p)	p_i	$P_i \ln P_i$
khorrarnabad	758699	55	0/33
Borojerd	387728	28	0/35
Aligodarz	223470	16	0/29
Sum	1369897	100	0/98

Source: Population and Dwelling Census of Lorestan State in 1986.

$$G = \frac{0.98}{\ln 3} = \frac{0.98}{1.1} = 0.89$$

Space organization analysis of the country by using entropy frequency and Napierian frequency

Regarding the population space organization, we studied space existence producers using entropy coefficient model in the states of the country of Iran.

In this part, three consecutively periods of dwelling and

population censuses in Iran in 1986, 1996, 2006 years were used (Table 10).

In these three periods, in 1986 country population space organization showed balance condition at state levels, as the entropy coefficient amount is close to one. It showed unbalance procedure in 1996 compared to 1986, when entropy coefficient decreased. Entropy

Table 5. Frequency entropy coefficient and Napierian of frequency of Lorestan cities in 1996.

Cities name	City population (p)	p_i	$P_i \ln P_i$
khorrarnabad	462133	29	0.36
Borjerd	316014	20	0.32
Kohdasht	188964	12	0.26
Dorod	142773	9	0.22
Aligodarz	133938	8	0.2
Delfan	128078	8	0.2
Azna	72583	5	0.15
Selsele	70586	4	0.12
Poledokhtar	69365	4	0.12
Total	1584434	100	1.95

Source: Dwelling and Population Census of Lorestan State in 1996.

$$G = \frac{1.95}{\ln 9} = \frac{1.95}{2.2} = 0.89$$

Table 6. Frequency entropy coefficient and Napierian of frequency of Lorestan Cities in 2006.

Cities name	City population (p)	p_i	$P_i \ln P_i$
khorrarnabad	522246	30	0.36
Borjerd	323826	20	0.33
Kodasht	211886	12	0.25
Dorod	160686	9	0.21
Aligodarz	137808	8	0.2
Delfan	137632	8	0.13
Poledokhtar	76541	4	0.13
Selsele	74353	4	0.13
Azna	71548	4	0.13
Total	1716527	100	1.94

Source: www.ostan-lr.ir.

$$G = \frac{1.94}{\ln 9} = \frac{1.94}{2.2} = 0.88$$

Table 7. Napierian frequency and frequency entropy coefficient calculation in Lorestan district levels in 1986.

District	Population (p)	P_i	$P_i \ln P_i$
North and east	771000	56	0/32
Center	398000	29	0/36
Western south and west	201000	15	0/29
Total	1370000	100	0/97

Source: Dwelling and population census of Lorestan State in 1986.

$$G = \frac{0.97}{\ln 3} = \frac{0.97}{1.1} = 0.88$$

Table 8. Napierian Frequency and frequency entropy coefficient calculation in Lorestan district levels in 1996.

District	Population (p)	p_i	$P_i \ln P_i$
North and east	863000	55	0/33
Center	462000	29	0/36
Western south and west	258000	16	0/29
Total	1584000	100	0/98

Source: Dwelling and Population Census of Lorestan State in 1996.

$$G = \frac{0.98}{\ln 3} = \frac{0.98}{1.1} = 0.89$$

Table 9. Napierian frequency and frequency entropy coefficient calculation in Lorestan district levels in 2006.

District	Population (p)	p_i	$P_i \ln P_i$
North and east	906000	53	0.34
Center	522000	30	0.36
Western south and west	289000	17	0.30
Total	1717000	100	1

Source: www.ostan.lr.ir

$$G = \frac{1}{\ln 3} = \frac{1}{1.1} = 0.91$$

coefficient, close to one, shows that space organization has balance procedure in the country levels.

Conclusion

If we draw attention to the frequency of Napierian entropy number in dwelling and population general census in 1986, 1996, 2006, we will understand that Napierian entropy coefficient of frequency of urban level has increased by three percent.

This increase is for urban population in the larger states. It means population centralizes in the urban area.

Entropy coefficient has shown more number in population dispersion, but entropy coefficient frequency of Napierian has shown smaller number. It increases the number of urban points from ten cities in 1986; in 1996, 23 urban points in 1385. The number of population in cities (less than a thousand populations), village and the centre of townships has increased.

Population differences of big, medium and large cities of state with these village-cities have shown high figure. And this entropy disorder is for this procedure (Table 11).

Entropy coefficient has shown balance procedure in cities level of state in three consecutively period of censuses in 1986, 1996, 2006; so we do not have

centralization phenomenon and unbalance in the cities levels.

That shows population order distribution of cities in the states (Table 11).

Entropy coefficient of napievan frequency distributed in district levels has shown relativity balance in population distribution. And napievan number has increased frequently from 0/88 percent in 1986 to 0/91 percent in 2006.

It shows that population distribution has been balanced step by step in district levels of state and it has balance procedure (Table 11).

The most population number of district levels of state belongs to the east and north districts. Khorramabad in the central part has special location for its crowded and high population. South and west have the least population.

At population centralization in states districts, good condition of weather in the north and east, financial centralization, mines, connective road and railway are the most important factors in those districts.

At the centre part, factors like climate, political centre services centralization, connective roads, and aerial ways are the most important factors of being crowded.

At the south and west part of the state, bad air condition is the most important factor for less population in this part of state (map number two).

Table 10. Frequency Napierian and entropy coefficient at urban levels Iran Country in (1986, 1996, 2006).

1986				1996				2006			
State name	P	P _i	P _i LnP _i	State name	p	pi	P _i LnP _i	State name	p	pi	P _i LnP _i
Tehran	9371699	18.96	0.36	Tehran	11176000	18.6	0.31	Tehran	13413348	19.03	0.32
Markazi	8754736	2.19	0.08	Ghom	853000	1.42	0.06	Ghom	1040681	1.48	0.06
Gilan	2081037	4.21	0.13	Markazi	1229000	2	0.08	Ghazvin	1143200	1.62	0.07
Mazandaran	3419346	6.92	0.18	Gilan	2242000	6.05	0.12	Markazi	1349590	1.92	0.08
Azarbaijane sharghi	4114084	8.32	0.25	Mazandaran	4028000	13.39	0.18	Gilan	2404861	3.41	0.12
Azarbaijane gharbi	1971677	3.99	0.13	Azarbaijane sharghi	3326000	5.52	0.16	Mazandaran	2920657	4.14	0.13
Kermanshah	1462965	2.96	0.1	Ardebil	1168000	1.94	0.08	Golestan	1617087	2.29	0.09
Khozestan	2681978	5.42	0.16	Azarbaijane gharbi	2496000	4.15	0.13	Azarbaijane sharghi	3603456	5.11	0.15
Fars	3193769	6.46	0.18	Kermanshah	1779000	2.96	0.03	Ardebil	1225348	1.74	0.08
Kerman	1622958	3.28	0.11	Khozestan	3747000	6.2	0.17	Azarbaijane gharbi	2873459	4.08	0.13
Khorasan	5280605	10.68	0.24	Fars	3817000	6.3	0.17	Kermanshah	1879385	2.67	0.1
Esfahan	3294916	6.66	0.18	Kerman	2004000	3.3	0.11	Khozestan	4274979	6.07	0.17
Sistan va Balochestan	1197059	2.42	0.09	Khorasan	60448000	3.32	0.19	Fars	4336878	6.15	0.17
Kordestan	1078415	2.18	0.08	Esfahan	3923000	6.53	0.18	Kerman	2652413	3.76	0.12
Hamedan	1505826	3.05	0.11	Sistan va Balochestan	1723000	2.86	0.1	Khorasane Razavi	5593079	7.94	0.2
Charmahale Bakhtiyari	631179	1.28	0.06	Kordestan	1346000	2.24	0.09	Khorasane Shomali	811572	1.15	0.05
Lorestan	1367029	2.76	0.1	Hamedan	1678000	2.79	0.1	Khorasane jonobi	634620	0.9	0.04
Eilam	382091	0.77	0.04	Charmahale Bakhtiyari	761000	1.26	0.06	Esfahan	4559256	6.47	0.18
Kohkiloye va Boyer Ahmad	411828	0.83	0.04	Lorestan	1584000	2.63	0.1	Sistan va Balochestan	2405742	3.41	0.12
Boshehr	612183	1.24	0.05	Eilam	488000	0.8	0.04	Kordestan	1438543	2.04	0.08
Zanjan	928988	1.88	0.07	Kohkiloye va Boyer Ahmad	544000	0.9	0.04	Hamedan	1703267	2.42	0.09
Semnan	417035	0.84	0.04	Boshehr	744000	1.23	0.05	Charmahale Bakhtiyari	857910	1.22	0.05
Yazd	574028	1.16	0.05	Zanjan	1037000	1.72	0.07	Lorestan	1716527	2.44	0.09
Hormozgan	762202	1.25	0.06	Semnan	501000	0.83	0.04	Eilam	545787	0.77	0.04
Total	49445010	100	2.89	Yazd	751000	1.25	0.05	Kohkiloye va Boyer Ahmad	634299	0.9	0.04
				Hormozgan	1062000	1.42	0.07	Boshehr	886267	1.26	0.06
				Total	60055000	100	2.78	Zanjan	964601	1.37	0.06
								Semnan	589742	0.84	0.04
								Yazd	990818	1.41	0.06
								Hormozgan	1403674	1.48	0.08
								Total	70472844	100	3.07

$$G = \frac{2.89}{Ln24} = \frac{2.89}{3.18} = 0.91$$

$$G = \frac{2.78}{Ln26} = \frac{2.78}{3.26} = 0.85$$

$$G = \frac{3.07}{Ln30} = \frac{3.07}{3.4} = 0.90$$

Source: <http://www-amar-ir.ir>, Population and Dwelling Census of Iran in 1986 and 1996.

Table 11. Frequency Napierian and entropy coefficient at urban levels and district and cities and town ships levels of Lorestan State and all over the Iran country in (1986, 1996 and 2006)

Level Year	Urban $P_i \ln P_i$	Town ship	District $P_i \ln P_i$	National $P_i \ln P_i$
1986	0.8	0.89	0.88	0.91
1996	0.83	0.89	0.89	0.85
2006	0.65	0.88	0.91	0.90

Lorestan provinces location in 2006 - www. Ostan – Ir. Ir

Malek HA (2006). space organizing and a lysis of markazi state by usingof entropy mode Amayesh geographical article, Azad university publication- malayer university- number one- winter pp.22-23.
Tolaee S (1996). Critic on economical geography (industry–energy–transportation) Jahad Daneshgahi Publ. p.225.

<http://www - amar-Ir.ir>

www. Dolat.ir

www. Ostan – Ir. Ir

REFERENCES

- Hekmatnia HMN (2006). Applied of model in geography with emphasis on urban programme and distric, Elm Novin publ. pp.189-190.
Kalantari K (2008). District expansion and programme (technical and the orical) khosh bin publ. p.109.
Iran statistic center dwelling and population census of lorestan state in 1986, 1996, 2006 years.