

The analysis of changes in urban hierarchy of Isfahan province in the fifty-year period (1956-2006)

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Abstract

The appearance of city and urbanism is one of the important processes which have affected social communities .Being industrialized urbanism developed along with each other in the history.In addition, they have had simple relationship for more than six thousand years, that is , from the appearance of the first cities . In 18th century by coming out of industrial capitalism, progressive development took place in urbanism in the world.

In Iran, the city of each region made its decision by itself and the capital of region (downtown) was the only central part and also the regional city without any hierarchy, controlled its realm. However, this method of ruling during these three decays, because of changing in political, social and economical issues that have caused changes in rural and urban relationship. Moreover, it has changed the variety of performance of cites and systematic urban network in Iran. Today, urban system has very vast imbalanced apace and performance. In Isfahan, the trend of urbanism is like the other part of Iran and systematic urban hierarchy is not suitable and normal.

This article is a quantitative and analytical. The statistical communities are Isfahan Province cites and the changes in urban network and its hierarchy during the period of fifty years (1956 -2006) have been surveyed .In addition, those data have been analyzed by model of Rank and size and Entropy index.

In this article Iran cites and also the factor of entropy of primate city and urban hierarchy of Isfahan Province have been introduced. Urban residents of this Province have been reached from 55 percent to 83% (2006). As we see the analytical data reflects that there is mismatching and imbalance between cites. Because the entropy index was .91 in 1956 .And it decreased to .63 in 2006. Isfahan city is the primate city in the whole of these periods. Moreover, the second and the third cites have population gap with regard to the other cites and finally, they don't follow the system of Rank- Size.

Key words: urban network, urban hierarchy, primate city. Isfahan province

Introduction

Increasing in urbanism and turning big villages into small towns, causes noticeable changes in city network and also spatial distribution of cities in Iran.

Today, the main controversy is between marginal and central part of big cities in the third world. Central parts, however, have the most interests and facilities for dominating on marginal areas (Bazr Afshan, p: 143. 2008). As a matter of fact, Iran has had homogenous urban system before contemporary urbanism. It means that, urban network has been in galactic manner and also has been

alive under the influence of inner development and traditional relationship between city and village. Then, because of changing and continuing in inner regional development and outer one which starts by promoting of changes in urbanism, and urbanization in the period of Gajar government (Beykmohammadi . et al , 2009 p:190).

Research method

It is applied –developed research. The method which is used here is quantitative- analytical. The statistical community is cites of Isfahan Province. Here, we are going to survey the urban hierarchy and also urban network of Isfahan during the fifty – year period.(1956-2006).

The data has been gathered from the Iran Statistical Site and also libraries, and statistical centers. After collecting the data, they have has been analyzed based on Rank-Size and Entropy index.

Theoretical point of view:

Urban network:

Urban network is the sum of cites in one area or Geographic boundary which come together like continual rings. Because of imbalance development, they radiate (dispread) on the area differently. The better economical development in any country, we have the more systematic urban network. The duties are distributed from larger cities to the smaller ones in a specific order.

However, imbalance in social and productive relationship in developing countries do not affect on systematic unban network.(Mousavi , et al . 2009.p:136). In fact, urban network organizes in a natural way and new cities or areas may appear in slow changes. Its order can be change in the course of business or decision making even though. Actually, becoming sets of cites , can be harmful for the balance development of cites. Moreover, developing in metropolis might change urban network from disorder to the new discipline (Nazarian , 1388,p: 185)

Omitting the role of small towns in each country, specifically in the third world, the urban network has become in a chain manner but, it is in balance and galactic manner in industrial counters.

2. Primate city

Experts for recognizing the mount of regional inequality in developing countries, they sometimes discuss the spatial inequality which is called primate city. In fact, this feature belongs to developing countries. It was declared by Jefferson (1938). It refers to the condition in which the biggest cities in a country dominate the others in terms of size and power. (parter, et al. 2005, p: 95).

Hierarchally , a place ,among the cites of the country , is on top ,because of some specific features .So , it should be the biggest city . Also it can be the capital of the country. It is somehow the symbol of national culture. (zangabadi , P: 129 , 2001).

Tehran in Iran is the sample of primate city. Its demography is different from the others and also is much more the second city; Mashhad.

Urban hierarchy: It is the result of central place theory. Every class of each city is determined by the number and the variety of the activities, after all, there is usually direct relationship between the number and variety of activities. It also depends on city population. Therefore, the higher of the city in classification means, the more population, as well. (Shoukoohi , p:389,1998)

It is important to survey urban hierarchy, as a main factor in recognizing the quality of spatial discipline. Moreover, it is useful in balance distribution of facilities and services among central parts especially small towns. This model is the best frame of organization of the space in geography.(A. Dorkesh , P:86, 2004).In urban hierarchy, the size of city depends on rank in which located and also the activities done in that city, however it also depends on place with regards to other co-rank or even larger cities. Therefore, being in optimal size in systematic urban hierarchy is meaningless when different sizes of that city are in that system. Because of this, demographic distribution of city is more important than the determination of optimal size of city (A. Dorkesh,P:86,2003).

We can use different patterns and model such as Theory of Periphery- model-center from John Friedman, Central place of Volker and the Rule of Rank-size of Ziff with regard to urban hierarchy. The aim of those theories is to explain the hierarchical system of the residential areas which enlarging in the direction of balanced development (Saffari P:132, 2000).

In the past, cities of each region were independent. In Iran, only the central part of the city was important and urban

Table one

Leveling the urban areas in Isfahan Province:

percentile	population	number	city	classifying(Thousand)	1956
37/57	254780	1	Isfahan	100and more	
-	-	-	-	50-100	
22/99	155876	4	kashan komeynishahr Shahreza Jajafabad	25-50	
38/81	263163	52	All of the cities except abovementioned	Less than 25	
%100	677982	57	-	sum	

Sources: authors

percentile	population	number	city	classifying(Thousand)	1966
46/47	424045	1	Isfahan	100and more	
6/4	58468	1	Kashan	50-100	
13/63	124440	3	Komeynishahr Shahreza& Jajafabad	25-50	
32/81	299435	57	All of the cities except abovementioned		
%100	912477	62	-	sum	

Sources: authors

percentile	population	number	city	classifying(Thousand)	1976
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area without any hierarchy ruled on human societies in those regions. Nowadays, we have a lot of changes not only in relationship of urban and village but also in variable application of cities and urban network. This is because of changes in social- economical and also political sections (Nazarian,P:215 ,2009).

The norm of cities in the world (without productive activities and city services) based on the UN data are:

1. Rural (under 25000)
2. Small town (25,000-50,000)
3. Middle city (50,000-100,000)
4. Average city (100,000-250,000)
5. Large middle city (250,000-500000)
6. Large city (500,000-1,000,000)
7. Very big city (metropolis, 1,000,000-above)

Whatever mentions in this article, like the standard classification and urban hierarchy of cities in Isfahan Province, is based on The UN data classification.

Isfahan Province (case study)

The menstruation of Isfahan Province is 107090/1 KM. it locates in center of Iran. It has got 23 cities-99 towns, 44parts and 124 rural districts (data from the last country's division in 2009).This province locates among the central Mounts ranges and east of Zagros .It also holds some Mountains and plains areas. The highest cities from the seabed are Ferydounshar, Chadegan and Semirom which have located in the west and south west. Its population is 4,559,256, from which 233,5399 are males and 2223857 females. From the demographic view, 3798728 (83%) settle in cities and 75889 (17%) in rural areas. Isfahan city with 1,602110 is the largest and Niasar (town) with 2003 people has been the smallest (statistics center, 2009)

47/07	661510	1	Isfahan	More than 500
-	-	-	-	250-500,000 -
-	-	-	-	100-250,000
16/05	225634	3	Komeynishahr Najafabad Kashan	50-100,000
11/62	163306	4	Shahreza Aran&bidgol Zarrinshahr Khorasgan	25-50,000
25/24	354790	49	All of the cites except abovementioned	Less than 25
100%	1405240	57	-----	Sum

Sources: authors

percentile	population	number	city	classifying(Thousand)	1986
%44/89	9867523	1	Isfahan	More than 500	
%16/93	372304	3	Komeynishahr Najafabad Kashan	500-250	
5/66	124522	2	Shahreza -Khorasgan	100-250	
13/04	286721	8	- Shahinshahr Falavarjan - Aran&Bidgol Zarrinshahr- fouldshahr Rehnan Dorcheh Golpayegan	50-100	
19/46	427766	45	All of the cites except abovementioned	25-50	
%100	2198065	59	-	Sum	

Sources: authors

percentile	population	number	city	classifying(Thousand)	1996
43/43	1266072	1	Isfahan	Above one million	
-	-	-	-	500-1,000,000	
-	-	-	-	250-500,000	
24/86	545758	3	kashan Khomaynishahr Najafabad	100- 250,000	
11/79	343725	5	Shahinshahr shahreza Aran&Bidgol Zarrin shahr Khorasgan	50-100,000	
8/58	250154	7	fouldshahr mobarakeh Golpayegan	25-50,000	

			Dorcheh Dolatabad Falavarjan Gahderijan	
17/46	509164	44	All of the cites except abovementioned	Less than 25,000
%100	2914837	60	-	Sum

Sources: authors

percentile	population	number	city	classifying	2006
41/65	1602110	1	Isfaahn	Above one million	
-	-	-	-	500-1,000,000	
6/59	253509	1	Kashan	250-500,000	
17/38	668731	4	Khomeynishahr Shahinshahr shahreza Najafabad	100-250,000	
8/26	317882	5	Aran&Bidgol Zarrin shahr Foulad shahr mobarakeh Khorasgan	50-100,000	
7/57	291328	8	baharestan Golpayegan Naeen Dorcheh dolatabad semirom falavarjan Gahderijan	25-50,000	
18/52	712446	74	All of the cites except abovementioned	Less than 25,000	
%100	3846006	93	-	sum	

Sources: authors

Urban network changes (1956-2006)

1. Urban network (1956)

The whole population of the province is 1221179. The average yearly growth is 3.83% and from which 677982 had settled in the urban areas and the rest in the rural ones.

Specific features in this period (1956):

- There isn't any city with above 500,000 people.
- Isfahan is in the first rank demographically.
- There is no city with 50-100,000 people.

2. Urban network (1966):

Statistically, the whole population of the province was 173901. The rate of urbanism to ruralism was 51.49%.

Specific features in this period (1966):

- We have no city above 1,000,00 people.
- Isfahan is the only city with 424045 (range of 100-500,000)
- Five new cities have added to the statistics of 1956.
- Kashan locates in the range of 50-100,000 .This is the only city (58468).

3. Urban network (1976):

In this period , the population of the province was 2176694 people from which 1405240 people settle in urban areas and 806618 people in rural ones.

Specific features in this period (1976):

- The number of cites are 57.
- Isfahan holds 47% of the whole population.
- In the range of 50-100,000 , we have three cites which hold 16% of whole population.
- In the range of 25-50,000, we have four cites which hold 16% of the whole population.
- In the range of less than 25000 , we have 49 cites which consist 25% of the whole population.

4. Urban network (1986):

The whole population is: 3294916, from which 2198065 live in urban areas and 1176673 people in rural ones. The percent of settlers is 64% in urban and 36% in rural places.

Some specific features in this period (1986):

- The number of cities reaches to 59.
- Isfahan is in the first rank with 986753 people (44.8 % of the whole population).
- The density of the cites in the range of under 25,000 people which consists 19.4% of the whole population.

5. Urban network (1996):

Based on the statistics of 96 , from the whole population of the province (3923255) 74% (2914874) live in the cites and 26% (1007087) live rural areas.

The Changes are:

- The whole of cites reach to 60 cites.
- 43.4% of urban population belongs to Isfahan itself.
- Isfahan with 1266072 people is classified in the rank of above 1,000,000 people.
- There is no city in the rank of 250-500,000 people.
- We have three cites in the classification of 50-100,000 (11.7% of the whole population)
- Small towns and rurbans are 44.

6. Urban network (2006):

The whole of population is 4,559256, from which 3,798728 (83%) settle in cites and 758890 people settle in villages.

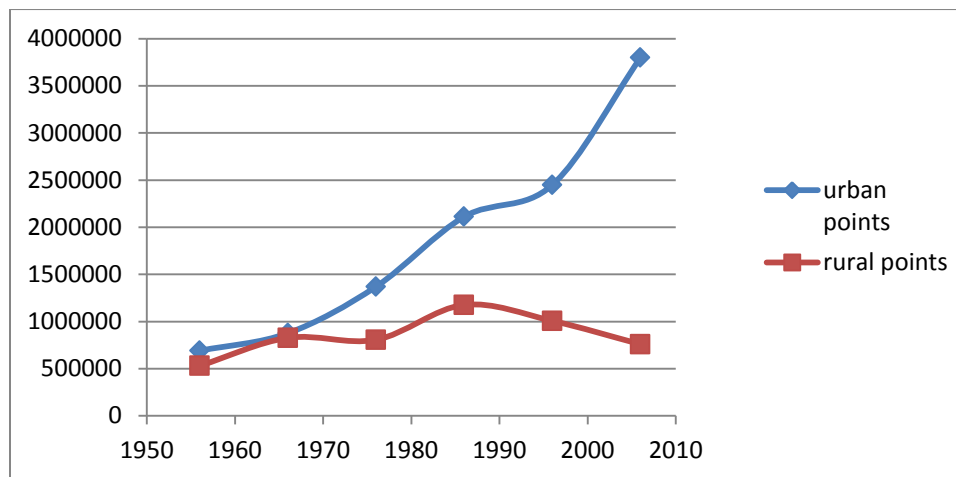
A few features of this period are:

- The number of cites have increased to 93.
- The population of Isfahan reaches to 1,500,000 people.
- The second rank is Kashan with 253509.
- However, the amount of differences in population in two cites (Isfahan & Kashan) is obvious.

- In percentile, the whole population of Isfahan is 41.6% and in the second rank, the cites of under 25, 000

(18.5%).

Table of number one



The organization of city location

It has been used by the rank-size model for surveying the quality of organization and location of cites. The rule of rank and size is a useful chart for analyzing the relationship between the number and the size of the settlement in a country. However, the settlements of a country are based on the amount

of population in the Province which has been ranked in a decreasing order.

The rule suggests that the size of specific city can be observed with the rank and amount of population of the largest city. (John, k. et al. P: 42, 2009). Ziff says that if we arrange the city settlements bases on population size, the population of the second city will be $\frac{1}{2}$ of the first one and the third city will be about $\frac{1}{3}$ the first one. At last the population of N city will be about $\frac{1}{N}$ the first one. If we have more populated city system, normal distribution is nearer. The math formula of this concept will be:

$$P_r = \frac{P_1}{R^b}$$

P_1 Stands for the population of the first city in a specific area.

p_r Stands for; the population of the city in a specific rank.

R = the city rank in each area

b = the slope of size –rank (Hekmatnia,et al P:191, 2006).

As a result, in above model, whatever b tends to minus, balance has increased in city system and the hierarchical ranks of cites will tend to complete loga-distribution. For this reason the population of r city will equal $\frac{1}{r}$ of the population the biggest city, or the first city of the area or country.

For determining the coefficient of b which is the line of slope of rank and size, here the logarithmic relation between ranks and sizes is used. After that, they put the logarithm of Rank-Size in t6he Regression equation the coefficient of b is determined. Which mathematically is? $y = a + bx$

$$x = \log R$$

$$y = \log P$$

a = stable amount

b = line slope (Mousavi, et al. P:151;2009)

With regard to this model, the rate of cites in Province to their population during the selected years in two columns in terms of Rank and amount of population are gathered (set).Then the log of each is determined. At last, between the log of rank (x) and city population (y) draw the chart. We determine a regression between them finally, line slope of rank-size is determined (Mosavi,et al).

According to calculation; the Rank of cites are:

1. There is a counter –coefficient between rank $\log (x)$ and the size \log of city (y)i.e., increasing in rank \log cause decreasing in city size.
2. The amount of line index or the line slop of rank-size during the years of 56-2006 are as follow:

$$b_{1956}=1.226$$

$$b_{1966}=1.27$$

$$b_{1976}=1.24$$

$$b_{1986}=1.27$$

$$b_{1996}=1.3$$

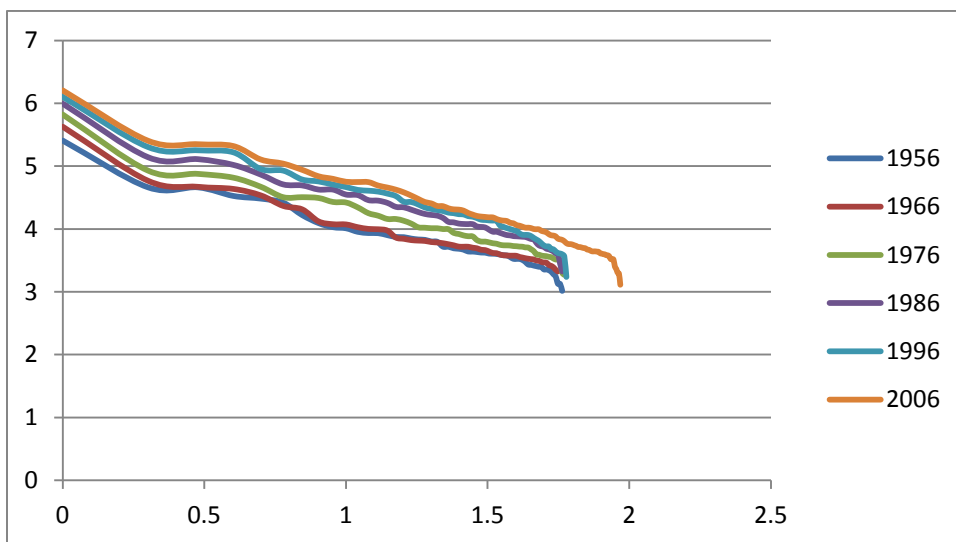
$$b_{2006}=1.36$$

As you know the line slope is much more than one during those years .So, there is an imbalance in city system of Isfahan Province and also the distance between the first city and the last one is a lot. There is imbalance and inharmonic in urban hierarchy of Isfahan Province during the years of 13956-2006.especially, there is a big different between the fist city and the others. The position

of urban system in this Province is: In 1956, the population of the first city (Isfahan) is 5.5 times as much as of the second city (Kashan) and is 8.3 of the third city (Khomeynishahr). In 1966 , the population of first city (Isfahan) is 7.2 times as much as the second city (Kashan) and 9 times as much as the third city (khomeynishahr) .In 1976 , the population of the first city (Isfahan) is 7.7 times as much as of the second city (Kashan) and is 8.7 times as much of the third city (najafabad).In 1986,the population of the fist city (Isfahan) is 7.2 times as much as second city (Kashan) and is 7.6 times as much as the third city (Najafabad). In

1996, the population of first city (Isfahan) is 6.2 times as much as the second city (kashan) is 7 times as much as the third city (najafabad). At last, in 2006, the population of first city (Isfahan) is 63 times as much as the second city (kashan) And it is 7.1 times as much as the third city(khomeynishahr). To sum up, we can say that Isfahan is a place in which people like to come and to live .For, amount of population is out of rank-size rule .Of course, there is a population distance between the second, the third, the fourth and the rest of cities. Thus, this is another reason for the lack of rank-size rule in this Province.

Table 2: log distribution in rank- size in Isfahan province between years of 1956 – 2006:



City	Rank	Real population	Model population	Amount of differences	City	Rank	Real population	Model population	Amount of differences
Isfahan	1	1602110	1602110	0	Habibabad	48	9880	33377	-23497
Kashan	2	253509	801055	-547546	Tajkhoncheh	49	9316	32696	-23380
Khomeynishahr	3	223071	534036	-310965	Zibashahr	50	9097	32042	-22945
Najafabad	4	208647	400527	-191880	Baqbahadoran	51	8812	31413	-22601
Shahinshahr	5	127412	320422	-193010	Kahrizsang	52	8267	30809	-22542
Shahreza	6	109601	267018	-157417	Zavareh	53	7924	30220	-22296
Khorasgan	7	87282	228872	-141590	Dehaq	54	7845	29668	-21823
Rehnan	8	68946	200263	-131317	Chadegan	55	7609	29129	-21520
Mobarakeh	9	62728	178012	-115284	Karkovand	56	7002	28609	-21607
Zarrinshahr	10	56375	160211	-103836	Harand	57	6842	28107	-21265
Aran& Bidgol	11	55833	145646	-89813	Gouged	58	6697	27663	-20966
Fouladshahr	12	55664	133509	-77845	Khour	59	6369	27154	-20785

Ngolpayegan	13	48987	123239	-74252	Alavichj	60	5940	26701	-20761
Baharstan	14	45629	114436	-68807	Nasrabad	61	5751	26264	-20513
dorcheh	15	42200	106708	-64508	Meimeh	62	5739	25840	-20101
Falavarjan	16	38224	100131	-61907	Manzarieh	63	5649	25430	-19781
Dolatabad	17	33961	94241	-60280	Joushegan	64	5490	25032	-19542
Qahderijan	18	30016	89006	-58990	Hana	65	5368	24647	-19279
Semirome	19	26795	84321	-57526	Abuzeidabad	66	5166	24274	-19108
Naeen	20	25516	80105	-54589	Sefidshahr	67	5151	23912	-18761
Kelishad	21	23215	76290	-53075	Barfanbar	68	5056	23565	-18509
Goldasht	22	23056	72823	-49767	Moshkat	69	4970	23218	-18248
Khansar	23	21313	69565	-48252	Rozveh	70	4927	22887	-17960
Gaz	24	20493	66754	-46261	Kouhpayeh	71	4700	22564	-17864
Khorzouq	25	20311	64084	-43773	Vazvan	72	4661	22251	-17590
Daran	26	19583	61619	-42036	Damaneh	73	4513	21946	-17433
Dizicheh	27	17966	59337	-41371	Sagzi	74	4397	21650	-17253
Dehaqan	28	16934	57218	-40284	Mohammadabad	75	4397	21361	-16964
Chmgourdan	29	16101	55245	-39144	Kamishah	76	4395	21080	-16685
Tiran	30	15744	53403	-37659	Hassanabad	77	4353	20806	-16453
Dastgerd	31	15524	51680	-36156	Nikabad	78	4324	20539	-16215
varnamkhast	32	15301	50065	-34764	Mahabad	79	4091	20279	-16188
Ardestan	33	15284	48548	-33264	Asgaran	80	4048	20026	-15978
Badrood	34	14415	47120	-32705	Jandaq	81	3967	19779	-15812
Freydounshahr	35	13821	45774	-31953	Todeshk	82	3947	19537	-15590
Imanshahr	36	13554	44502	-30948	Rezvanshahr	83	3812	19302	-15490
Sedeh lenjan	37	13372	43200	-29828	Afoos	84	3805	19072	-15267
Natanz	38	12509	42160	-29651	Qamsar	85	3667	18848	-15181
Chermahin	39	12304	41079	-28775	Ezheh	86	3315	18629	-15314
Varzaneh	40	11520	40052	-28532	Khaledabad	87	3308	18415	-15107
Koushk	41	11271	39075	-27804	Barzok	88	3264	18205	-14941
Pirbakran	42	10856	38145	-27289	Vanak	89	2516	18001	-15485
Noushabad	43	10485	37258	-26773	Komeh	90	2310	17801	-15491
Boeen	44	10479	36411	-25932	Niasar	91	2003	17605	-15602
Baharan	45	10325	35603	-25278	Abrisham	92	1946	17414	-15468
Golshahr	46	9973	34828	-24855	Anarak	93	1294	17226	-15932
zayanderood	47	9891	34087	-24196					

Sources: statistics in 2006

Locating of population in cites:

We have entropy model for surveying and analyzing population location in cites and spatial balance on that area. This model is a tool for measuring the population distribution of city and the distribution of the number of cites in city classification in one area. By applying this model, we can find the amount of spatial balance

of population location and the number of cites in the level of Province, area and national network. The whole structure is: (Hekmatnia ,et al P:189-190,2006)

$$G = \sum p_i \ln p_i$$

$$G = \frac{H}{LnK}$$

H= the sum of frequency in Napery Log

p_i = The frequency of napery log

K= the number of classes

G= the amount of entropy

If the entropy tends to zero that means that, more concentrerlization of increasing in centralizations

Table 3: changes of Entropy index in Isfahan Province.(1956-2006)

Entropy (G) index	(LnK) Napery logarithm	Number of classes (K)	H Absolute entropy	year
0/91	1/6	5	1/47	1335
0/88	1/6	5	1/42	1345
0/8	1/79	6	1/44	1355
1/1	1/95	7	2/15	1365
0/8	1/95	7	1/56	1375
0/83	2/07	8	1/72	1385

Sources: authors

The index of entropy was 91% in 1956 which has been decreasing in 1966, and 1976. It shows imbalance of spatial distribution of cites in 1956. But in 1976, we can see huge balance in spatial distribution in cites. The index has been increased to 1.1. However, the index entropy shows less balance in 1986. Because it has been decreased to .8 and it has been .83 in 2006.

Conclusion

The system of urban hierarchy of Isfahan has experience the ups and downs during the recent years. The number of cites from 59 cites in 1956 reaches to 93 cites in 2006. Increasing in the number of cites related to 1996-2006. This is because of turning large villages into cites or building new cites in this province. Most of cites have been located in the south and south west because of better climatical conditions. Based on the result of this paper, Isfahan was the primate city during those years and even the second and the third cites have populated distance with regard to others cites. It means, they don't obey the system of Rank-size Isfahan because of its position and also suitable economical, social-cultural and political potentiality was best place for settling of people. There was a tendency to spatial balance based on the entropy index in 1956. However, it decreased and turned to imbalance in 1976. But it again increased in 1986. This is because of increasing in the population of the middle and small towns for the sake of entrance of immigrants of war-stricken.

The entropy index decreased in 1996 but it grew balance in 2006. In a nutshell, if we don't pay much attention to the understructure of middle cites and by centralizing facilities and services in Isfahan city. we have to wait a big rupture in this city.

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or imbalance in population distribution among cites. If it tends to one or more, it shows more balance in distribution in the area (Hekmatnia, et al P: 190,2006).

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