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Optimization of Urban Spaces to Municipal Development (Case Bandar Abbas)

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Abstract

Cities have grown haphazardly and urban areas have expanded to several times their primary size in a short while or have developed in separate sections without planning, tightly and randomly. This issue has come to be known as dispersion pattern or Sprawl and is a source of many problems in developing and developed cities. Bandar Abbas has also had a haphazard growth in the recent years. This paper attempts to investigate horizontal and vertical congestion in different parts of the city as a grid and then tries to draw on entropic indices with a cellular view to assess the order and balance of this grid city. Also, the results are used to compare the physical-operational concentration of the city between 2014 and 2006. In the end, a table is formulated according to the results presenting approaches, policies and projects for maintaining a balance between different parts of the city.

Keywords: development, Relative Entropic Index, urban, Bandar Abbas.

1 Introduction

This phenomenon that was triggered at the turn of the 20th century, gained momentum in the aftermath of the Second World War and has been problematic in most cities. In developed countries, the urban dispersion process is a by-product of modernist attitudes to urban spaces and an emphasis on two principles of operational separation and reliance on vehicles in urban transportation. Haphazard physical expansion of cities in our time has created a significant issue in Land Use. This development is in fact the continuation of city expansion to its suburbs; since around metropolitans there are areas in constant transition from rural to urban use (Shokui, 2003). In all, it must be said that what is being criticized as negative aspect in urban planning and development is not related to the cities but to the irregular and exogenous process of urbanization that often results in physical development leaving infrastructure development behind or preference of precedence of scale to operations and quantity to quality.

MATERIAL AND METHODS

The research method in this study is mixed-method based on descriptive, analytic, case study and field research designs. As for theoretical discussions, descriptive and analytic methods were used based on information provided by library archives of different organizations. In the next stage, the data was used in compiling reports for comprehensive plans in Bandar Abbas in order to analyze the Land Use and census data from National Iranian Statistics Organization in a six-month period (1966-2011). In order to assess the order and regulation in different areas of the city, although there are many different models like entropic, Shanon, Holdren, Muran's coefficients and others, interpreting them prove complicated sometimes. Nonetheless, entropic index is better than other approach since it is not affected by the number of sub-areas (Rahnama & Abbaszadeh,

2008). Hence, the entropic index is used in this study.

In this part, distribution balance of accommodation and population is assessed in neighborhoods and across the city of Bandar Abbas. Different indices and parameters are at work here that are generally categorized into operational and physical indices. A series of criteria and general principles governing the issue of balance can be used that are value of land, tourist attraction, building concentration and land occupation. Using the entropic index, these four indices are analyzed in both neighborhoods and across the city:

- Neighborhood scale in form of 240 by 240 meter grid cells
- City-wide scale in form of larger grids

After cellular categorization, the degree of balance between the grid cells is assessed using cellular entropy; in the end, while compiling a SWOT table, Bandar Abbas is physically assessed.

Theoretical foundations

There have been many theories about the available options for shape and structure of cities. Among the theorists, Persman in 1985 and Minery in 1992 have presented several main geometric shapes as a sample: 1. Dispersed city, 2. Compact city, 3. Marginal city, 4. Corridor city and 5. Edge city (Cathy and Berton, 2004).

Undoubtedly, selecting each of these forms is influential in strategic management and planning. Nevertheless, detecting the form and existing shape of the city demands study, research and analysis. Here the main two groups of cities are described:

Compact city

Following the ideas of Le Corbusier about sparkling city, Dantzing and Saati (1979) proposed compact city with a view of improving life quality but not at the cost of the next generation. The main idea of this was to create cities with high concentration without the issues of a modernist city. The popularity of consistent

development has significantly contributed to the promotion of compact city ideology. Since the 1980s, most studies have supported compact cities with a mixture of activities. Some researchers believe that compact cities will provide opportunities for reducing fuel consumption; since work and leisure are close by. (ECOTEC, 1993; Newman and Kenworthy, 1989; Hilman, 1996)

Dispersed form or extension model

This model was proposed seriously in 1960s in urban forum and since then it has been common in countries with cheap land, abundant road construction and excessive car manufacturing. This phenomenon was only seen in developed countries for so long but it is considered international with most cities facing it particularly in developing countries (Hutchison, 2010).

Such city form is seen in areas in which the development speed of urban lands is faster than that of its population leading to lower concentration. Although higher urban dispersion is a disadvantage and is indicative of environmental destruction, social gap and lack of a sense of belonging to a community, it has its proponents defending it. Dispersion theorists that are mostly from the US, Australia and Canada, claim that though dispersive development is a sign of higher fossil fuel consumption and adverse effect of pollutants and greenhouse gasses, due to the existence of vast lands in these countries in contrast with European countries, less concentrated destructive effects on environment are seen in them. Supporters of this theory are mostly from capitalists, big factory owners making cars and related industries whose benefits rely on the use of private cars and liberation in using fossil fuels and natural resources. Thus, through providing the conditions of welfare and comfort, the citizens of these countries support them (Meshkini, et.al, 2010).

But since basically this dispersion happens in developing countries in unprepared urban areas, adverse consequences like inefficient use of land and huge costs on infrastructures are incurred (Zhang, 2000).

Hence, it is considered an inconsistent and unstable development. This development model has caused many problems in third world countries and especially ours in which the consequences of horizontal sprawl are witnessed in different economic, social, political and environmental dimensions (Azizi, 2003).

Grid city

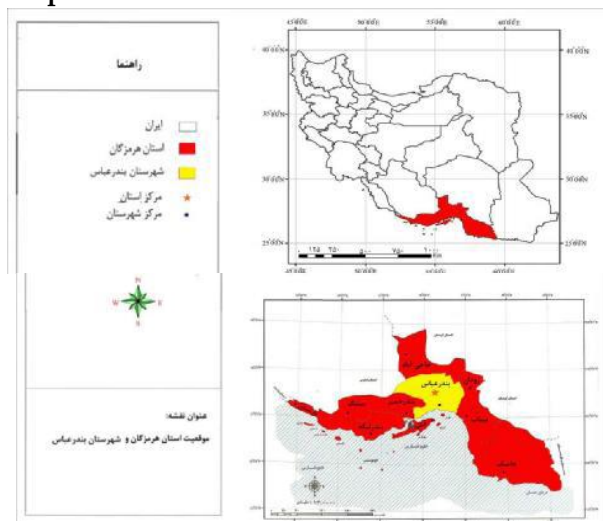
This form that is quite old goes back to Roman Empire and Greek cities. Throughout the history, grids have been introduced as the decisive shape for designed cities. Some of its problems can be seen in the connection of cross roads and junctions that prove dangerous. Indeed in some of these forms, the separation of sidewalks from streets and fewer junctions have reduced the problems in comparison with other forms. Nevertheless, this form consists of knots and junctions occupying huge spaces making it impossible to use public transportation.

RESULTS AND DISCUSSION

Bandar Abbas

According to general census in 1335, Bandar Abbas had a population of 15764 with an annual growth rate of 4.38 percent that has reached 23757 in a 10-year period leading to 1345. During the next 20 years, the increasing population trend continued (5.7 percent in the first decade and 6.3 percent for 55-65 period) and after that during 1988 to 96 a decreasing trend of 3.2 percent was reported. On the other hand, between 1996 and 2006 this rate went up to 4.33 percent. This continued more rapidly at 5.1 percent by 2006 ending in 2011.

These figures show that Bandar Abbas has been accepting immigrants throughout this period that has reduced during 1986-1996 period particularly in the latter half, boosting again by 1996-2006. The population growth of Bandar Abbas in all of the four decades covered here is higher than that of all other areas in the province and the country. This suggests that Bandar Abbas has hosted more immigrants than other parts of the province and the country with faster urbanization.

Map 1. The location of Bandar Abbas in central Iran**Table 1.** Climate data for Bandar Abbas

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °C (°F)	32.0 (89.6)	33.0 (91.4)	39.0 (102.2)	42.0 (107.6)	47.0 (116.6)	51.0 (123.8)	48.0 (118.4)	46.0 (114.8)	45.0 (113)	42.0 (107.6)	38.0 (100.4)	32.0 (89.6)	51 (123.8)
Average high °C (°F)	23.5 (74.3)	24.4 (75.9)	27.7 (81.9)	31.6 (88.9)	36.3 (97.3)	38.4 (101.1)	38.2 (100.8)	37.7 (99.9)	36.8 (98.2)	35 (95)	30.4 (86.7)	25.5 (77.9)	32.13 (89.83)
Daily mean °C (°F)	18.1 (64.6)	19.4 (66.9)	23.1 (73.6)	26.8 (80.2)	31.2 (88.2)	33.7 (92.7)	34.4 (93.9)	34.0 (93.2)	32.5 (90.5)	29.6 (85.3)	24.3 (75.7)	19.7 (67.5)	27.23 (81.03)
Average low °C (°F)	12.1 (53.8)	14 (57)	17.5 (63.5)	20.9 (69.6)	24.7 (76.5)	28 (82)	30.3 (86.5)	30.1 (86.2)	27.7 (81.9)	23.5 (74.3)	18 (64)	13.5 (56.3)	21.69 (71.04)
Record low °C (°F)	3.0 (37.4)	5.4 (41.7)	7.6 (45.7)	11.5 (52.7)	17.0 (62.6)	20.0 (68)	25.2 (77.4)	25.0 (77)	21.0 (69.8)	12.0 (53.6)	6.0 (42.8)	2.0 (35.6)	2 (35.6)
Average precipitation mm (inches)	39.7 (1.563)	47.5 (1.87)	34.8 (1.37)	10.7 (0.421)	4.8 (0.189)	0.0 (0)	0.6 (0.024)	2.2 (0.087)	0.8 (0.031)	1.3 (0.051)	5.0 (0.197)	24.0 (0.945)	171.4 (6.748)
Avg. precipitation days (≥ 1.0 mm)	3.3	3.1	2.6	1.3	0.2	0	0.1	0.2	0.1	0.1	0.4	2.3	13.7
Avg. relative humidity (%)	64	68	67	64	61	64	68	69	67	64	61	63	65
Mean monthly sunshine hours	220.1	211.9	224.9	242.4	312.7	302.2	264.6	270.1	270.1	283.4	251.2	228.8	3,082.4

Source: City and House consultation co, 2010, Bandar Abbas comprehensive plan

The physical growth and development

It can be inferred from the assessment of the developmental stages of this village in different periods that its main settlement was basically in its southern sector; after the establishment of this settlement the village stretches laterally to east and west especially towards its neighboring village (Mahdieh).

The most significant obstacles of physical development in this period were the river, the southern grove, northern heights and the northeastern cemetery. These obstacles are determining elements in the lateral development of the village.

With the reforms coming in 30s, Bandar Abbas requires special facilities as a governed center and a bureaucratic-political city. The face

of the city has changed and new bureaus, offices and buildings are constructed with the first streets coming at the same time and after the establishment of the central government, changing its name from Dehkord to Bandar Abbas. Immigration from neighboring areas and village's gains momentum and farms are replaced by new buildings. Physical expansion is quite extensive in this time as a single glance at the map of the city reveals a great land occupation after 1956, bigger than the original area of the city since its establishment. At this time, the city continues to expand linearly from east to Kuwaitis district and from west to Saman's Gate. This causes the development of industries in construction; as many brick making factories are built all over the area. Meanwhile, Bandar Abbas is now quite poor in terms of

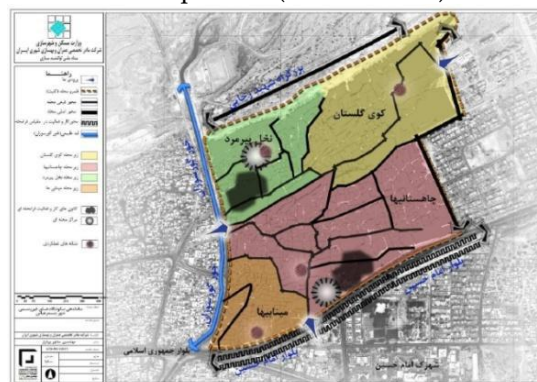
cultural and artistic facilities and this trend goes on until 60s and after the Islamic Revolution.

After the Islamic Revolution, the government policy of leading investments to deprived and undeveloped areas leads to evolutions in this area. As a result of such policies Sharekord and its surrounding areas undergo erratic changes in early 60s with close to 100 new industrial workshops being established in 1981 and 1982 alone. Early 1981s is the pinnacle of industrial development of this area in its short history of industrial revolution; though these industries undergo recession in 3 to 4 years. Following this recession, many of the factories go bankrupt and are almost shut down. Between 1976 and 1986, Bandar Abbas expands physically and different areas including Poice District, Farhangian District, Organizational housing in east, Shoore Boomi area in north and Karmandan District and Shahr-dari District in west are added to it. Also man-made woods in west, northwest and north are constructed around the same time.

For any reason, so far Bandar Abbas has come to own many office, governmental, cultural, artistic, industrial and urban facilities that has in turn made the bed for better potential and growth. After 1986 and until early 70s the city extends in north and northeast, terminal and barracks area and southeast areas. Also the

construction of a ring way in west of the city in 1996 expanded the city west- and southwestwards which had seen the least development since 1956. In 2001, the northeast- and northwards development is seen that has since 2006 been limited to northeast and southeast due to the existence of natural boundaries.

Map 2. the development process of the city in different periods (scale 1/10000)



Cellular analysis of the concentration of buildings in district scale in all 30 districts of Bandar Abbas

As an example the concentration of buildings in district no. 4 is given in the following table:

Table 2. The concentration of buildings in district 4 in 2012

The concentration of buildings								Cell no.	District
Average no. of floors	Total number of houses	Total buildings	5+ stories	4 stories	3 stories	Two stories	Single floor		
2.90	450	155	12	38	54	25	26	n 9	Number 4
2.58	321	124	5	24	41	23	31	n 10	
2.61	335	128	7	16	49	33	23	n 11	
2.44	311	127	5	25	31	27	39	o 9	
2.78	381	137	13	28	36	36	24	o 10	
2.66	435	163	5	36	45	54	23	o 11	
2.61	351	134	8	23	47	22	34	p 9	
2.64	416	157	4	31	58	34	30	p 10	
2.52	376	149	6	20	55	33	35	p 11	

Source: 1. The identification software for Bandar Abbas municipality for buildings constructed after 1996, 2. The field research by author, 3. Central census organization, 4. Bandar Abbas municipality, estate auditing statistics,

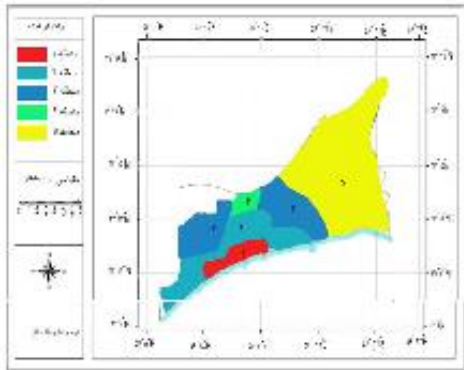
1390, 5. Bandar Abbas municipality, municipality districts year book, 2011.

The results of assessing concentration of buildings

Vertical concentration

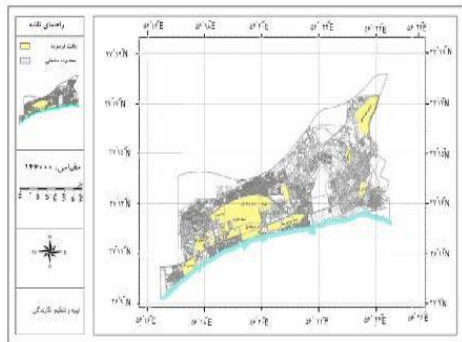
According to the surveys, the highest vertical concentration (3+ stories on average) was seen on 23rd district in eastern part and 18th, 13th and 12th districts in the north, center and downtown areas.

Map3.three dimensional image of vertical concentration in Bandar Abbas.



Source: the authors

Map 4. Cellular view with average concentration of 3+ stories (scale 1/10000)

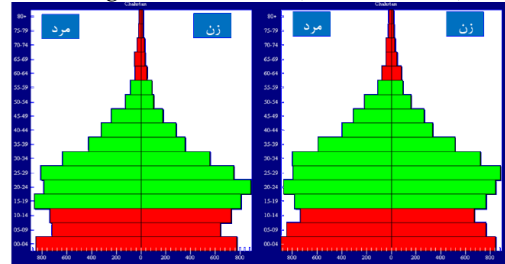


Source: the authors

Horizontal concentration

Also the highest horizontal concentration was seen in the following districts: 1, 3, 4, 5, 8, 9, 10, 11, 15 (with an occupation area of more than 50% of total area of each cell). With a comparison of this map and the historical development process of Bandar Abbas, it can be concluded that the highest horizontal concentration is seen in the southern part particularly in the older areas.

Fig1. The cellular view of cells with 50+% building concentration (scale 1/10000)



Source: the authors

According to the investigations, more than 70% of the structures are outdated. Thus more than 70% of them are lacking Urban Planning Principles; some of the factors in high horizontal concentration of the old areas are narrow dead ends and open spaces due to lack of Urban Planning Principles in the areas.

Calculation of the relative entropic coefficient in district scale in 30 districts of Bandar Abbas

Here, 4 factors are analyzed including constructed area, building concentration, land value and tourist attraction for each cell. Finally, calculating the entropic coefficient the author clarifies the degree of balance in district and city-wide scales. As an example, the relative entropic coefficient of district 2 is given below:

Table3. Results of the cellular relative entropic coefficient of indicators of the study in district 2

Entropic coefficient	Tourist attraction		Land value		Construction concentration		Constructed area		Cell name	No
	$\ln(p_i/p_i \times)$	Vehicle per hour	$p_i \times \ln(p_i)$	Thousand tomans	$\ln(p_i/p_i \times)$	No. of building	$p_i \times \ln(p_i)$	Hectares		
-0.89	-0.33	1256	-0.31	2000	-0.30	282	-0.29	2.42	m 6	1
-0.87	-0.33	1256	-0.31	2000	-0.28	250	-0.29	2.33	m 7	2
-0.92	-0.33	1256	-0.31	2000	-0.32	327	-0.32	2.92	m 8	3
-0.83	-0.25	650	-0.29	1800	-0.30	294	-0.30	2.59	n 6	4
-0.82	-0.25	650	-0.29	1800	-0.30	278	-0.30	2.50	n 7	5
-0.80	-0.25	650	-0.29	1800	-0.28	250	-0.29	2.42	n 8	6
			5718				1681		15.20	total

Source: the authors

Assessing the order and physical-operational balance in district scale

Through analyzing the difference of entropic coefficients in each district, using tables 5-9 to 5-38 the physical-operational balance in district scale can be measured. As was indicated in map 5-5, districts which had the highest physical-operational balance are colored in green. Also the yellow color is indicative of districts with moderate balance and red indicates low balance. The highest entropic coefficients are indicated by darker shades.

CONCLUSION

The results of analyzing vertical concentration

According to the surveys, the highest vertical concentration (3+ stories on average) was seen on 23rd district in eastern part and 18th, 13th and 12th districts in the north, center and downtown areas; the following influence the vertical concentration in Bandar Abbas:

1. Enforcing a policy of higher concentration in Bandar Abbas as the prices soar in the north of city center became popular since 1986-96 and peaked in the recent years. High price of land is one of the main reasons of heightened concentration in northern part of city center.
2. Relative reduction of concentration in northeast parts that are topographically suitable, available communication network, proximity to employment centers and thus the expansion of the city in the recent decades are accounted for in this way.
3. Construction of 5, 6 and 7 story buildings in the 60s in eastern part of the city for teachers increased the vertical concentration of this area.

Hence, in an overall trend, high land price, topographic conditions, access to city center, development of communication infrastructures and expansion of living spaces either in a planned fashion or by rural immigrants is the main factor behind formation of urban distribution pattern in Bandar Abbas.

The results of analyzing horizontal concentration

Also the highest horizontal concentration was seen in the following districts: 1, 3, 4, 5, 8, 9, 10,

11, 15 (with an occupation area of more than 50% of total area of each cell). With a comparison of this map and the historical development process of Bandar Abbas, it can be concluded that the highest horizontal concentration is seen in the southern part particularly in the older areas.

The following factors influence the horizontal concentration distribution in Bandar Abbas:

1. Lack of adherence to Urban Planning Principles as the main element in increasing horizontal concentration of the city
2. High population congestion in southern parts of the city due to being close to city center and having cheaper land because of unsuitable topographic conditions and environment has made it an attractive urban area for rural migrants.
3. Low concentration of southeastern sector is due to implementation of preparation plans in vast and separate sectors, easy access, farm lands and big residential land grids.

The results of assessing physical-operational order and balance of district scale in Bandar Abbas

Via evaluating the difference of entropic coefficients between different cells it was clear that this difference is huge in central and older parts; this is somewhat indicative of a lack of physical-operational order and balance in these parts.

The results of assessing physical-operational order and balance of city-wide scale in Bandar Abbas in 2003 and 2011

Via evaluating the difference of entropic coefficients between different districts between 2003 and 2011 it was clear that during recent years the tendency for centralization has grown in this city and the highest entropic coefficients are witnessed in center. Analyzing Strengths, Weaknesses, Opportunities and Threats

- Constructing malls in Mofatteh street and relocating the old stores of Mellat st. there

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