VOL. 2, NO. 3, SEPTEMBER 2013 ISSN 2305-493X
ARPN Journal of Earth Sciences

www.arpnjournals.com

# EVALUATION PHYSICAL DEVELOPMENT PATTERNS AND SPATIAL DISTRIBUTION OF PUBLIC SERVICES WITH SOCIAL JUSTICE APPROACH (THE CASE STUDY: NAGHADEH, IRAN)

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## ABSTRACT

With increasing world population and consequently, urbanization of societies, spatial development and equitable allocation of resources and urban services according to society needs and also communication between urban physical development and these uses development rate in different regions are important concern of city managers. Based on that, this article attempts to study spatial distribution and their equitable allocation of resources in Naghadeh (Iran) beside to analyses the physical development of this city from 1996 to 2010. Applied research methodology in this article is descriptive and analytical, based on functional aim. Development process in this city evaluated based on Shanon Antropy. We used from Williamson Index to analyses distribution of urban services. Finding of this research indicated that physical development of city was scattered and spiral and also with spatial development of this city over time urban services distribution was not compatible with urban regions, so many people specially people of north of city are excluded from urban resources and services. Also, quantitative evaluation of urban land uses in Naghadeh showed that most of urban land uses in this city was not compatible with standard capita in Iran that according to spatial shortage we can point to transportation and depots, green spaces, educational, urban equipments, commercial, industrial, and workshop land uses.

**Keywords:** physical development, urban services, spatial distribution, shanon antropy, williamson index, naghadeh city.

## INTRODUCTION

World population in early 21st century was about 6 billion and if this growth rate will continue, population will become 8.6 billion in 2025 (Yar Ahmadi, 1999). This population growth cause an increase in city buildings, specially housing units and that in turn, led to changes in land use construction (Ahadnejad Roshti *et al*., 2011). Urbanization velocity cause significant changes in how to utilize urban lands and this physical- spatial change is as a result of complicated interaction between different behavioral and constructive factors in cities (Yu *et al*., 2011; Mallinns *et al*., 2011; Thapa and Murayama, 2010). Unequal distribution of resources and services in urban region is mostly because of fast and ungovernable urbanization growth in the countries that manage by centralized system and development by capital. Usually, urban master plan and zoning policy in countries that, manage by centralized system, are base of land use and services distributions, and also morphological structure in urban regions. But because in practice, most of these plans and policies are not practical because of some factors such as lack of coordination between institutions and organizations, inefficiencies in controlling mechanisms, non concurrence between plan goals with facts, inflexibility, and also government and region organizations weakness in financing, extensive land use changes, and illegal dealing of lands and most importantly lack of afford of some peoples (such as people with low income, unemployed immigrants, poor women, orphans, people with disabilities, and unskilled workers) to payment urban fees and therefore inaccessibility to urban resources and facilities and finally residence of them in slums (Ezzat Panah, 2009).

Physical development of cities is a dynamic process that done by some vertical and horizontal changes in physical space of the city. If this process done without management it may change physical balance and environment of city and soon disable the city system to perform tasks well (Jabbari *et al*., 2010). One of the basic problems due to inappropriate spatial structure that now a day urban planning face with it, is the inappropriate development of cities, this growth not only destruct the environment (Shams and Haji malayeri, 2009) but also cause damaging effects on cities such as heterogenity of landscapes and loss farmlands. Despite, the research findings have demonstrate that this pattern for city development is not effective, but still it is the major pattern for city development (Batisane and Yarnal, 2008). In general, we must say a thing that now a days in cities and urban development as a negative aspect is criticize, mostly not the nature of the city but it is discordant process that often induced by precedence of physical growth and development of cities to infrastructures and needed services (Pourmohammadi and Jam kasra, 2011). So, attention to urban development in last decades, specially, from physical-spatial dimension as a scientific framework was important (Rabani, 2002).

## LITERATURE REVIEW

Different researches about physical-spatial development have done. Some researches that directly or indirectly related to the physical-spatial development are as follow:

Zanganaeh Shahraki (2007) in a research with name “Review phenomenon of Tehran city and their effects on farmlands” concluded that, spatial growth and development in the Tehran city in the past was slow and

relative density, but with beginning the rapid urbanization and uncontrolled immigrations of villagers to cities, area growth get rapid, so that we can perceived diffuse growth pattern or uncontrolled horizontal development to this city. Zaheri (2008) in an article with subject "Role of physical development of Tabriz in making rural and villages land use changes; A case study: Alvar, Baagh marouf, Shaad abad mashayekh, and Kondroud" indicated that, development of Tabriz metropolis and shifting perspectives from farming to industry and services, in other word, industrial and sociological revolutions are effective in shifting relations between city and village. Ibrahimzadeh and Rafee (2009) in a research showed that Marwdasht city up to 1996 developed intensively, but after 1996 the city developed spirally and sector-focused pattern for this city was diagnosed. Pour Ahmad *et al*. (2010) in a research unfurled that rapid development of Gorgan developed intensive, but after this year total area of the city get threefold and thus developed spirally. As, up to 2006 this condition got sever. Shaykhi *et al*. (2012) concluded that Isfahan city have dense development pattern but this pattern is not totally monopole and we can see little transmittal that mostly is strip and from center to around the city this density decrease. Zangane Shahraki *et al*. (2012) showed that in Yazd city just one factor do not cause spiral distribution but a set of social, economical, environmental-geographic and political-management factors led to rapid and vast spatial occupy that in terms of volume and size is unique.

Since, researches that conducted in the field of spatial fairness of urban services availability is slight and, consider concept of land use capita for residence access to urban services, and also people access to services, prosperous and non prosperous people to services and how to services locate is neglected. Finally, despite the spatial effects of services on how to access residences also the external effects of services on each other are not using the spatial analyses in these studies (Dadashpour, 2011).

Globally from late 1960s, conception and use of social justice got into the geographic literatures. In Iran, Lotfi and Kouhsari (2009) in a research in Tehran reviewed educational, commercial and green space services with regarding two approaches "equal opportunity" and "need base justice" in neighborhood scale. Also, khakpour and Bavanpouri (2009) compared spatial distribution of urban services with entitlement level in Mashhad with using moris and Arc GIS software, results indicated that there is a negative relation between population rate and entitlement level of urban services (Dadashpour, 2011).

## MATERIALS AND METHODS

This study was conducted by descriptive and analytical methods and was according to functional purpose. The main data employed in this study has been obtained from library studying (statistics from Census of Population and Housing about 1996, 2006 and 2011 and also master plan of Naghadeh), field studies and observations. Common and standard capitas of Iran used as criterion for evaluation balanced and unbalanced physical development rate we used from Shanon Antropy and for quantitative survey of land uses and determination of deficiencies. In order to investigate urban resources distribution and public services, we used Williamson model. Finally, rating plans and regions prioritize drawn with using Auto Cad software.

### Studied location

Naghadeh city located in south of West Azerbaijan province of Iran, about 10 $km^2$ area, placed in $36.57^o$ N and $45.22^o$ E. Naghadeh in 1956 get a city of Iran and population of this city was 4453. Population in 1966 got 10801 (increased by 9.26%). In this period Naghadeh with low economic income was not able to attract and employ immigration and got an emigration places. Population of this city in 1970s was about 23836 (increased by 11%). In this decade because of adding Alimalak and Chiane villages to Naghadeh metropolitan area population increased. In 2006 population increased to 70000 (by 2.56% growth). According to last census, population of Naghadeh estimates to be 75399, based on calculations population growth because of immigrations of around villages increasing by 3-3.5%.

## RESULTS AND DISCUSIONS

### Physical development pattern analyses based on Shanon Antropy model

Given that, one of the important goals of this article is to review physical development of Naghadeh city with regarding land uses development and how to spatial distribution. Therefore first we analyze physical development of Naghadeh base on Shanon Antropy Model. This model use for analyze and determine inappropriate urban development value. The overall structure of model is as follow:
Shanon Antropy equation:

$$H = -\sum_{i=1}^{n} Pi * Ln(Pi)$$

H = Shanon Antropy value
Pi = building area (total building density) of region related to all regions building area
n = total regions

Shanon Antropy value is between zero to Ln (n). Zero is very dense physical development of city. Whereas, Ln (n) value is dispersed physical development of city. When Antropy value be more than Ln (n), inappropriate urban development (spiral) occure (Hekmatnia and Mousavi, 2006).

In Naghadeh at 1999, urban total built area was 292 hectare that contribution of each region (3 regions) was 100, 71 and, 121 hectare, respectively. In 2011, urban built area estimates to be 398 hectare that contribution of each region (3 regions) was 122, 97 and, 178 hectare, respectively.

**Table-1.** Calculating Shanon Antropy value of three region of Naghadeh in 1999.

| **Region** | **Built area** (hectare) | **Pi** | **Ln** (Pi) | **Pi*Ln** (Pi) |
|---|---|---|---|---|
| 1 | 100 | 0/3424 | -1/0715 | -0/3669 |
| 2 | 71 | 0/2431 | -1/4140 | -0/3438 |
| 3 | 121 | 0/4143 | -0/8809 | -0/3650 |
| Total | 292 | $\sum Pi = 1$ | $\sum Pi * Ln(Pi) =$ | -1/0758 |

H = -1.0758

**Table-2.** Calculating Shanon Antropy value of three region of Naghadeh in 2011.

| **region** | **Built area** (hectare) | **Pi** | **Ln** (Pi) | **Pi*Ln** (Pi) |
|---|---|---|---|---|
| 1 | 122 | 0.3073 | -1.1799 | -0.3625 |
| 2 | 97 | 0.2443 | -1.4092 | -0.3443 |
| 3 | 178 | 0.4483 | -0.8021 | -0.3596 |
| Total | 398 | $\sum Pi = 1$ | $\sum Pi * Ln(Pi) =$ | -1.0665 |

H = - 1.066

According to tables Antropy value in Naghadeh at 1999 estimates to be -1.0758 and maximum value Ln (2) is -1.4140. Little differences between Antropy value and maximum value showed that urban physical development is dispersed and spiral and also it tend to imbalance in physical development of Naghadeh city.

**Quantitative evaluation of Naghadeh land use according to common standards**

Urban land use capita that obtains from relation between land use area and population is an index that shows land use distribution spatial justice in neighborhood and region level. To this end, in the following discussion in addition to evaluate urban land use area we compare existing capita in Naghadeh with common standards in Iran as follow:

**Residential land use:** Reviewing studies about Naghadeh development plan (comprehensive) show that total land use area in Naghadeh was 1540972 $M^2$ that residential capita by 792204$m^2$ (51.1%) is in the first rank of capitas. Contribution of each region (3 regions) is 273917, 239915, 278372 $m^2$, respectively. Comparing residential land use (37.33 $m^2$) with common standards in Iran (maximum 50 $m^2$) indicates a deficit in this land use about 209296 $m^2$ that is a very high.

**Commercial land use:** Most of commercial land uses in Naghadeh aggregated in the city center specially Esmail Abad st, around Ghalabashi hill and also two self employed market that altogether have 19450 $M^2$ by 1.04 $m^2$ capita. This capita is 1.2% of city area. According to conducted calculations about commercial land uses in Naghadeh shows 60670 $M^2$ deficit that is not appropriate amount.

**Public education land use:** This capita in Naghadeh is about 8 hectare (about 5% of city net area). Educational land use is about 3.85 $M^2$. Subcategories of this land use included exceptional education, preschool, primary school, guidance school, high school, Conservatory, technical and vocational education. Deficit of this capita in Naghadeh according to common standard in Iran (4-9 $m^2$) is 100070 $m^2$ that shows inappropriate situation of this land use.

**University land use:** this land use included Islamic Azad University and Payam Nour University. Total area of this land use in Naghadeh is about 28800 $m^2$ (about 1.43 $m^2$ per each person). University land use, conclude 1.8% of total land uses in this city. Naghadeh needs 1245 $m^2$ to get common standards of university land use in Iran (1.5 $m^2$).

**Religious land use:** In Naghadeh there are many religious places such as mosques, tombs and etc. total are of these places is 11560 $m^2$ that represents 0.7% of net area with 0.57 $m^2$. High level of religious places in this city lead to no shortage of this land use related to common standards in Iran.

**Cultural land use:** This land use included libraries, museums, and etc. this land use area in 2004 was 900 $m^2$. Cultural land use is 0.05 $m^2$ by 0.05% in Naghadeh. Cultural land use in Iran is between 0.75-1.5 $m^2$ that in compared with this land use in Naghadeh (1.5 $m^2$) needs to 29145 $m^2$ to compensate this lack.

**Medical land use:** This land use included 2 hospitals, two healthcare centers, and several pharmacies. This land use is about 15500 $m^2$ area by 1% of urban net area. Medical land use capita in Naghadeh is 0.87 $m^2$. With regarding 1.5 $m^2$as standard medical land use in Iran, this city needs 14545 $m^2$ for development of these areas.

**Sanitary health:** total area of this land use in Naghadeh is 11200 $m^2$ (0.7% of total services land uses). With respect to existing capita (0.55 $m^2$), this city needs 818 $m^2$ of medical land use.

**Sport land use:** Sport land use area in this city is 28000 $m^2$, including 2 stadiums (Takhti and Welayat sport complexes) and some football fields. This land use represents 1.39 $m^2$ by 1.8% of Naghadeh net area that shows 22075 $m^2$ related to standards of Iran (2.5 $m^2$).

**Governmental land use:** Governmental land use in this city estimates to be 65925 $m^2$ that is 4.3% of urban net area with 1.9 capita per each person. This shows a deficit in comparison with common standard in Iran (2 $m^2$).

**Green space land use:** Green space area in Naghadeh is 25500 $m^2$ by 1.6% of total area with 1.05 $m^2$ capita per each person. With regarding 10 $m^2$ capita as standard capita in Iran, this city needs 174800 $m^2$ to this land use.

**Table-3.** Different land uses capita in Naghadeh and deficiencies of it.

| R | land use | Existing situation | | | Standards ($m^2$) | Deficit ratio |
|---|---|---|---|---|---|---|
| | | **Capita** ($m^2$) | **Area** ($m^2$) | **Ratio** (%) | | |
| 1 | residential | 33.37 | 792204 | 5.51 | 30-50 | 209296 |
| 2 | commercial | 04.1 | 19450 | 2.1 | 2-4 | 60670 |
| 3 | university | 43.1 | 28800 | 8.1 | 5.1 | 1245 |
| 4 | educational | 85.3 | 80200 | 2.5 | 4-9 | 100070 |
| 5 | religious | 57.0 | 11560 | 7.0 | 3.2-0.0 | -5551 |
| 6 | cultural | 05.0 | 900 | 05.0 | 5.75-1.0 | 29145 |
| 7 | medical | 87.0 | 15500 | 1 | 5.75 -1.0 | 14545 |
| 8 | sanitary | 55.0 | 11200 | 7.0 | 6.0 | 818 |
| 9 | sport | 39.1 | 28000 | 8.1 | 5.2 -2 | 22075 |
| 10 | governmental | 9.1 | 65925 | 3.4 | 2 | -25865 |
| 11 | green space | 05.1 | 25500 | 6.1 | 15]7- | 174800 |
| 12 | tourism | 04.0 | 800 | 05.0 | 2.0 | 3206 |
| 13 | industrial | 79.0 | 16000 | 03.1 | 5.2 -3 | 54105 |
| 14 | urban equipment | 12.0 | 2150 | 14.0 | 2-5 | 98000 |
| 15 | terminals | 01.0 | 332 | 02.0 | 2 -5 | 99818 |
| 16 | transport | 52.23 | 471251 | 58.30 | 50-60 | 730549 |
| Total | | - | 1540972 | 100 | - | |

According to common standards (2003)

**Tourism land use:** Now, allocated level to tourism land use is 800 $m^2$ with 0.04 $m^2$ per capita by 0.05% of urban net area. Common capita for tourism in Iran is 0.2 $m^2$ that with respect to this capita in Naghadeh needs 54105 $m^2$.

**Urban equipment land use:** This land use area in Naghadeh is about 2150 $m^2$ that include 0.14% of this city. This capita per each person in Naghadeh is 0.12 $m^2$. According to conducted calculations this city needs 98000 $m^2$ to get common standards in Iran.

**Terminals and depots land use:** Total area for this land use in Naghadeh is 332 $m^2$ that is 0.02 $m^2$ with 0.01 $m^2$ per capita. For compensate this deficit, Naghadeh needs 99818 $m^2$. Therefore, this land use is one the land uses that has not appropriate situation.

**Transportation land use:** This land use area in Naghadeh is about 471251 $m^2$ with 23.52 $m^2$ per capita. According to Table-3, common capita to this land use considered being 50 to 60 $m^2$, thus this city needs 730549 $m^2$ to get standards in Iran.

Overall, most of urban land uses in Naghadeh is far from standard capita in Iran according to spatial deficits we could mention transportation, terminals and depots, green spaces, educational, urban equipments, commercial, industrial, and workshop land uses. Also according to conducted calculations, governmental, religious, sanitary, and university land uses in comparing with common standards in Iran have relatively good situation.

**Urban services distribution analyses according to Williamson index**

For measuring that how much an index could distribute imbalance between regions we used coefficient of variance (CV) that usually called as Williamson factor. CV calculate by an equation as follow:

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$$CV = \frac{\sqrt{\frac{\sum_{i=1}^{N} (Xi - Xi)2}{N}}}{\frac{\sum_{i=1}^{N} Xi}{N}}$$

Xi = amount of an index in a certain area
X = index i mean
N = number of regions

This method used to evaluation existing inequalities in development indexes between regions in wide range, that high value of CV indicate inequalities in distribute mentioned index.

**Table-4.** Different urban services area according to regions of Naghadeh in 2003.

| Region | Residential | Commercial | Public education | Urban equipment | Religious | Cultural | Medical | Sport | Governmental | Green space | Tourism |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 273917 | 9285 | 18625 | 2150 | 600 | 900 | 15500 | 28000 | 29000 | - | 250 |
| 2 | 239915 | 6680 | 19150 | - | 6000 | - | - | - | 14925 | 1500 | 400 |
| 3 | 278372 | 3485 | 42425 | - | 4960 | - | - | - | 22000 | 24000 | 150 |

For analyzing Williamson Index or CV first we present some of main activities and urban services area in Table-4 then, according to Williamson Index equation, we calculate distribution and equilibrium of considered indexes at urban region level and finally according to ranking method (one of the common methods in evaluate development rate) we evaluate rank of three regions that in 2003 were components of urban residential areas in providing 10 services.

**Table-5.** Distribution of land uses capita and ranking regions in Naghadeh according to Williamson index (2003).

| Region | Residential | Commercial | Public education | Urban equipment | Religious | Cultural | Medical | Governmental | Green space | Tourism | Combined index | Ranking |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 43.46 | 57.1 | 16.3 | 37.0 | 10.0 | 15.0 | 63.2 | 49.0 | - | 04.0 | 94.54 | 1 |
| 2 | 17.41 | 15.1 | 28.3 | - | 03.1 | - | - | 56.2 | 26.0 | 07.0 | 52.49 | 2 |
| 3 | 52.33 | 42.0 | 11.5 | - | 60.0 | - | - | 65.2 | 89.2 | 02.0 | 21.45 | 3 |
| mean | 73.37 | 04.1 | 85.3 | 12.0 | 576.0 | 05.0 | 876.0 | 9.1 | 05.1 | 04.0 | 89.49 | - |
| Standard deviation | 15.18 | 581.0 | 09.1 | 213.0 | 465.0 | 086.0 | 51.1 | 22.1 | 59.1 | 02.0 | 87.4 | - |
| variance | 44.329 | 338.0 | 194.1 | 045.0 | 216.0 | 007.0 | 30.2 | 493.1 | 55.2 | 00.0 | 77.23 | - |
| CV | 481.0 | 558.0 | 283.0 | 77.1 | 807.0 | 72.1 | 72.1 | 642.0 | 51.1 | 5.0 | 09.0 | 5.0 |

According to CV or Williamson Index that presented in Table-5, some of urban services such as urban equipment (1.77), Cultural (1.72), medical (1.72), and green space (1.51) land uses distribute unequally between regions in Naghadeh. Based on this table, public education (0.283), residential (0.481), tourism (0.5) and commercial (0.558) land uses distributed relatively equal between regions of Naghadeh. According to results of Table-5 and calculate ranking method, highest proportion of urban capita allocated to regions 1, 2, and 3, respectively.

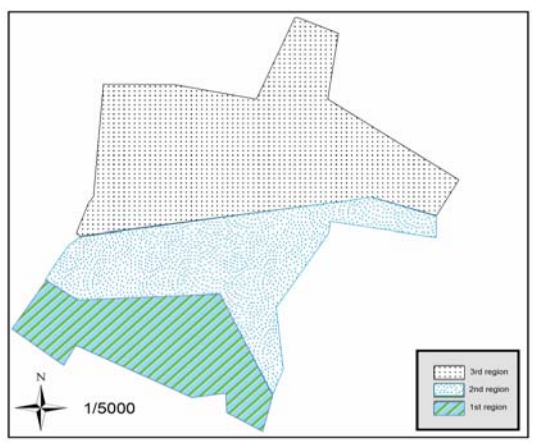


**Figure-1.** Ranking regions of Naghadeh according to access to urban capita.

With respect to Figure-1 attention to land use planning in deprived regions of Naghadeh is necessary

that should regard in urban development and governmental service plans. Accordingly, in rest of article we discussed about prioritize of land use planning in region levels of Naghadeh: first priority in planning and urban activities development must allocate to 3rd region and in second priority is 2nd region and finally 1st region is in final priority.

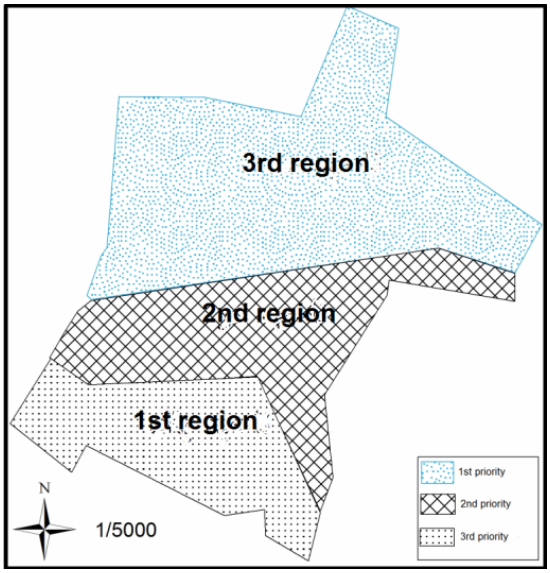


**Figure-2.** Spatial development of land use ranking in Naghadeh.

## RESULTS AND DISCUSSIONS

Unequal physical development is one of the things that most of cities with uncontrolled population growth face with it. Naghadeh is one of the cities that because of uncontrolled immigration of villagers to city and joining some villages to this city area in last decades faced with unequal physical development. Naghadeh area in 1999 was about 292 hectare and this amount in 2011 reached to 398 hectare (100 hectare development in 12 years). In other hand, results of Antropy model indicate that during 1999 to 2011 this value decreased from 1.0758 to 1.066 that show a dispersed and spiral development of this city.

Results from quantitative evaluation of land uses in Naghadeh showed a non concurrency between land uses capita and common standards in Iran, such as transportation, terminals and depots, green space, educational, urban equipment, commercial, industrial, and workshop land uses. Also according to conducted calculations, governmental, religious, sanitary and university land uses in compared with common standards in Iran have relatively suitable situation.

Williamson Index results indicated that spatial distribution of urban equipments (1.77), cultural (1.72), medical (1.72) and green space (1.51) land uses in city (specially, in northern part of city) is unequal.

Equal distribution of population in different parts of city lead to more control of government on urban physical development with applying policies such as: supporting mass housing companies, and performing land preparation plans, empowerment of poor regions and prevent dispersed buildings and spiral development, specially designing and constructing compatible buildings with environmental and social-cultural conditions of Naghadeh are among proposed strategies to appropriate and principled physical development.

Equal spatial distribution of urban activities and land uses in different regions by government and service offices in poor regions is important for spatial improvement of Naghadeh. Balanced and proportioned increasing urban equipment, cultural, medical and green space land uses capita urban regions and areas regarding deficits in land uses strongly felt.

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