Distributional planning of educational places in developing cities with case studies

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ABSTRACT

This paper illustrates needs for revisions on educational land use policy in developing cities. It discusses the importance of educational spaces when they give services to many people and cover considerable areas of cities. It also states that present urban educational sites faced to problems such as lack of lands, disproportionate distribution in views of family needs, not consistent with other urban functions and lack of accessibility.

The first aim is to analyze the distribution pattern of existing educational sites across a case study city and to examine an optimal model to redistribute the schools. The ultimate goal is to give a new map on the spatial distribution of educational sites in tune with new urban needs and development.

This research uses an integrated spatial equity evaluation method, which is analytic and descriptive. It uses the Moran's I index to classify and analyze the collected data. This research uses ArcGIS and AHP (analytic hierarchy process) soft wares as well. The contribution of this research to the problem is twofold. One is highlighting the problems of the existing non-optimal distribution of the schools throughout the city. In addition, this paper proves the need for changes in the land use policy and for allocating adequate and suitable lands to educational spaces aiming at optimal schools' distribution in the developing cities.

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1. Introduction

1.1. The need for schools

A growing need for new educational spaces in Iran comes from rapid the population increase. As scholars, i.e. (Dadras, Shafri, Ahmad, Pradhan, & Safarpour, 2014) and (Mehrara & Rezaei, 2015) have illustrated, Iran's cities have been expanded physically in recent decades. The expansion is caused by increasing population. Undoubtedly, the most important effect of the rapid uncontrolled urban physical enlargement is failure of urban socioeconomic plans and land use policies (Cullingworth, 2015; Fuseini & Kemp, 2015; Pourahmad, Lotfi, Omranzadeh, & Mahdi, 2015; Salehi & Reza-ali, 2005). Inhabitants in developing cities demand various urban services including good education and therefore the cities shall plan for it quantitatively and qualitatively (Razavi, Hosseini, & Najafpour, 2015; Zhou, Xu, Wang and Lin, 2015). From the other side, the increasing demand for the educational spaces requires functional and efficient land use policies and spatial plans (Hosseini, 2015).

1.2. The problem

One component of the sustainable development is achieving urban basic education for all boys and girls by the year 2025 (Vision of education development in Iran). This target will not be realized as long as there is an imbalance in the distribution of the schools throughout the cities. Owing to the importance of adequate education supply for all people, an optimal educational land use policy is a major task of the cities (Yigitcanlar, Velibeyoglu, & Martinez-Fernandez, 2008).

The problem as Jamshidzade illustrated is "how shall the urban planners allocate land to schools?" (Jamshidzade, 2008: 24). Ebrahimzadeh and Ardakani have experienced that "an optimal urban land use policy is a major function in the process of urban planning and design" (Ebrahimzadeh & Ardakani, 2006:43). The schools

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encompass large urban land areas and many people in a city (Ameli, Hamidi, Garfinkel-Castro, & Ewing, 2015; Yigitcanlar, 2009). To get an optimal model of urban land use policy, specifications and requirements of every urban function relative to each other shall be analyzed carefully. In other word, the interwoven connections among various urban spaces shall be known from adoption and neighborhood views as well (Wingo, 2013). As Saeednya suggests, "*it is necessary to define the relevant criteria and indicators*" (Saeednya, 2004: 24). Thus, a major part of this problem is the non-optimal placing of schools so that a new distributional pattern of the schools is necessary to remedy the existing urban imbalance in the distribution of the schools in a city.

1.3. The methods applied

Given the importance of the schools, the methods applied by this paper are focusing on the need for changes in current land use policy aiming to allocate adequate lands to schools. This paper will study the present problems of educational places and will suggest a new plan for optimal distribution of educational sites in a case study city. To prepare the new map for the needed urban educational sites free of the present problems, this paper uses a case study. Data about the schools' sites in the city have been collected. This paper is going to use a nearest neighbor index of Moran's I to show the distribution pattern of the educational lands in the city. An analytic hierarchy process and its super decision software ease the decision process to decide the best sites for the schools regarding some certain indicators. Then, various layers of the new map are provided with the help of a geographical information system. So, the new plan is going to specify appropriate lands for the schools in harmony with the defined indicators.

1.4. The structure of this paper

This paper has been organized in eight sections in the following way. This first introductory part deals with the problem addressed by this paper and its research methods. The second section discusses on the background of the problem and provides grounding theories of optimal placing of the schools throughout the developing cities. Section three introduces the indicators required in the process of decision making for optimal distribution of the schools. Part four of this paper introduces the case study city. The fifth part goes in the methods and data collection. Section 6 suggests optimal locations of the schools in Piranshar city. Section 7 introduces the findings of the case study carried out by this paper and finally, the eighth part presents concluding remarks.

2. Theoretical foundations of the public schools' distribution in the city

The grounded theoretical approach of this research consists of two ideas. One is the theory of self-development presented and examined by Shahraki who theorized his observation: *"Developing countries are building traditionally and self-automated owing to emergency pressures and without pre-planning. Newly, they recognized that urban planning systems, codes, and acts are significant in the process of urban development"* (Shahraki, 2014:37). He also theorized that without planning the cities are not able to overcome the increasing urban difficulties, i.e. the non-optimal distribution of the educational spaces. Another is a spatial equity evaluation theory, which is an important component of sustainable urban planning. Taleai, Sliuzas, & Flacke (2014) introduced an Integrated Spatial Equity Evaluation (ISEE) framework based on spatial multi-criteria analysis to assess spatial equilibrium. This paper has used this theory as well to redistribute the schools' spaces proportional

to required indicators. The urban land use policy scholars like Pawar and Li have introduced important indicators to distribute the schools' places in the cities. Pawar (2015) in his study concerning the location analysis of schools in the Shivaji city of India opines that the variations in the schools' places are in harmony with the patterns of population distribution over the time. The question of the access to the schools stresses the importance of location and distance. Generally, the empirical studies related to the schools' distribution in the cities have been attributed to several factors such as distance, and type of facility available in the schools. Li and Zhao (2015) found that the schools' places were unevenly distributed among the urban neighborhoods and that the distance was a paramount factor for the families in China. These empirical studies show that uneven distribution of the educational spaces affects unevenly urban services, distribution i.e. MacDonald's restaurants in a city. Many studies such (Fitzgerald & Zientek, 2015) and (Arribas-Bel, Kourtit, Nijkamp, & Steenbruggen, 2015) have understood cities as dynamic living organisms i.e. Lars Orrskog wrote *"We understand each city dynamically and look at every city as a living systemic organization"* (Orrskog, 1993:41). Foremost, he stated that cities as living creatures are changing. Cities in developing countries are expanding in terms of population and skeleton continuously. So, urban planners shall distribute the educational lands parallel to the expansions (Momeni, 2015; Qureshi, 2010). Given the importance of the urban educational spaces, scholars have tried to analyze the land use policy related to educational services world widely. Pizzolato and his colleagues had previously attempted to decide suitable locations for schools. Under a Brazilian area case study, they analyzed the sites of state primary schools according to criteria such as the number of requested schools, costs, and accessibility (Pizzolato, Broseghini-Barcelos, & Nogueira Lorena, 2004). Their goal was to find suitable places for the schools with the help of Arc/GIS software. Mulaku and Nyadimo in their study entitled " GIS in education planning: the Kenyan school mapping project " created a GIS database for similar factors Pizzolato made earlier. Their GIS would specify the number of demands for standard and equal educational opportunities. The system also contributed positively to improving the urban land use policy, mapping of schools and quality of the education in Kenya (Mulaku & Nyadimo, 2011). In 2010, Masoud Badri used a GIS for improving urban land policy and school sites in the city of Abu Dhabi as well. He evaluated possible land use scenarios and laid optimal routes for biking and ways for school busses. His system was based on matching the needs of schools, school sites and useful spatial factors (Badri, 2010). Returning to Iran, the metropolitan areas and the big cities in this country have become larger too. At the same time, the population grew and the need for educational spaces increased. According to the 2011 population census, Iran has 75 million inhabitants, a fourfold increase since 1956. Table 1 shows that urban population increased from 31.4% of around 19 billion to 71.4% of a total of 75 billion in 2011. It means a big increase in urban

Table 1
Urban population growth.

Census date	Population	Average annual growth (%)	Proportion urban (%)
01-11-1956	18,954,704		31.4
01-11-1966	25,785,210	3.1	37.0
01-11-1976	33,708,744	2.7	47.0
22-11-1986	49,445,010	3.9	54.0
01-11-1996	60,055,488	2.0	61.0
01-11-2006	70,495,782	1.6	68.5
01-11-2011	75,149,669	1.3	71.4

Source: (Statistical center of Iran, 2011, figures for 1966, 1986 and 1996 are estimates).