Analysis the Environmental Impacts of Pardis New Town 
By TOPSIS Model

Dr. Gholam Ali Khammar*
*Department of Geography and Urban Planning, University of Zabol, Zabol, Iran

Abstract
Nowadays, with increasing urban population in Iran, urban management made the decisions to control the population by developing new towns in order to improve the urban services. In this research we have analysis Pardis New towns as a residential city. In order to, the applied methodology is based on qualitative and quantitative methods with point on social indicators to adjusting the level of settlements in the spatial system of the regions and reduction and removal of the existing inequalities among these regions by TOPSIS model. Results showed that the major environmental issues in Pardis New town involved the problem of water shortage, urban and industrial and agricultural sewage entering the watercourse natural, existence of different factories and create noise pollution, soil erosion and soil contamination. Finally presented some solve ways.

Key words: Environmental effects, New town, TOPSIS, Mohajeran

Introduction
Acute problems of urbanization led to new theoretical perspectives and solutions that have been reflected in national development policies. Building new towns has been proposed as one of the basic policies toward population growth and inflation in large cities. In different periods of history, new towns have been built around the world (Frank, 1972). Building new towns in Iran goes back to past times; one can count many cities that were founded in a specified period (Piran, 1989). In Iran, during the last three decades, the rapid growth of urban population has not been in proportion to the capacities of urban space facilities, and due infrastructure and required profession were not also provided. Since, spatial distribution of cities and population has not been based on a comprehensive plan which is in congruent with regional and provincial sectors, the issues resulted from the rapid urban population growth have become multifarious and convoluted. Consequently, issues like unaffordable housing, unemployment, and illegal housing are reflected as the thorniest issues of urban life of our country whose alleviation needs comprehensive planning and attempts (Ziari, 2000). Therefore, building new towns was put on the government's agenda as a strategic approach to these issues. New towns are among the national issues, and the national issues could not be solved with regional perspective, rather dealing with them demands national resolution and support (Qarakhlu, 2006). Now, after more than two decades from passing the Act No. 108 328 (dated 1986,3,4) by Council of Ministers about new towns, 14 towns have been under construction and repopulation phase and 11 new towns are in the preliminary stages, under investigation or implementation plan. There are different statements about the success or failure of this program. Those responsible for this project, namely the authorities in the ministry of roads and urban development and especially New Towns Development Company (NTDC) insist on the success of this policy, and are determined to continue and extend this policy. On the other hands, critics and experts in various fields especially in urban development have had various ideas about the inefficiency and failure of this policy. In such circumstances, analyzing the function of these cities and the results of this policy seems essential. During the early years after the Islamic revolution of Iran and occurrence of the imposed war, extensive migrations started all over the country. Many farmers came to cities progressively because of economic stagnation in villages resulted from land reform and waning of seasonal economy. In addition to farmers’ migrations, there were widespread migrations from towns to large cities, mainly to the center of provinces. Configuration of the country’s population was changed by these migrations which led to fast growth of urbanization
in the country. According to these conditions and upon evaluating the trends, demographers predicted that the population of cities in Iran will double through the next 20 years (Miran, 2007). Such a prediction could have different meanings for planners and decision makers; first, constructing towns through the next 20 years should be accomplished equal to present cities with regard to area, volume and space in order to reside applicant population, primarily the migrants. Second, composition of the country’s population balance between city and village had a drastic change and through next years, city population would outweigh village population, therefore the problem required a specific planning approach. Third, lack of planning and foresight for the great number of migrants to cities would result in doubled pressure on large cities, occurrence of different cultural, economic and social side effects, occurrence of serious social abnormalities, and vanishing of large cities’ identity (Ardeshiri, 2007). In recent years attention to ecological and environmental principles in urban planning has been presented in framework of different patterns as: garden city, design with environmental, ecological footprint, urban metabolism, spatial planning by GIS and the function of ecological earth surface landscape.

**Background**

In different periods, in different places of world some new places have been created that named as New Town. The major objectives of the new towns after the revolution and as one of the strategies of urban development were to absorb the overflow population of large cities, to offer housing to low-income groups, to prevent population growth and anatomic enlargement of the cities, to decentralize population and industries, and to accommodate workers of industry sector near the industrial poles. It seems that the policy of establishing new towns in Iran is in close relationship with the goals of establishing new towns in some other countries (Micarelli, 2008). With almost 200,000 new dwellers flooding in to the world cities and towns each day, inequalities are worsening and informal settlements are mushrooming. If unchecked, this could lead to wide-scale violence and chaotic cities (UN-HABITAT, 2009). Main targets of establishing new towns define the population type and their reasons for immigrating to these towns. The main reasons for immigration to new towns may be listed as follows:

1. Trying to solve the overpopulation problem in mother cities through decreasing the population density.
2. Dealing with housing shortage problem,
3. Minimizing distances between work and residence locations,
4. Decreasing time and cost for travel to work,
5. Maintaining a better quality of life (Center of Investigation of Perlman of Iran, 2002; Khammar, Heydari & Shahmoradi, 2012).

![Fig. 1. Factors in shaping the pattern of settlement Iranian New Towns](Resource: Authors adapted Mohesara, 2013.)

Similar research on the function of new towns in Iran and absorbing the overflowing population of metropolitan cities have been conducted, but less has been done to investigate the role of living conditions in new towns' repopulation from the citizens' perspective. We will refer to some of them in the following line: Qarakhlu and Panahdeh khah (2009) evaluated the function of new towns around Tehran (Hashgerd, Pardis, Parand and Andisheh) in absorbing the population of metropolises. Using
"standardized score" on the predicted population for the specified time horizon, they believed that the four new towns around Tehran were not on the same level of success in absorbing the population. Zebar Dast and Jahanshahlu (2007) in evaluating the function of new town of Hashtgerd in absorbing the overflow population showed that although the new town has not fully achieved its expected programs, but the anticipated role and functions for the town in absorbing the overflow population of Karaj and Tehran metropolis have gradually been achieved. Ziari & et al (2007) in a comparative analysis of the reasons for not achieving the goals of new towns in Iran using the ANP, and proposing an approach in Multiple Criteria Decision Making and also ranking the main causes of this effect, has examined the effectivity of these causes in all kinds of new towns and believe that among the new towns, continuous towns have suffered the greatest amount of loss from failing to achieve their goals; self-sustaining and satellite towns were respectively in the second and third ranking. Seyyed Fatemi and Hosseinzadeh Dalir (2010) in their analysis of the role of Sahand new town in spatial organization of Tabriz large urban space believed that despite the huge investments made in Sahand new town, it has had little effect in balancing the spatial organization of cities and their hierarchy in the province; furthermore, up to the end of the fourth development plan, it would have reached only 40 percent of its goals in repopulating new towns. Negahdari (2002) examining the function of Sadra new town, located in Shiraz urban area, believed that the town has not reached its original objectives or has faced delays, the underlying factors causing this process could be summarized as: finding proper land, land ownership, lack of basic services, rival settlements, lack of public participation and lack of appropriate job opportunities. Gholamiyan (2010) in his analysis of the role of new towns in absorbing the overflow population of metropolitan cities and decentralizing them believed that building new towns in Iran has failed to achieve its predetermined goals, besides they have not been successful enough in decentralization and absorbing the overflow population of metropolitan cities. Noriyan and Shayesteh-Paydar (2007) using AHP hierarchical analysis in evaluating the function of Golbahar new town have shown that the success of Golbahar new town compared to its optimal choices in its study was 23.79 percent, which signifies severe backwardness of the new town from its proposed programs. In order to the research hypothesis can be said as Location and build of Mohajeran and Pardis New town have had a significant impact on their environmental problems and Pardis New town In terms of environmental pollution is much lower.

**Methodology**

The research method that we have used is based on descriptive-analytical approach. In order to in the first step we have been conversion the decision matrix to the less scale matrix. In second step calculated the less Scale weighted matrix by entropy Shannon. Then less scale matrix was obtained with the square matrix \(W_n \times m\). In third step the positive and negative ideals for both of indicators was calculated. In the fourth step, we have obtained the distance between each alternative of positive and negative ideal. In the fifth step, has calculated the relative of each alternative to the ideal solution and in sixth step were ranked the options. Finally presented some solve ways.
Fig. 2. The conceptual diagram of research plan
Resource: Authors adapted Mohesara, 2013.

Results
Environmental problems in the Pardis New Town
Pardis New town is located in east of Tehran on the southern slopes of the Alborz heights between 1700 to 1980 meters from free sea levels between cities of Jajrud and Boomehen in the 35 Km² route of Tehran- Shomal road between 35°, 43’ to 35°, 46’ north geographical latitude and Longitude 51 degrees 47 minutes 51 degrees 53 minutes east.

Fig. 3. Map of Pardis New Town.
The road passes through the center of the Pardis town and its campus is divided into two parts, north and south. Southern part of the city is mainly occupied by the construction of industrial and service sectors and its northern part is dedicated to the construction, residential and office sectors. The area of north part is about 1200 ha and in southern part is 300 ha and with including of 500 ha added land in west is totaling approximately 2,000 hectares. The rainfall rate in Pardis new town is equal 378 mm per year. Also this city is located in a seismically active region. The main source of supply water for pardis city comes of semi-deep and deep wells in the area. Wastewater and sewage produced by the city and neighboring industries town mostly without treatment directly are crossing into natural floodways of the city and its outskirts that cause of environmental pollution and are
increasing pest and diseases. Due to location of Pardis New Town in the transit road of Tehran – Roudehen crossing of vehicles led to air pollution in this region. Also the existence of cement factory in 10 km of southwest and an adjacent of Pardis new town and ethanol factory in the southwest corner of city caused Pardis new town had a pollution air. Housing of residents concurrent with the construction of residential and passing heavy vehicles bearing provides noise pollution. Despite the location of Khojir park and Sorkhehesar park in the near of Pardis new town, this city suffer from the weakness of green spaces. Also pardis new town according to formal census of Iran in 2011 had 25360 persons. The almost population of Pardis city to work and shopping are depended to Tehran and nearby towns such Boomehen and Roudehen. The existence of pardis new town on the south side of Khoramdasht town and the increasing of urban population and the entrance of municipal and industrial sewage discharge will follow of air and water pollution. In transit road of Tehran- Roudehen due to the passage of motor vehicle production the rate of air pollutants is high. With taking into account the contribution of country pollutants and estimate the contribution of other parts according table 1, in total in each day 14 tons co$_2$, 53 tons of SO$_X$, 8 tons of NO$_X$, 5 tons of HC and 3/4 tons from different parts into Pardis air.

Table 1
Emissions of air pollutants from various sources in Pardis New town in terms of tons in 1996

<table>
<thead>
<tr>
<th>Pollution source</th>
<th>CO$_2$</th>
<th>SO$_X$</th>
<th>NO$_X$</th>
<th>HC</th>
<th>Suspended particles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
<td>9.50</td>
<td>1.28</td>
<td>3.24</td>
<td>2.63</td>
<td>0.17</td>
</tr>
<tr>
<td>Stationary and heating sources</td>
<td>0.28</td>
<td>39.2</td>
<td>3.99</td>
<td>0.11</td>
<td>1.31</td>
</tr>
<tr>
<td>Industries</td>
<td>1.43</td>
<td>11.73</td>
<td>0.08</td>
<td>0.72</td>
<td>1.32</td>
</tr>
<tr>
<td>Solid waste disposal</td>
<td>0.78</td>
<td>0.16</td>
<td>0.23</td>
<td>0.25</td>
<td>0.11</td>
</tr>
<tr>
<td>other</td>
<td>2.51</td>
<td>0.96</td>
<td>0.68</td>
<td>1.34</td>
<td>1.42</td>
</tr>
<tr>
<td>Total</td>
<td>14.5</td>
<td>55.33</td>
<td>8.13</td>
<td>5.05</td>
<td>4.33</td>
</tr>
</tbody>
</table>


Table 2
Emissions of air pollutants from various sources in Pardis New town in terms of tons in 2016

<table>
<thead>
<tr>
<th>Pollution source</th>
<th>CO$_2$</th>
<th>SO$_X$</th>
<th>NO$_X$</th>
<th>HC</th>
<th>Suspended particles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
<td>20.9</td>
<td>2.81</td>
<td>7.12</td>
<td>5.78</td>
<td>0.37</td>
</tr>
<tr>
<td>Stationary and heating sources</td>
<td>0.61</td>
<td>86.24</td>
<td>8.77</td>
<td>0.24</td>
<td>2.88</td>
</tr>
<tr>
<td>Industries</td>
<td>3.14</td>
<td>25.80</td>
<td>0.17</td>
<td>1.58</td>
<td>2.90</td>
</tr>
<tr>
<td>Solid waste disposal</td>
<td>1.71</td>
<td>0.35</td>
<td>0.50</td>
<td>0.55</td>
<td>0.24</td>
</tr>
<tr>
<td>other</td>
<td>5.52</td>
<td>2.11</td>
<td>1.49</td>
<td>2.94</td>
<td>3.12</td>
</tr>
<tr>
<td>Total</td>
<td>31.88</td>
<td>117.31</td>
<td>18.05</td>
<td>11.09</td>
<td>9.51</td>
</tr>
</tbody>
</table>


Due to the high topography of Pardis city most construction operations cause to soil erosion in short period and scattering by aerosols and pollution.

Modeling Results
The TOPSIS technique as part of the MCDM family or today’s multi criteria decision making techniques has found become a prominent method for ranking a variety concepts in a range of sciences. The main reason for its prominence is due to its use of mathematic and clear logic, without having executive problems. Using techniques in this family (such as hierarchical analysis of data) requires some adjustment in sending and receiving or exchanging the data with the specialists that generally leads to lack of justifiability and dynamism researches due to having no access to the information. However, the TOPSIS method alleviates this problem because it does not make the dual (in pairs) comparison and uses the accurate quantitative ranks. Additionally, multiplicity of criteria in the compared units also leads to the problems in decision making by using the general techniques that in any event such problems do not exist in the TOPSIS technique. Finally, being compensatory and with the aim of offering the reasonable and appropriate ranking with the mental or subjective inference of specialists justifies using this powerful technique (Asgharpoor, 1998).

Step 1: Quantize and admeeasuring of decision matrix (N):
In this method the kind of scale less was used by norms.
A1: Pardis New town

According to below formula we will have:

\[ n_{ij} = \sum_{i=1}^{n} a_{ij} \]

Table 3

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Industries</th>
<th>Transportation</th>
<th>Heating sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>5</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>---</td>
<td>0.485</td>
<td>0.707</td>
<td>0.768</td>
</tr>
</tbody>
</table>

Step 2: To obtain rhythmic admeasuring matrix, it is required to have the weights of the indices. To do this first with the technique of entropy Shannon (or other methods) the indices weights are measured. These weights are obtained through the following method.

\[ p_{ij} = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}} \]

Table 4

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Industries</th>
<th>Transportation</th>
<th>Heating sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>0.375</td>
<td>0.5</td>
<td>0.545</td>
</tr>
</tbody>
</table>

\[ K = \frac{1}{\ln 2} = 0.693 \]

\[ E_j = K \sum [P_{ij} \ln P_{ij}] \]

Table 5

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Industries</th>
<th>Transportation</th>
<th>Heating sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>0/451</td>
<td>0.497</td>
<td>0.476</td>
</tr>
<tr>
<td>D</td>
<td>0/549</td>
<td>0/521</td>
<td>0.524</td>
</tr>
<tr>
<td>W</td>
<td>0/344</td>
<td>0.326</td>
<td>0.328</td>
</tr>
</tbody>
</table>

Step 3: Now the positive and negative ideals for each index should be obtained. For an index with a positive aspect, the positive ideal is the greatest amount of \( V \) and in opposite an index with a negative aspect the positive ideal is the smallest amount of \( V \). In addition, the negative ideal for the positive index is the least amount of matrix \( V \), the negative ideal for a negative index is the greatest amount of matrix \( V \). The amount of positive and negative ideals for these indices is as follows:

\[ V_i^+ = \{ \min_i V_{i1}, \max_i V_{i2}, \max_i V_{i3}, \max_i V_{i4}, \max_i V_{i5}, \max_i V_{i6}, \max_i V_{i7}, \max_i V_{i8} \} \]

\[ V_i^- = \{ \max_i V_{i1}, \min_i V_{i2}, \min_i V_{i3}, \min_i V_{i4}, \min_i V_{i5}, \min_i V_{i6}, \min_i V_{i7}, \min_i V_{i8} \} \]

\[ i^+ = \{ 0/008, 0/221, 0/109, 0/010, 0/040, 0/234 \} \]

\[ i^- = \{ 0/060, 0/002, 0, 0/004, 0/006, 0 \} \]

Table 6

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Industries</th>
<th>Transportation</th>
<th>Heating sources</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Alternative Industries Transportation Heating sources

<table>
<thead>
<tr>
<th>Alternative</th>
<th>dials</th>
<th>0.485</th>
<th>0.707</th>
<th>0.768</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>0/166</td>
<td>0/230</td>
<td>0.251</td>
<td></td>
</tr>
</tbody>
</table>

Step 4: To obtain the distance between every option and the positive or negative ideals, the following formulas are used:

$$d_i^+ = \sqrt{\sum_{j=1}^{n}(v_{ij} - v_j^+)^2}$$

$$d_i^- = \sqrt{\sum_{j=1}^{n}(v_{ij} - v_j^-)^2}$$

These amounts measured for the mentioned matrix as:

- $d_1^+ = 0/288$, $d_2^+ = 0/308$, $d_3^+ = 0/210$, $d_4^+ = 0/239$, $d_5^+ = 142$, $d_6^+ = 0/273$, $d_7^+ = 0/210$, $d_8^+ = 0/307$, $d_9^+ = 0/338$, $d_{10}^+ = 0/297$
- $d_1^- = 0/067$, $d_2^- = 0/067$, $d_3^- = 0/211$, $d_4^- = 0/222$, $d_5^- = 0/229$, $d_6^- = 0/133$, $d_7^- = 0/241$, $d_8^- = 0/069$, $d_9^- = 0/054$, $d_{10}^- = 0/099$

Step 5: In this step, the degree of closeness of every option to the ideal solution is measured. To do this the following formula is used.

$$cl_i^* = \frac{d_i^-}{d_i^- + d_i^+}$$

- $cl_1^* = 0/188$, $cl_2^* = 0/178$, $cl_3^* = 0/501$, $cl_4^* = 0/481$, $cl_5^* = 0/617$, $cl_6^* = 0/327$, $cl_7^* = 0/534$, $cl_8^* = 0/183$, $cl_9^* = 0/137$, $cl_{10}^* = 0/270$

Step 6: The ordering of options can done according to the obtained CL in the previous step. An option with more CL is a better or ideal one. The ultimate result of estimating model clarified orders

$$A_1 > A_2$$
Conclusion
According to research findings, Pardis New Town with increasing of population, crossing of motor vehicles and inattention to environmental parameters will faced with seriously environment challenges. Cement factory, ethanol industry, Khoramdasht industry town and crossing of vehicles are considered as the main causes of air pollution in the Pardis region. Also the most of industries in Pardis New Town don’t have wastewater treatment system that continuous of it led to the risk of river water pollution and degradation of the environment.

References
Center of Investigation of Perlman of Iran. (2002), Geography and Economic Theory, USA: MIT Press.
Nowzari (2007), the role of second homes on land use change and economic development of Kordan County, MA thesis, Tehran University. (In Persian)
UN Habitant (2009), The analysis and comparison of the degree of being developed in the agricultural sector of provinces in Iran", agricultural and development magazine, year 16: p. 72.