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Examining the relationship between commercial and residential land uses and energy consumption using Gis and Vickor model (case study: District 6)

Examen de la relación entre usos de tierras comerciales y residenciales y consumo de energía usando Gis y modelo Vickor (estudio de caso: Distrito 6)

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ABSTRACT

The city is a living thing whose population determines its future. Given its administrative and political pole in Iran, Tehran has attracted a significant population and District 6, given the establishment of commercial-administrative centers is the administrative pole. The purpose of the study was to examine and compare the energy consumption in the field of transportation and administrative-commercial buildings. For this purpose, the research method was based on a researcher-made questionnaire based on 6 main variables and 49 items. The sample size of 384 people was selected to reach the results using Cochran's test to answer. The study was applied in terms of purpose and descriptive-analytical in terms of nature. Data collection was based on library documents, and Vikor test was used to rank energy consumption and reach the final results. It has to be acknowledged that the results showed a significant relationship between social and economic factors in the field of transportation and residential and commercial areas until the end of January 2019. Other cases followed a 5-year pattern with a not-so-low consumption rate. Moreover, there was a significant relationship between pollutant production and energy consumption in the second quarter of each year. The statistical results based on the Vickor model showed that the first and second conditions of the above statistical test were confirmed and Districts 2, 3 and 8 have the best rank in terms of Q value, respectively, and the final result is correct.

Keywords: Energy consumption, residential and administrative buildings, transportation.

RESUMEN

La ciudad es un ser vivo cuya población determina su futuro. Dado su polo administrativo y político en Irán, Teherán ha atraído una población significativa y el Distrito 6 dado el establecimiento de centros comerciales-administrativos es el polo administrativo. El propósito del estudio fue examinar y comparar el consumo de energía en el ámbito del transporte y edificios administrativos-comerciales. Para ello, el método de investigación se basó en un cuestionario elaborado por el investigador basado en 6 variables principales y 49 ítems y para llegar a los resultados se seleccionó el tamaño de muestra de 384 personas mediante la prueba de Cochran para responder. El estudio se aplicó en términos de propósito y descriptivo-analítico en términos de naturaleza. La recopilación de datos se basó en documentos de la biblioteca y se utilizó la prueba de Vikor para clasificar el consumo de energía y llegar a los resultados finales. Hay que reconocer que los resultados mostraron una relación significativa entre los factores sociales y económicos en el ámbito del transporte y las áreas residenciales y comerciales que hasta finales de enero de 2019. Otros casos siguieron un patrón de 5 años con un no tan bajo tasa de consumo. Además, hubo una relación significativa entre la producción de contaminantes y el consumo de energía en el segundo trimestre de cada año. Los resultados estadísticos basados en el modelo de Vickor mostraron que la primera y segunda condiciones de la prueba estadística anterior fueron confirmadas y los Distritos 2, 3 y 8 tienen el mejor rango en términos de valor Q, respectivamente, y el resultado final es correcto.

Palabras clave: Consumo de energía, edificios residenciales y administrativos, transporte.

1. INTRODUCTION

The city is a living thing, and paying focus on its interior and appearance in an advanced manner can pave the way for creating a suitable platform for its inhabitants' powerful presence. The cities are in transition from their old shell on the path to reach sustainable development, where they are determined to achieve intelligence. (babaei, 2007, pp,17) Smart cities have started their activities in six main areas monitoring and controlling several sub-branches, including smart governance, smart economy, smart living, smart transportation, smart environment, and smart infrastructure. It has to be stated that the smart urban environment in the world should be studied and managed:

- Smart and sustainable building (smart home)
- Smart energy (energy management, renewable resources, and smart meter)
- Environmental pollution control (air, water, soil, and noise)
- Smart water management
- Sustainable urban planning (climate resilience, density, and green space)
- Urban green space management
- Conservation of (original) species
- Waste management (solid)
- Sewage management (Poorahmad, 2018, pp. 99, 36)

As is seen, the energy issue is an integral and significant part of this section. Our world today somehow suffers from many environmental problems in all parts of it. However, these problems are not the same everywhere, and their nature is fundamentally different in different places. Thus, attention to national and transnational actions is essential. As the political and administrative capital and a population of nearly 14 million people (Statistics Center of Iran) per day (Cheraghi, 2018, pp,32,34), Tehran is no exception to this rule. Just as all aspects and dimensions of social, psychological, and individual human beings should be considered in the design of buildings and cities, we cannot succeed without considering the energy consumption in construction. However, we can say with certainty that societies that ignore the waste of energy in their society's physical structures will have no place in today's competitive world. The significance of using designing methods is unbeatable compared to other ones in saving fuel consumption and energy. Hence, designing methods to manage optimal energy consumption can be considered as clean methods (Nasrollahi, 2017, pp32). Turn it into a healthy one that will have a significant positive consequence and will lead to the use and construction of new models that can be used to untie economic and environmental knots. The present study has been conducted to help eliminate existing shortcomings, solve problems, move towards new findings, and provide practical information to future researchers. Realizing the vision document of Horizon 2025 and creating a favorable image of the future, paying attention to energy sources and how to consume is of the most important goals. Thus, without comprehensive energy management with the approach of reforming the consumption pattern, especially in the supply and demand sector, the above objectives will not be possible and will need the sector to have the necessary mechanisms for expansion and development in all areas. Given the cases and contents stated above, the implementation and development of a comprehensive energy plan for energy management and especially improving energy intensity by increasing energy efficiency and productivity using new technologies as important factors in achieving the 20-year outlook of the country's energy is a national necessity (Hasheminejad, 2009, pp49). The research hypotheses considered in this study are as follows;

A. The highest energy consumption in District 6 of Tehran seems to be related to transportation and traffic.
B. It seems that District 6 of Tehran needs physical and basic infrastructure to achieve a livable area.
C. The energy consumption in District 6 of Tehran seems to increases from September to March of each year.
D. Providing an appropriate energy consumption pattern seems to provide the necessary conditions for the realization of a livable area based on sustainable principles.

2. METHODS

2.1. Population, Sampling Method and Sample Size

The population of the district studied was the fixed and variable population of District 6 of Tehran. The sampling method was random using Cochran's test. The sample size was divided into two parts, fixed and variable population, according to the residence length of each. The sample volume was calculated using Cochran's method as follows. It has to be noted that according to the last census conducted in 2016, the population of District 6 of Tehran was 251384 people(Tehran municipality portal).

$$n = \frac{N \times P(1-P) \times Z^2_{1-\frac{\alpha}{2}}}{Nd^2 + P(1-P) \times Z^2_{1-\frac{\alpha}{2}}} \qquad 383.57 \approx 384 \qquad (1)$$

2.2. Applied Models Used in The Field of Energy

The significance of optimizing energy supply-demand has highlighted the need for strategic energy management in the present era. Indeed, the purpose of the paper is to create a deeper understanding of the level of energy models, the need for modeling in the energy sector, identification of the various uses and techniques used in science and art of modeling the energy sector(Nanzari, 2009,pp18-22) Strategic energy management is the art and science of formulating, implementing and evaluating decisions that pave the way for the success of the energy sector in achieving long-term goals. Reviewing energy modeling can drastically help energy designers, researchers, and policymakers. Nowadays, models have turned into the standard tool for energy planning. Many efforts have been made to formulate and implement energy planning strategies in developing countries in recent years. Among the problems faced by these countries is their strong dependence on traditional energy sources, which has led to problems like rapid deforestation and so on. Thus, a large amount of information is required to describe the relationships between the parameters and various tools needed to analyze the various cases so that they can be used to achieve various results that can help researchers in the design process(Paryan, 2009,pp34). The index of per capita energy consumption as one of the essential indices in life quality has been growing in recent decades, the main result is the increase in energy demand. However, inefficient, traditional technologies and limited local resources cannot meet this energy demand. Using energy models leads to the development of planning related to the supply and transmission of energy and the forecasting and optimizing energy resources. Appropriate methods have been developed for statistical sampling to help partially estimate and plan requirements. The development of mathematical energy models as a tool to support energy sector decision-making started in the 1960s. The first oil price crisis in 1973 led to increased activity in the development of energy models around the world. The various models developed are:

2.3. Power Supply Models

1- These models have been for demand for electricity generation to determine development plans. The downside of these models is that they explain the development of energy supply and demand separately. Thus, these models cannot consider the alternative relationship between energy carriers.

2- Second-generation models (energy system models): These models specify the energy flow from different sources of primary energy through the stages of conversion, transportation and distribution to end-users. In these models, substitution between energy carriers can be considered too. They include energy supply and demand models. In these models, the relationship between the energy system and other economic sectors is not considered.

3- Third generation models (energy-economy models): These models state the interactions between energy sectors and other economic sectors. The boundaries of these models are partial, regional, national and general models and the time horizon considered in the models are short-term (less than 1 year), medium-term (from 1 to 10 years), and long-term (more than ten years).

2.4. Rotterdam Model

Rotterdam Energy Planning Approach (REAP) is the most appropriate model for energy planning using clean energy in residential areas. This strategy is studied at various and interconnected levels, including buildings, neighborhoods, districts, and cities, making this approach superior to other energy planning methods. Hart van Zuid first used this model to reduce carbon dioxide in an area with three neighborhoods near Ahoy, South Rotterdam. Although this method is specifically related to Hart van Zuid's study, it can also be used as a general method that can be used in other areas (Polady, 2013, pp64).

REAP approach has three steps:
1. Reducing consumption
2. Using renewable energy sources
3. Providing clean and efficient residual energy demand

Data in this energy consumption method and its output are strategies for optimizing energy consumption (Fazeli, 2013, p. 19).

2.5. Markal Model

Rafaj and Kypreos (2003) identified the electricity sector using a multi-regional global model. In this model, five global regions are considered and the final consumer sectors include industrial, domestic and commercial sectors, transportation sector, and non-commercial use of biomass and non-energy consumption. The supply side includes technologies for generating electricity, heat and a variety of final fuels (petroleum products, alcohol, hydrogen, and natural gas) from fossil and non-fossil sources and transmission and distribution chains. Chen (2005) used the MARKAL-MACRO model to examine carbon emission costs in China. The defined energy system includes mining, importing, exporting energy, converting, transferring and distributing to the final consumer. Primary energy sources are conventional fossil fuels like coal, oil and natural gas and renewable energy. About 50 conversion technologies have been defined to convert primary energy into final energy, and the demand sector includes industry, agriculture, trade, urban housing, rural housing, and transportation. Chen et al. examined carbon reduction strategies in the Chinese energy system and their effects on the economy MARKAL-MACR using three models from the MARKAL family of models, including MARKAL-ED, MARKAL, and MARKAL-MACRO (Kazemi, 2013, p. 16).

2.6. Times Model

Vaillancourt et al. (2007) analyzed the role of nuclear energy in long-term climate scenarios using the World-TIMES model (Kazemi, 2013, p. 7).

2.7. Efom Model

Cormio et al. (2003) developed an energy planning model including renewable energy sources and environmental constraints for areas in southern Italy. The sections included in the model include the initial supply sections, the power generation and heating sections, and the final consumer (Pournazar, 2013, pp29-36). The objective function includes the total cost of conversion of primary energy over the studied time horizon and is limited to only construction time constraints, peak demand-supply, power generation limit, renewable energy potential limit, power generation limit, power generation and consumption balance, the constraint on the steam inlet are steam turbines, environmental restrictions, primary energy consumption restrictions, thermal energy production, and so on. This year, Dicurato et al. used the EFOM model to evaluate the share of distributed generation and energy efficiency measures. The methodology presented fully describes primary sources' extraction, generation of electricity and heat, emission of pollutants, and final consumer sectors (Kazemi, 2013, p. 7).

2.8. Geographical Scope of the Study

District 6 is geometrically located approximately in the geographical center of Tehran and on the other hand, in terms of location and proximity to the old center of gravity of the city, affected by the measures taken by the first Pahlavi in developing Tehran and with gradual transfer and movement of the city center to the north and northwest, it has taken a space-activity center since the 1940s. With a population of over 251384 people (2016) and an area of 2137.9 hectares from four directions west, east, north and so, this district is surrounded by Chamran, Modares, Hemmat, and Enqelab-Azadi highways, respectively (Rezaei Bezanjani,2019, pp60). Moreover, with an area equivalent to 3% of the area of Tehran and 2.9% of its total population, the district currently houses more than 30% of government-state buildings, public and private institutions and banks, and the main organs of the country. In other words, the thinking center of the government, the decision-making system, the government management, as well as the new trade-economic system engine of Tehran are located in District 6. The above set of factors, together with its special urban access and transportation network (hierarchical diversity of the network in the district from urban highways to neighborhood access), has provided the district with a comparative advantage in demand for regional, urban, national and even transnational uses. This can be considered as potential as well as a threatening force. Thus, future plans for land-use change should be meticulously accompanied by calculating the side effects of this potential on the residential structure, the balance of land uses, and the district's urban life (Tehran Municipality Portal).

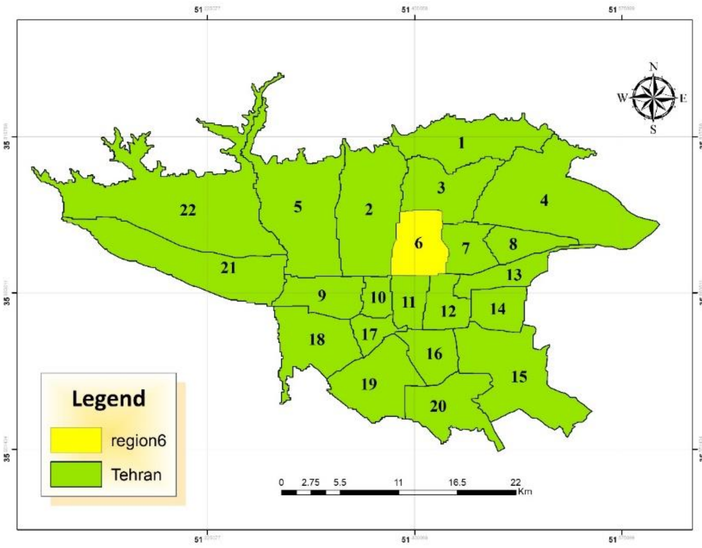

Figure 1. Tehran with emphasis on District 6.

3. RESULTS AND DISCUSSION

3.1. Land use zoning in the district (according to the comprehensive plan zones)

3.1.1. Residence Zone

Residential zoning, which includes general and special residential areas, currently has an area of 755 hectares and occupies 35.2% of the district.

3.1.2. Activity Zone

This group of zoning, including commercial and service activities and special activities (services, administrative and commercial), has an area of 830 hectares and occupies 38.7% of the district.

3.1.3. Mixed Zone

The mixed zone is the result of the establishment of both residence and activity. The area of this zone is 443 hectares and occupies 20.7% of the district. The accumulation of this group of activities is usually seen in the district's southern and eastern parts.

3.1.4. Protection Zone (Green and Open)

This zone includes the two main zones of public and open green space and private green space, privacy and special zones. In District 6, this zone has an area of 116 hectares and occupies 5.4% of the district (Comprehensive plan, 2016).

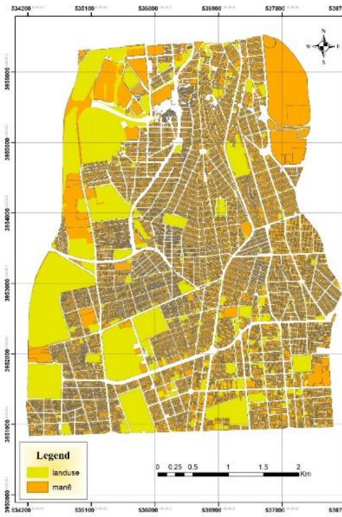

Figure 2. The use of the current situation of District 6.

3.2. The Pattern of Distribution of Commercial Activity In Space In 22 Districts Of Tehran

The commercial activities studied in this section include retail stores and some local housing support services and wholesale centers in the 22 districts of Tehran. The table below indicates the distribution of commercial activity in all floors of buildings in terms of the number of units and area and per capita in different areas of Tehran. District 12 has the largest share of area and number of commercial units among the regions due to the location of Tehran Grand Bazaar and on the other hand, the establishment of many wholesale shops and commercial passages and trade lines. The percentage of the frequency of business units by 22 districts is shown in the attached diagram. Because of the existence of a large market in District 12, this district has the highest percentage of commercial units in Tehran. Then there are districts 11 and 18. Districts 5, 3, 2 and 1 are close to each other in terms of share of the number of commercial units and less than other areas.

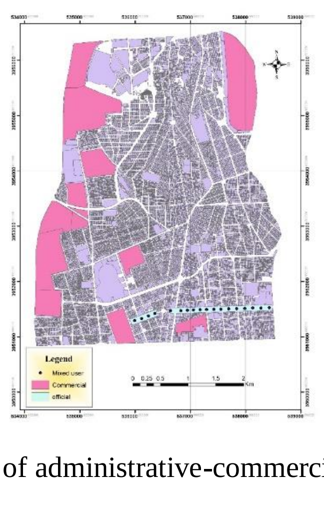

Figure 3. The density of administrative-commercial areas of District 6.

By comparing the percentage share of the number of residential units in the total number of units in each district, it is clear that although the share of residential activity in most areas is dominant in terms of number of activities, in districts 5, 14 and 8, more than 90% of the units are residential. Among these, districts 12 and 6 have the lowest share of the number of residential units. According to the 2011 census, separately for twenty-two districts, the average per capita living activity in space for the entire Tehran is 39 square meters. These per capita in districts 22 and 1 with about 64 and 74 square meters have the highest, and in districts 16 and 19, about 25 square meters have the lowest share among other regions. Moreover, the average area of residential units for the whole city is calculated as 90 square meters. It has to be noted here that many activities that have an administrative, cultural, health and medical nature, even commercial and are located in units with a residential permit, and are in the category of residential use according to the explicit text of the law and presented in the statistics of residential infrastructure.

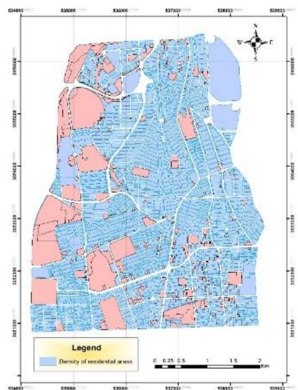

Figure 4. Density of residential areas in District 6 of Tehran.

3.3. The Intensity of Transportation Use in 22 Districts Of Tehran

Suppose Mehrabad Airport is considered separate from the transportation use. In that case, the highest level of transportation land is located in District 16, which is due to the railway station's existence and the southern passenger terminal. The largest average size of the user plot in question is in District 16, with an area of 417991 square meters. The average size of transport parts in Tehran is 76882 square meters. The ratio of transportation lands to the regional level is the highest in District 16, 5 and 6, showing the great significance of this land use in these regions. At the same time, the highest intensity of transportation use in Tehran is in Districts 6 and 16, so that about 86% of the area of transportation land in Tehran is concentrated in these two areas. Overall, 0.42% of the city area is allocated to transportation spaces.

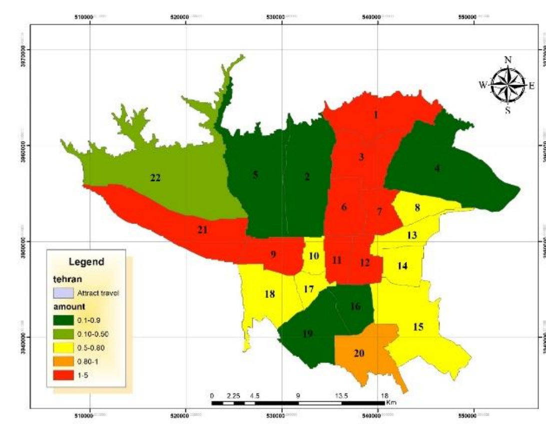

Figure 5. Travel attraction and population density in Tehran.

3.4. The Intensity of Educational Use in 22 Districts Of Tehran

The highest level of educational use is in Districts 6 and 1 and the lowest level is in Districts 9 and 10. The average net educational use is 2628 square meters. The largest educational plots are located in District 1 with an average size of 4260 square meters and the smallest plots in District 13 with 839 square meters based on the average plot size. The highest intensity of educational use among the regions is related to District 6, as 6.1% of the region is dedicated to educational spaces. This is due to a large number of universities and educational complexes in the district more than any other factor. After that, the second rank of educational use is allocated to Districts 1 and 16 with a ratio of 2.6% of the regional level. Overall, educational spaces occupy 1.3% of the area of Tehran. Districts 6 and 1 together have more than 30% of the city's educational level, equal to 0.4% of the total area of the city. Overall, 1.6% of the city is covered by educational use.

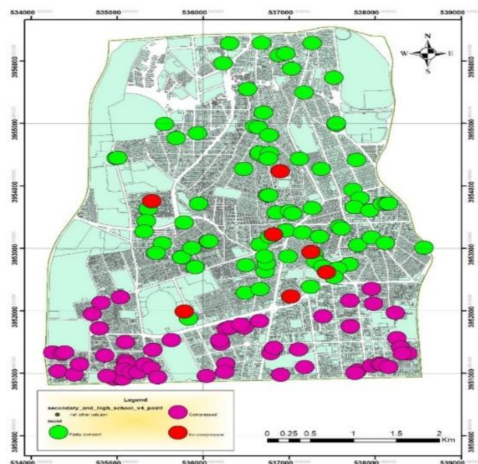

Figure 6. Centralized and intensive schools in District 6 of Tehran.

3.5. The Results of the Model Studied

Step 1: After collecting the data from the data collection, a researcher-made questionnaire and the available library documents, the raw data matrix of each of the criteria in the study area were defined as shown in the table below. The decision matrix is a matrix with options (rows) and criteria (columns). Our options are logic adjacent to the study area and our criteria are 6 indices. The chapter is introduced at the beginning.

Table 1. Decision matrix.

Index / Districts	Social index	Communication index	Cultural index	Economic index	Legal index	Management index
Six	14.29	39.09	21.28	36.00	19.08	20.98
Seven	6.92	29.64	16.32	36.02	14.76	20.66
Three	10.34	23.82	18.78	29.14	16.09	18.62
Eight	11.46	30.55	20.22	27.19	18.07	16.57
Two	8.68	26.58	13.66	23.08	15.00	13.29

Step 2: After forming the decision matrix, we normalized this matrix by the Euclidean method, as one of several scaling methods. As it is positive for all indices used, the relevant formula of indices with a positive direction was used. The relevant formula is given below.

$$n_{ij} = \frac{r_{ij}}{\sqrt{\sum_{i=1}^{m} r_{ij}^2}} \quad (2)$$

Step 3: Then, it was necessary to determine their relative weight to express the relative importance of the criteria. To this end, the Analytic Hierarchy Process (AHP) method was used to determine the weight of the indices. AHP is a theory for measuring pairwise comparisons and relies on researchers' judgments to scale priorities. According to all of them, the theory helps the decision-maker select the best of the various alternatives, used only to determine the indices' relative importance and use the software specific to this model. Expert Choice has compared pairs of indices, the results of which are given in the table below.

Table 2. Weighting the indices.

Indices	**Social index**	**Communication index**	**Cultural index**	**Economic index**	**Legal index**	**Legal index**
The weight of each index	0.435	0.263	0.302	0.395	0.059	0.193

Step 4: In this step, after the current state matrix is normalized according to the mentioned formula, we determine the best and worst value in each of the indices and the maximum (maximum limit) values related to the indices as F * and obtain the minimum (minimum limit) values for each criterion as F- and calculate the difference between the two.

Table 3. Calculating the best and worst values.

Indices	**Social index**	**Communication index**	**Cultural index**	**Economic index**	**Legal index**	**Management index**
Max	0.49	0.53	0.39	0.51	0.37	0.46
Min	0.23	0.41	0.26	0.37	0.22	0.34
F*- F-	0.26	0.12	0.13	0.14	0.15	0.12

$$f_j^* = Max\ f_{ij} \quad ,i = 1,2,\ldots, m$$
$$f_j^- = Min\ f_{ij}, j = 1,2,\ldots, n \quad (3)$$

Step 5: In this step, the distance between the options from the ideal positive solution and the amount of usefulness and regret of each index is calculated according to the following formula. In other words, in this step, after calculating the normalized matrix and weighted matrix and obtaining the highest and lowest values for each index, to calculate the Vickor index, we rank our options. The value of S is the usefulness index or the utility and the value of R is the regret or dissatisfaction index.

$$S_i = \sum_{j=1}^{n} w_i (f_j^* - f_{ij}) / (f^* - f_j^-)$$
$$R_i = Max[w_i (f_j^* - f_{ij}) / (f^* - f_j^-)] \quad (4)$$

Table 4. Calculating S and R values.

District examined	S	R
District 6	0.71	0.36
District 7	0.53	0.23
District 3	0.62	0.19
District 8	0.49	0.26
District 2	039	0.20

Step 6: In the final step, the value of Vickor (Q), which is the final score of each option, is calculated using the following formula. Q value shows each of the studied areas' final rank from the total of 6 general indices examined. If it is closer to one, it shows a weakness in energy consumption.

$$Q_i = v\left[\frac{S_i - S^*}{S^- - S^*}\right] + (1-v)\left[\frac{R_i - R^*}{R^- - R^*}\right] \quad (5)$$

Table 5. The final ranking of the areas examined of Tehran based on Vickor model.

District examined	R	S	Q
District 6	1	0.71	0.36
District 7	0.59	0.53	0.23
District 3	0.46	0.62	0.19
District 8	0.51	0.49	0.26
District 2	0	0.39	0.20

The ranking was based on Q value so that the lowest value has the highest priority. As shown in the table above, District 2 of Tehran with the first rank in the best situation and Districts 6 and seven are in the most unfavorable situation, respectively. The accuracy of the final answer is tested as follows.

First condition: Where $A^{(1)}$ and $A^{(2)}$ are, respectively the first and second choices and $DQ = \frac{1}{(i-1)}$ and i are the number of alternatives.

As the value of Q is 0.25 for the second option and 0 for the first option, and the difference between the two is 0.25, which is greater than the value of DQ = 1 / i-1, which is 0.16, the first condition is confirmed. The second condition is that the top option of the first must also have the best rank in terms of S and R, that regions two, three and eight have the best rank in terms of the value of Q, respectively, so the second condition is approved and the end result is correct.

3.6. Testing Hypotheses

After obtaining the final information and testing the data and statistical information, the researcher concluded a statistically significant relationship between social, cultural, managerial, economic and other indicators with the optimal energy level in District 6 of Tehran. Among all the components, there is the most relevance and correlation related to social and economic indices, and the most important influential sub-indices of the indices are the role of education and economic issues and the sense of national-local belonging. Thus, based on the above cases, one can reject or confirm the relevant hypotheses in this section, which we will follow in this paper:

3.6.1. Examining The First Hypothesis "It Seems That the Highest Energy Consumption in District 6 Of Tehran Is Related to Transportation and Traffic"

According to the data obtained from the results, several strategic points are obtained. First, some of the most important sub-indices like cultural, economic, social, and managerial indices have a special place, so that the mentioned factors affect the statistical results and differentiate the study area from other areas. Secondly, the strategic point is that focusing on the theories and explanations can help develop and achieve a livable district. Thus, being in the educational path and facilitating the transportation conditions and equipping old and new buildings with appropriate systems for energy consumption by promoting a sense of national-local belonging and with a view to reducing economic costs and healthy environment with emphasis on other factors lead to inevitable effective energy consumption and can be one of the effective factors to achieve a livable area. According to the above and the attached tables in the chapters of the study, the first hypothesis of this research - "maximum energy consumption in District 6 of Tehran is related to the field of transportation and traffic" and the most important reason is the presence of a variable population during working hours (7 am to 5 pm) in the area under review - is confirmed. Regarding this hypothesis, questions 22 to 26 of the questionnaire attached to the researcher are considered and the necessary tables and diagrams can be cited in the fourth chapter of the present dissertation.

3.6.2. Examining The Second Hypothesis

It has to be stated that according to the achievements of the research on the second research hypothesis, "it seems that District 6 of Tehran needs physical and basic infrastructure to achieve a livable area." One can argue that achieving a livable area at the same time needs adequate physical infrastructure in both construction and transportation so that the lack of coordination between these factors can have adverse effects like air pollution, mental illness, increased energy consumption, and the like. Thus, the above hypothesis is also confirmed. Questions 27 to 31 of the questionnaire attached to the researcher-made question are considered and the necessary tables and diagrams can be cited in the fourth chapter of the present dissertation to obtain the necessary confirmation of this hypothesis.

3.6.3. The Third Hypothesis

The third hypothesis is "it seems that energy consumption in the 6th district of Tehran increases in the second half of each year." One can state that besides construction equipment and the insulation or non-insulation of doors and windows, the health of fuel consumed by cars and engines in circulation in District 6 of Tehran, geographical location, is the most important factor livable. In the second half of each year in the above area encounters problems. The problem of inversion is the only factor that leads to the emergence of problems in the region, and this does not mean that the intensity of consumption in the second half of each year increases compared to the first half. Thus, the present hypothesis, the statistical interpretations of which are available in chapter four of the thesis, is not finally confirmed. Questions 32 to 35 and 22 to 26 of the attached questionnaire are considered by the researcher and the necessary tables and diagrams can be cited in chapter four of the study to achieve the necessary result for this hypothesis.

3.6.4. The Fourth Hypothesis

Ultimately, the final hypothesis of the study is, "It seems that providing an appropriate pattern of energy consumption provides the necessary conditions for the realization of a livable area based on sustainable principles." It has to be stated that the pre-determined model based on the principles and laws of urban planning and timely and appropriate education of citizens can bring about the easiest access to a livable urban area in District 6 of Tehran and inattention to the points can make the achievement much longer and even more unattainable. Thus, the hypothesis is confirmed by relying on precise factors. Questions 1 to 21 and 36 to 41 of the researcher-made attached questionnaire are considered and the necessary tables and diagrams can be referred to in the fourth chapter of the present dissertation to achieve the required result for this hypothesis.

4. CONCLUSIONS

Tehran is one of Iran's most important cities in terms of size, population, and administrative-political pole. The researcher focuses on its most important administrative-commercial district, District 6 of Tehran Municipality, to examine the energy consumption in the three sectors of residential, administrative-commercial, and transportation and state the results for future studies planning. The results were based on a researcher-made questionnaire in six sections with more than 41 items where the final results were extracted based on statistical methods. With a population of 251384 people (2016) and an area of 2137.9 hectares, the district is surrounded by Chamran, Modares, Hemmat and Enqelab-Azadi highways, respectively, from the west-east, north, and south is surrounded. Moreover, with an area equivalent to 3% of the area of Tehran and 2.9% of its total population, the district currently houses more than 30% of government-state buildings, public and private institutions and banks, and the main organs of the country. After collecting the data, a researcher-made questionnaire was collected, and the existing library documents of the raw data matrix of each of the criteria in the study area were defined as follows. The decision matrix is a matrix that consists of options (rows) and criteria (columns). Our options are logic adjacent to the study area, and our criteria are 6 indices that are introduced in the tables.

Step 2: After forming the decision matrix, we normalized this matrix by the Euclidean method, which is one of several scaling methods. As it is positive for all indices used, the corresponding indicators with positive direction were used.

Step 3: Then, it was necessary to determine their relative weight to express the relative importance of the criteria. To this end, the AHP method was used to determine the weight of the indices. AHP is a theory for measuring pairwise comparisons and relies on researchers' judgments to scale priorities. According to all of them, the theory helps the decision maker select the best of the various alternatives, used only to determine the relative importance of the indices and using the software specific to this model. Expert Choice has compared pairs of indices, the results of which are given in the table below.

Step 4: In this step, after the current state matrix is normalized according to the mentioned formula, we determine the best and worst value in each of the indices and the maximum (maximum limit) values related to the indices as F * and obtain the minimum (minimum limit) values for each criterion as F- and calculate the difference between the two.

Step 5: In this step, the distance between the options from the ideal positive solution and the amount of usefulness and regret of each index is calculated according to the following formula. In other words, in this step, after calculating the normalized matrix and weighted matrix and obtaining the highest and lowest values for each index, to calculate the Vickor index, we rank our options. S's value is the usefulness index or the utility and the value of R is the regret or dissatisfaction index.

Step 6: In the final step, the value of Vickor (Q), which is the final score of each option, is calculated using the following formula. Q value shows the final rank of each of the studied areas from the total of 6 general indices examined. If it is closer to one, it shows a weakness in energy consumption.

The ranking was based on the value of Q, so that the lowest value has the highest priority. As the table above shows, District 2 of Tehran with the first rank, is in the best situation and Districts 6 and 7 of Tehran are in the most unfavorable situation, respectively. Now, special conditions for Vikor technique were used to assess the final answer's accuracy according to the results.

The first condition, as the value of Q is 0.25 for the second option and 0 for the first option, and the difference between the two is 0.25, which is greater than the value of DQ = 1/i-1, which is 0.16, the first condition is confirmed.

The second condition is that the top first option must have the best rank in terms of S and R, where districts 2, 3, and 8 have the best rank in terms of Q value, respectively, so the second condition is confirmed too, and the final result is correct.

REFERENCES

Babaei, M. (2007). Social Problems of Disabled Elderly Care Families in Karaj. Elderly Quarterly, 3.

Chan, A. L. S., Chow, T. T., Fong, K. F., & Lin, Z. (2009). Investigation on energy performance of double skin façade in Hong Kong. Energy and Buildings, 41(11), 1135-1142.

Cheraghi, M., & Kazemi, N. (2018). Food security and related economic factors in rural elderly women. Koomesh, 20(2), 203-209.

Fazeli, A. (2013). Optimization of energy consumption in residential areas of Tehran using the Rotterdam Energy Planning Approach (REAP), Journal of Energy Planning and Policy Research, First Year 3, 83-87.

Hashemnejad, H. (2009). Using daily living space to improve the quality of life of the elderly, Armanshahr Architecture and Urban Planning Magazine, consecutive 2.

Kazemi, A., Shakouri Ganjavi, H., Raoofi, Z., Hossein Zadeh, M., & Shakiba, S. (2013). A Review of Energy Supply Modeling Studies and Choosing Best Ones in Iran with the Use of AHP. Journal of Energy Planning and Policy Research, 1(2), 5-28.

Khodashahi, A. (2019). Strategic Analysis of Tehran's Big City Management Challenges with an Integrated Urban Management Approach, Scientific-Research Journal of New Attitudes in Human Geography, 11(2), 23-44.

Manzoori, L. (2009). Depression and Related Factors in Isfahani Elderly, Elderly Quarterly, 14

Mohammadi, M., & Sabouri, M. S. (2018). Regional Planning of Solar Energy Use in Broiler Farms in Semnan Province, Journal of New Attitudes in Human Geography, (3), 181-201.

Nasrollahi, F., & Bahadrian, N. (2018). Reduce the energy consumption of a residential building by calculating the optimal dimensions of the window opening, The first conference on architecture, urban planning, civil engineering and geography in sustainable development, pp32-34

Piran, H. (2009). Explaining the Dimensions and Components of Sustainability in Urban Transportation by Using Factor Analysis. Journal of New Attitudes in Human Geography, 11(2).

Poorahmad, A. (2018). Smart City: Explaining the Necessities and Requirements of the City of Tehran for Intelligence. Scientific-Research Quarterly New Attitudes in the Human Geography, 10(2),36-28.

Pouladi, S.H. (2013). Explaining the concept of family insight in elderly care. Urmia School of Nursing and Midwifery Monthly, 11(7).

Pourazar, M. (2013). Comparison of Mental Health in Older Men with Different Levels of Weekly Sports Activity. Journal of Research in Rehabilitation Sciences, 9(5).

Rezaei Boznjani, R., Azani, M., Saberi, H., & Momeni, M. (2019). Analysis and Evaluation of Urban Smart Growth Strategy in Kermaneh Charkaneh. Journal of New Attitudes in Human Geography, 11(3), 41-25.