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DECISION MAKING METHODS AND CLASSIFYING SCHOOLS BY USING TOPSIS

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Abstract:

In this paper, statistical methods and statistical programs were used in arranging and analyzing raw data to obtain criteria and weights that are used with geographic information systems (GIS) and spatial analysis programs in determining the proposed school sites in the holy Karbala governorate, depending on several criteria, including (population, number of students,the number of classes, the distance of school from the street, the number of teachers). TOPSIS Method was used using Matlab and Geographic Information Systems (GIS) for the purpose of analyzing factors and restricting them to the main factors and knowing which factor is the most influential.

It was concluded that the geographic information systems (GIS) program has a great potential in the field of locating crowded schools through students and population preparation in order to determine the need to de-inflation in them as well as to prepare a strong geographical database, containing natural and human variables affecting the educational reality as well as the ability diagnosis of defects according to statistical methods such as the near neighborand standard distance, and building educational databases aimed at ease of exchange and analysis of information. Schools were classified according to the school's degree (primary, intermediate, secondary and High secondary) according to the importance of the TOPSIS method (of the utmost importance, the most important, the important and the least important) The percentages of schools with overcrowded were respectively obtained as follows (42, 11, 3, 7) from the total number of schools in the Karbala Governorate center.

Keywords: categorical data; make decision; Geographic Information Systems (GIS); Classification of schools; TOPSIS

1- Introduction

This study relied on categorical data approaches and based decision-making method (MCDM), which is an appropriate way to solve problems when decision makers find it difficult to determine the best alternative based on many factors that must be taken into consideration. TOPSIS' method was used to select overcrowded schools. Geographical information systems (G.I.S) were used to determine places and coordinates for them and to draw geographical maps.

2-Research problem

The problem of the study and its justifications represented the existence of an urgent need to analyze educational services and the distribution of schools in the Holy Karbala Governorate. The problem of selecting sites and the comparison between them can be described as the problem of multi-criteria decision making (MCDM).

3- Research Objectives

The research aims to apply a scientific and practical methodology to find the best sites for temporary schools in the holy Karbala governorate, as well as to make compatibility tables for the data classified in terms of academic level (primary, intermediate, preparatory) and draw a roadmap to it using Geographical Information Systems (Gis) in order to reaching the best suitable distribution for educational schools, based on a methodology that integrates the GIS, disaggregated data, and the classic method (TOPSIS).

4- The Classical TOPSIS Method

In many multi-choice situations, people aspire to make a "calculated" decision from a scientific viewpoint, there are analytical and numerical methods that take into account multiple alternatives with multiple criteria. The TOPSIS method is a multiple choice preference technique by analogy with the ideal solution, and it is one of the numerical methods for making multiple criteria decisions, as complexity arises when there is more than one decision maker. One is because the preferred solution must be agreed upon by interest groups that usually have different goals. The classic TOPSIS method is explained to the single decision maker and group decision-making methodically, and there are cases based on the TOPSIS method, which are based on the following: (Penjani HN, 2018)

"The basic principle is that the chosen alternative should have the shortest distance from the positive ideal solution and the longest distance from the ideal negative solution."

We have m options (alternatives) A_i, each dependent on n parameters (criteria) $X_j$whose values are positive real numbers X_{ij}

i = 1,2, ..., m

j = 1,2, ..., n

And here we must choose the best alternative (option). (G. H. Tzeng, 2011)

5-Mathematical model of the method:

Start, the parameter values of Xij must be balanced according to the normalization procedure. Assume that a_{ij} is the parameter values that are normalized. Each alternative (option) A_i is expressed as a point

$A_i (a_{i1},\ldots,a_{in}) \in R^n$

Choosing the optimal value a * j ∈ $\{a_{1j}, ...,A_{mj}\}$ for each parameter of X_j, we will define the positive optimal solution $A^+ = (a^+_1,\ldots .a^+_n)$. On the other hand, the negative ideal solution will be $A^- = (a^-_1,\ldots .a^-_n)$, the positive and negative optimal solution is also denoted by A +, A-.

$$D_i^* \frac{d(A_i,A^-)}{d(A_i,A^+)+d(A_i,A^-)} \frac{1}{\frac{d(A_i,A^+)}{d(A_i,A^-)+1}} \quad \ldots (1)$$

Option A^+ is the optimal solution if:

$D^*_{A^+} = Max\{D^*_1,\ldots..,D^*_m\}$

Option A^- is the bad solution if it is

$D^*_{A^-} = Min\{ D^*_1,\ldots..,D^*_m\}$

And other options between these two terminal values. And the Great distance

$D^* = Max_{i=1,2,\ldots,m} D^*_i$

It is usually called TOPSIS. (J. Xu, 2012)

6- Geometricrepresentation of the TOPSIS method:

Figure (1) shows the initial arrangement of alternatives in the TOPSIS method for n = 2, the parameter $X_1 = X^*_1$ has a monotonic increasing preference, the positive and negative optimal solutions A^- and A^+ are located in the diagonally opposite sites, the best solution is the alternative A_7 close to Positive Optimal Solutions (KA Yoon, 1987: pp. 277-286)

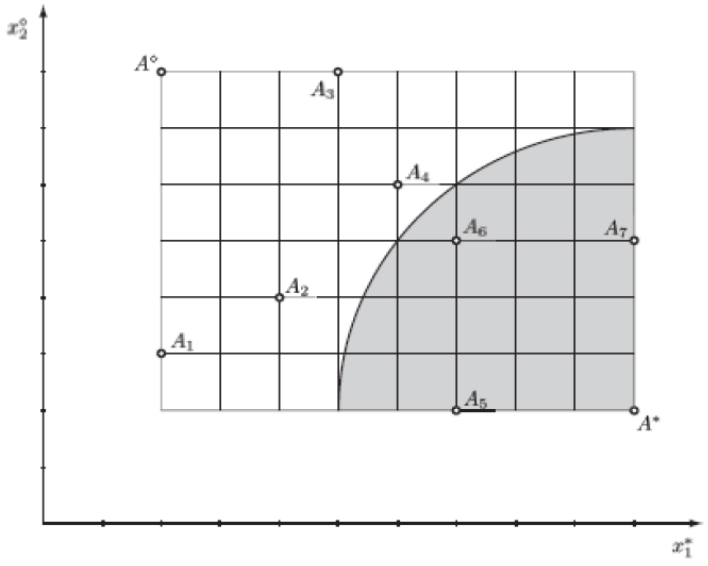


Figure (1) Geometric representation of the TOPSIS method

These types of methods allow compromise between different criteria, as a bad result in one criterion can be compensated for by a good result in another criterion. An assumption of TOPSIS is that each criterion has either an increased or a decreasing preference. Because standards can be modeled, compensatory methods are used, including certainly TOPSIS, which are widely used in various multi-criteria decision-making sectors. (I. B. Huang, 2011: PP.3578-3594)

7- Procedures for calculating the TOPSIS method:

We will test m of substitutes A_1, ..., A_m of each alternative A_i, relative to n of the criteria x1, x_2, ..., x_n, which is expressed in positive numbers x_{ij}. The criterion x_1, ...,x_k is useful (monotonic increasing preference) and the criterion x_{k+1}, ...x_n is not useful (monotonic decreasing preference) and weights w_j for criterion x_j are given such that $\sum_{j=1}^{n} wj = 1$. It is necessary to choose the best alternative. Initial table and decision matrix: For better insight, the alternatives, criteria, and weights specified in Table (1) are the initial distribution of the TOPSIS method. (G. R. Jahanshahloo, 2006: pp. 1544-1551)

Table (1) distribution of standards and weights for TOPSIS

CRIT ERIA	x_1 cr. 1	x_2 cr. 2	... ...	x_n cr. n
weights	w_1	w_2	...	w_n
A_1	x_{11}	x_{12}	...	x_{1n}
A_2	x_{21}	x_{22}	...	x_{2n}
⋮	⋮	⋮	⋱	⋮
A_m	x_{m1}	x_{m2}	...	x_{mn}

The given numbers x_{ij} are represented by the following matrix:

$$X = \begin{bmatrix} x_{11} & x_{12} & \dots . x_{1n} \\ x_{21} & x_{22} & \dots . x_{2n} \\ \vdots & \vdots & \vdots \\ x_{m1} & x_{m2} & \dots . x_{mn} \end{bmatrix} \dots (2)$$

It should be balanced, as long as the numbers x_{ij} represent values of different parameters in different units of measure. First, we must also take into account the weights w_j of the standard x_j, and first the scale numbers x_{ij} for the x_j standard are replaced by the normal or relative numbers. (K. A. Yoon, 1987: pp. 277-286)

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}, \text{ for } i \in I = \{1,2,\Lambda\ ,m\} \text{ and } j \in J = \{1,2,\Lambda\ ,n\}$$

Which belongs to the open period (0,1), and according to the participation $w_j x_j$ of the $x_j$criterion, the r_{ij} is replaced by the weighted standard numbers

$$a_{ij} = w_j r_{ij} = w_j \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \ldots(3)$$

It belongs to duration (0,1), and the additional data processing uses a standard weighted decision matrix

$$A = \begin{bmatrix} a_{11} & a_{12} & \ldots . a_{1n} \\ a_{21} & a_{22} & \ldots . a_{2n} \\ \vdots & \vdots & \vdots \\ a_{m1} & a_{m2} & \ldots . a_{mn} \end{bmatrix} \quad \ldots(4)$$

If all weights are exactly equal, and in the case of wj = 1 / n, then the numbers r_{ij} can be applied to the matrix A as well as the numbers a_{ij}.

Table (2) illustrates the extraction of the standard weighted decision matrix A and all the data that we will calculate and we will try to write them in one table. I. B. Huang, 2011: PP.3578-3594)

Table (2) working table for the TOPSIS method

CRIT ERIA	x_1^* cr. 1	x_2^* cr. 2	... ...	x_k^* cr. k	$x_{k+1}^\diamond$ cr. $k+1$	... ...	$x_n^\diamond$ cr. n	d^* dips	$d^\diamond$ dins	D^* topm
A_1	a_{11}	a_{12}	...	a_{1k}	$a_{1\,k+1}$	...	a_{1n}	d_1^*	$d_1^\diamond$	D_1^*
A_2	a_{21}	a_{22}	...	a_{2k}	$a_{2\,k+1}$	...	a_{2n}	d_2^*	$d_2^\diamond$	D_2^*
⋮	⋮	⋮	⋱	⋮	⋮	⋱	⋮	⋮	⋮	⋮
A_m	a_{m1}	a_{m2}	...	a_{mk}	$a_{m\,k+1}$	...	a_{mn}	d_m^*	$d_m^\diamond$	D_m^*
A^*	a_1^*	a_2^*	...	a_k^*	a_{k+1}^*	...	a_n^*	A^*	$A^\diamond$	$d^* \sim d^\diamond$
$A^\diamond$	$a_1^\diamond$	$a_2^\diamond$	...	$a_k^\diamond$	$a_{k+1}^\diamond$	...	$a_n^\diamond$			

The coordinates a^*_j of the optimized positive solution $A^* = (a^*_1, \ldots .. a^*_n)$ will be chosen according to the following formula:

Calculate the normal weighted value a_{ij}

$$a_{ij} = w_j r_{ij}, \ \forall i \in I, \forall j \in J.$$

Where w_j is the weight value of the j^{th} criterion, and $\sum_{j=1}^{n} w_j = 1$.

Determine the ideal positive A + solution and the ideal negative A- solution.

$$A^+ = \{(a_1^+, a_2^+, \Lambda\ , a_n^+)\} = \{(\max_i a_{ij} | j \in S_B), (\min_i a_{ij} | j \in S_C)\}$$

$$A^- = \{(a_1^-, a_2^-, \Lambda\ , a_n^-)\} = \{(\min_i a_{ij} | j \in S_B), (\max_i a_{ij} | j \in S_C)\}$$

The numbers d + i for column $d^+ = (d^+_1, \ldots .. d^+_m)^T$ is the distance from points A_i to point A^*, which is calculated according to the following formula:

$$d_i^+ = d(A_I, A^*) = \sqrt{\sum_{j=1}^{n} (a_{ij} - a_j^+)^2}, \forall i \in I \ldots(5)$$

The numbers d-i for column $d^- = (d^-_1, \ldots\ldots, d^-_m)^T$ is the distance from points A_i to point A^- which is calculated according to the following formula:

$$d_i^- = d\left(A_i, A^-\right) = \sqrt{\sum_{j=1}^{n} (a_{ij} - a_j^-)^2}, \forall i \in I ...(6)$$

The numbers D^* i for column $D^* = (D^*_1, ..., D^*_M)^T$ is the distance from points A to points A^+ and A^-, which is expressed in the following form:

$$D^*_i = \frac{d_i^-}{d_i^+ + d_i^-} = \frac{d\left(A_i, A^-\right)}{d\left(A_i, A^*\right) + d\left(A_i, A^-\right)} ...(7) \text{ for } i \in I.$$

If it was:

$D^*_{i1} = \text{Max}\{D^*1, \ldots..D^*m\}$

We accept the Ai1 alternative as the best solution, if it is

$= \min\{D^*_1, \ldots\ldots, D^*_M\} D^*_{i2}$

We accept Ai2 as a bad solution. To classify the alternatives using this indicator, we can choose the best alternative with the maximum relative convergence value.(Parkhan, 2018)

8- Data Description

The research data included the information available in the records of the General Directorate of Education in the Holy Karbala as well as the Holy Karbala Governorate Office / Department of Geographical Parameter Systems to obtain aerial maps and the Karbala center for studies and research / specialized studies division The study area and the criteria used were obtained as follows:

A_1: Population by age group

A_2: The number of students in the school

A_3: The number of people in the school

A_4: distance school from the street

A_5: The number of teachers in the school

C: The proposed educational schools in Karbala Governorate N = 1,2 ……, 489

Five criteria were defined and the opinion of experts with specialization in geographic information systems, statistics and education was taken through the expert evaluation form number (118), as well as real data for the population and the number of students.

9- Study area

The appropriate sites will be determined according to the population density in the holy Karbala region, as the study includes the ancient kasbah of the holy city of Karbala, and the main point between the two holy mosques has been determined and Buffer work for the study area 10km

10-The results:

10-1 Decision Matrix

Preparing the matrix of even comparison based on the weights resulting from the main vectors of the decision matrix. The main diameter of the decision matrix is units.

Table (3) matrix of paired comparison of criteria

A5	A4	A3	A2	A1	Criteria
4	2	3	1	1	A1
4	3	2	1	1	A2
3	2	1	0.5	0.33	A3
2	1	0.5	0.33	0.5	A4
1	0.5	0.33	0.25	0.25	A5
14	8.5	6.83	3.08	3.08	Column totals

Table (3) matrix comparison of paired comparison of criteria was prepared by the opinions of experts specialized in this field to determine the importance between each criterion using table (2) measures of relative importance between the standards, and then building a matrix of marital comparison of standards.

10-2 Priorities for Criteria

Depending on the decision matrix, it was found that the probability weights resulting from the criteria based on the pairwise comparisons are as follows:

Table (4) the (relative) priorities of the probability weights resulting from the criteria

(-)	(+)	Rank	priority	Criteria	Category
10.60%	10.60%	1	32.60%=33	A1	Population by age groups
3.30%	3.30%	2	31.60%=31	A2	The number of students in the school
4.80%	4.80%	3	17.20%=17	A3	The number of people in the school
2.90%	2.90%	4	11.90%=12	A4	After school from the street

1.10%	1.10%	5	6.70%=7	A5	The number of teachers in the school

From Table (4), the criteria were determined according to the importance and ranking of each criterion, and the number of population by age groups was the most influential to determine the most overcrowded schools, and the result of its probability weight was (32.60), and after that the number of students in the school was the second best criterion by (30.60) .

10-3 Estimating consistency ratio

Compute the consistency index (CI).

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

Since n is the number of items being compared

Compute the consistency ratio (CR)

$$CR = \frac{CI}{RI}$$

Since RI is a random index, it is the consistency index of a randomly generated pairwise comparison matrix. It can be shown that RI depends on the number of items being compared.

Multiply each value in the first column of the pairwise comparison matrix according to the relative priority of the first element searched. And the same procedures for other items. Sum the values across the rows to get a vector of values named “weighted sum”

Calculate the calculated values (λ_{max})

$$\lambda_{max} = 5.109$$

$$CI = \frac{\lambda_{max} - n}{n - 1} = \frac{5.109 - 5}{5 - 1} = 0.02725$$

$$CR = \frac{CI}{RI} = \frac{0.02725}{1.11} = 0.024 \le 0.02725 \quad = \%2.4$$

Note that the degree of consistency resulting from the pairwise comparison matrix is acceptable.

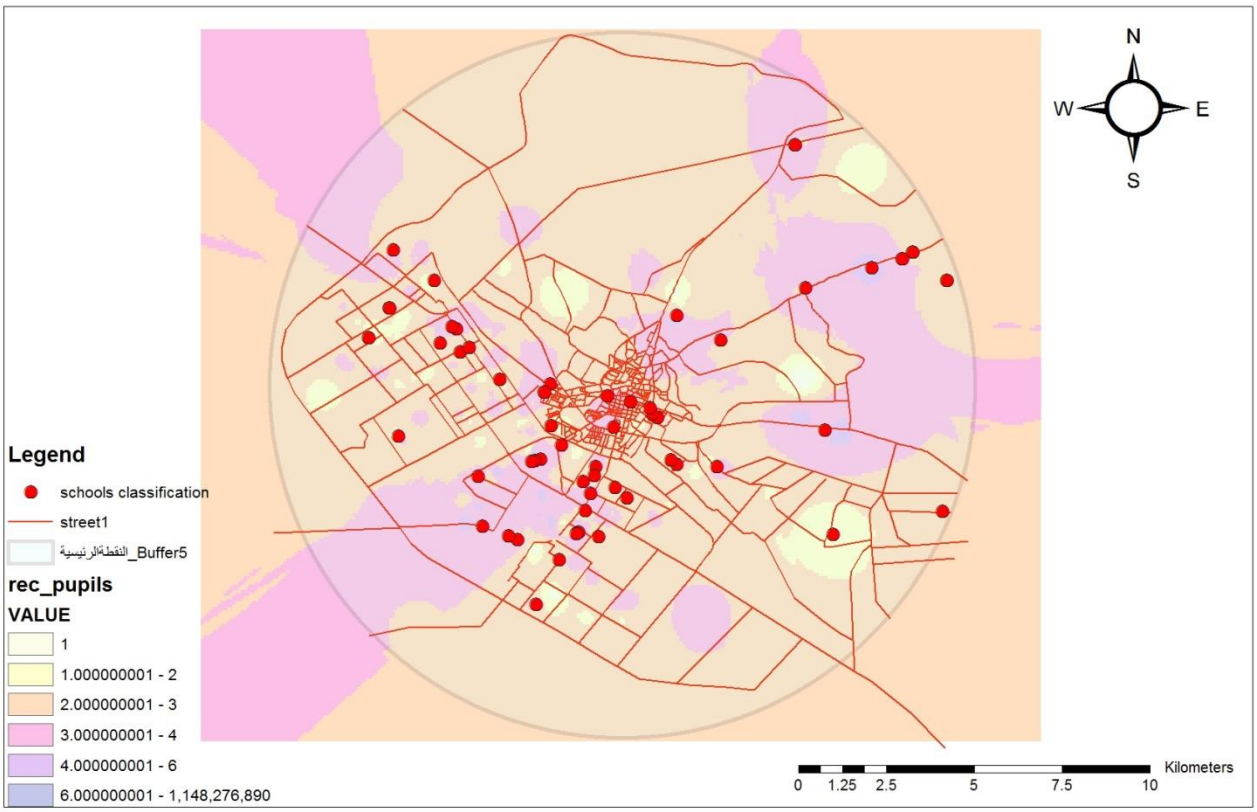
10-4Results of the classic method (TOPSIS)

The classification of schools is based on criteria. The higher the value of the indicator, the better the alternative is evaluated as:

$$Di^*_1 \le 1 \ge 0$$

TOPSIS is widely applied to a wide variety of decision-making problems. This method is based on the concept that the definition of the best alternative is one that must, simultaneously, be closer to (have the shortest Euclidean distance from) the positive ideal solution (PIS). And further from the ideal passive solution (NIS). The final ranking is obtained by the convergence index and the centers are classified according to the proximity coefficient into four sections: -

The schools were the most important for elementary schools and this is due to the great momentum of the pupils as shown in Map (1) below:



Map (1) class map and classification of schools of primary importance for the TOPSIS method (researcher's work)

As shown in Table (5) below that these values are arranged according to the significance of the impact of each criterion and that the interpretive ability of these criteria resulted in the approach coefficients for centers of utmost importance. Schools and finally secondary schools 3 schools with the most influence, according to the interpretive ability of each criterion

Table (5) class and classification of schools of greatest importance for TOPSIS method

Middle school is most important for unlocking the momentum with TOPSIS														
Nearest factor	Negative optimal solution	Positive optimal solution	Construct normalized decision matrix					Axes						
D*	di-	di+	A5	A4	A3	A2	A1	Y	x	Subdistrec	School_Deg	Schol_Nam	Criteria	ت
0.76	2.272	27.6282	0.17	0.02524	0.02292	0.0061	0.02235	32.577861	44.028389	Karbala Center	primary	Imam Reza	C9	1
0.744	2.223	27.6421	0.113	0.08762	0.08432	0.0083	0.12506	32.605694	44.032194	Karbala Center	primary	Umm Salamah	C26	2
0.783	2.3508	27.6553	0.17	0.11983	0.12078	0.0101	0.05025	32.608306	44.043417	Karbala Center	primary	Sana'a	C38	3
0.712	2.1198	27.6438	0.17	0.08762	0.08432	0.0066	0.12506	32.595583	44.02775	Karbala Center	primary	Mrs. Nafisa	C43	4
0.733	2.1874	27.6353	0.283	0.11983	0.12078	0.002	0.05025	32.616889	44.016111	Karbala Center	primary	Useful	C49	5
0.948	2.8939	27.6393	0.198	0.11983	0.12078	0.0036	0.05025	32.614778	44.0145	Karbala Center	primary	Algeria	C50	6
0.832	2.509	27.6353	0.227	0.08169	0.07644	0.0043	0.02806	32.613694	44.030806	Karbala Center	primary	The tribe	C53	7
1	3.0692	27.6269	0.255	0.08169	0.07644	0.0035	0.02806	32.578833	44.023389	Karbala Center	primary	the challenge	C60	8
0.927	2.8245	27.637	0.17	0.08169	0.07644	0.0046	0.02806	32.590278	44.032583	Karbala Center	primary	The Immaculate Ardas	C69	9
0.997	3.0585	27.6194	0.255	0.08169	0.07644	0.0047	0.02806	32.578833	44.023389	Karbala Center	primary	Banu Hashe	C71	10

												m		
0.749	**2.2379**	**27.6385**	**0.142**	**0.08169**	**0.00764**	**0.0108**	**0.02806**	**32.587722**	**44.035611**	Karbala Center	**primary**	Jaffa	**C77**	**11**
0.732	**2.1819**	**27.6342**	**0.142**	**0.08169**	**0.00764**	**0.0046**	**0.02806**	**32.630806**	**43.992**	Karbala Center	**primary**	Mrs. Hajar	**C78**	**12**
0.828	**2.4914**	**27.6093**	**0.17**	**0.00818**	**0.00209**	**0.009**	**0.17825**	**32.627333**	**43.987917**	Karbala Center	**primary**	Andalus	**C86**	**13**
0.703	**2.0882**	**27.627**	**0.085**	**0.00818**	**0.00209**	**0.0078**	**0.17825**	**32.577**	**44.007778**	Karbala Center	**primary**	Innocence	**C94**	**14**
0.74	**2.206**	**27.6055**	**0.057**	**0.00619**	**0.00669**	**0.0319**	**0.46204**	**32.5975**	**44.013611**	Karbala Center	**primary**	Sharif Al-Radhi	**C111**	**15**
0.713	**2.1225**	**27.6435**	**0.198**	**0.00876**	**0.00843**	**0.007**	**0.12506**	**32.614778**	**44.0145**	Karbala Center	**primary**	Zuhair bin Al-Qain	**C119**	**16**
0.939	**2.8596**	**27.6098**	**0.255**	**0.00876**	**0.00843**	**0.0035**	**0.12506**	**32.601111**	**44.018889**	Karbala Center	**primary**	Al-Husseinland	**C120**	**17**
0.857	**2.5898**	**27.6352**	**0.142**	**0.02998**	**0.00534**	**0.0053**	**0.10742**	**32.580444**	**43.998778**	Karbala Center	**primary**	Mujahideen	**C121**	**18**
0.802	**2.4096**	**27.6365**	**0.113**	**0.11983**	**0.12078**	**0.0062**	**0.05025**	**32.609167**	**44.042167**	Karbala Center	**primary**	Arwa	**C123**	**19**
0.731	**2.1813**	**27.6398**	**0.085**	**0.02524**	**0.00229**	**0.0048**	**0.02235**	**32.641306**	**44.081278**	Karbala Center	**primary**	The farmer	**C127**	**20**
0.902	**2.7349**	**27.599**	**0.057**	**0.00876**	**0.00843**	**0.0078**	**0.12506**	**32.628**	**44.059583**	Karbala Center	**primary**	Al-Razi	**C130**	**21**
0.871	**2.6357**	**27.6148**	**0.085**	**0.11983**	**0.12078**	**0.0063**	**0.05025**	**32.677917**	**44.078778**	Karbala Center	**primary**	Generations	**C137**	**22**
0.811	**2.4416**	**27.6493**	**0.057**	**0.00876**	**0.00843**	**0.0087**	**0.12506**	**32.64875**	**44.106056**	Karbala Center	**primary**	Tuff	**C140**	**23**
0.732	**2.1843**	**27.668**	**0.085**	**0.1198**	**0.1207**	**0.0036**	**0.05025**	**32.6432**	**44.1174**	Karbala	**prima**	Toler	**C143**	**24**

		5		3	8			78	44	Center	ry	ance		
0.794	2.3847	27.64	0.113	0.11983	0.12078	0.0112	0.05025	32.64875	44.106056	Karbala Center	primary	Umm al-Qura	C157	25
0.76	2.2745	27.6356	0.085	0.00637	0.00757	0.0113	0.0179	32.63278	44.117444	Al-Husseinia	primary	The tender	C162	26
0.839	2.5317	27.6305	0.085	0.11983	0.12078	0.0048	0.05025	32.64644	44.098222	Al-Husseinia	primary	Imam Hassan (PBUH)	C164	27
0.788	2.3636	27.6157	0.085	0.00022	0.00021	0.003	0.00129	32.63616 7	43.975	A-Hur	primary	Jafar Tayyar	C218	28
0.756	2.2608	27.6459	0.085	0.00735	0.01265	0.0032	0.00182	32.59566 7	44.05875	A-Hur	primary	Camille bin Ziyad	C226	29
0.82	2.4388	27.3197	0.085	0.00724	0.00912	0.0035	0.05355	32.60508 3	44.086222	A-Hur	primary	The most trustworthy handhold	C492	30
0.802	2.3886	27.3797	0.113	0.00724	0.00912	0.0045	0.05355	32.57833 3	44.088472	Al-Jadwal AlGhrby	primary	Two kisses	C505	31
0.76	2.272	27.6282	0.113	0.00724	0.00912	0.0085	0.05355	32.57188 9	44.018417	Karbala Center	primary	Tutors	C521	32
0.712	2.1198	27.6438	0	0.00818	0.02092	0.042	0.17825	32.56038 9	44.012417	Karbala Center	primary	Anbar	C570	33
0.948	2.8939	27.6393	0.028	0.00818	0.02092	0.018	0.17825	32.60341 7	43.977194	A-Hur	primary	Jellyfish	C579	34
1	3.0692	27.6269	0.028	0.00818	0.02092	0.0208	0.17825	32.60611	44.016333	Karbala Center	primary	Literature	C598	35
0.997	3.0585	27.6194	0.085	0.00816 9	0.00764 4	0.092	0.02806	32.62867	43.969583	A-Hur	primary	Deliveranc	C610	36

												e		
0.732	**2.1819**	**27.6342**	**0.113**	**0.08169**	**0.00764**	**0.00168**	**0.02806**	**32.628667**	**43.969583**	**A-Hur**	**primary**	The nail	**C623**	**37**
0.802	**2.4096**	**27.6365**	**0.085**	**0.08169**	**0.00764**	**0.00226**	**0.02806**	**32.636167**	**43.975**	**A-Hur**	**primary**	Qatif	**C694**	**38**
0.811	**2.4416**	**27.6493**	**0.085**	**0.06192**	**0.00664**	**0.002**	**0.03616**	**32.636306**	**43.974889**	**A-Hur**	**primary**	Hopefully	**C703**	**39**
0.794	**2.3847**	**27.64**	**0.085**	**0.02524**	**0.00229**	**0.00023**	**0.02235**	**32.593139**	**43.997556**	Karbala Center	**primary**	Maya r	**C711**	**40**
0.76	**2.2745**	**27.6356**	**0.085**	**0.08762**	**0.00843**	**0.00118**	**0.12506**	**32.584306**	**44.116389**	**A-Hur**	**primary**	Praise	**C712**	**41**
0.788	**2.3636**	**27.6157**	**0.085**	**0.08762**	**0.00843**	**0.00016**	**0.12506**	**32.597361**	**44.046861**	Karbala Center	**primary**	alraed	**C737**	**42**
The most important intermediate schools to break the crowdedby use use of TOPSIS														
0.774	**2.3152**	**27.6028**	**0.085**	**0.00735**	**0.01265**	**0.00065**	**0.00182**	**32.63425**	**44.048417**	Karbala Center	interm ediate	Jerusalem	**C362**	**43**
0.733	**2.185**	**27.6083**	**0.113**	**0.00735**	**0.01265**	**0.00058**	**0.00182**	**32.597139**	**44.012111**	Karbala Center	interm ediate	Mays aloon	**C365**	**44**
8.964	**27.5702**	**3.1871**	**0.085**	**0.06192**	**0.00664**	**0.009**	**0.03616**	**32.591861**	**44.0245**	Karbala Center	interm ediate	The banner of Islam	**C375**	**45**
5.549	**15.4735**	**12.4101**	**0.113**	**0.06192**	**0.00664**	**0.00033**	**0.03616**	**32.593472**	**44.027222**	Karbala Center	interm ediate	Primary names / 2	**C380**	**46**
0.753	**2.2336**	**27.4282**	**0.057**	**0.08762**	**0.00843**	**0.00232**	**0.12506**	**32.597083**	**44.01125**	Karbala Center	interm ediate	The marty r Abu Al-Maali main / 2	**C381**	**47**
0.777	**2.3275**	**27.6162**	**0.085**	**0.00637**	**0.00757**	**0.00184**	**0.00578**	**32.626167**	**43.995306**	Karbala Center	interm ediate	In front of the	**C383**	**48**

												pious		
0.832	**2.509**	**27.6353**	**0.113**	**0.08169**	**0.07644**	**0.0247**	**0.02806**	**32.577944**	**44.005333**	Karbala Center	interm ediate	chand elier	**C589**	**49**
0.828	**2.4914**	**27.6093**	**0.085**	**0.00735**	**0.01265**	**0.0075**	**0.06498**	**32.596167**	**44.0485**	Karbala Center	interm ediate	Sharif Al-Murtada	**C638**	**50**
0.74	**2.206**	**27.6055**	**0.085**	**0.00724**	**0.00912**	**0.0322**	**0.05355**	**32.643306**	**43.986333**	**A-Hur**	interm ediate	Fruiting	**C674**	**51**
0.713	**2.1225**	**27.6435**	**0.113**	**0.11983**	**0.12078**	**0.0112**	**0.05025**	**32.677917**	**44.078778**	**Al-Husseinia**	interm ediate	Forbidden	**C687**	**52**
0.902	**2.7349**	**27.599**	**0.0283**	**0.08762**	**0.08432**	**0.00761**	**0.125058**	**32.650444**	**44.108861**	**Al-Husseinia**	interm ediate	The jewel	**C700**	**53**
The most important secondary schools to break the crowdedby use of TOPSIS														
0.986	**3.0234**	**27.636**	**0.085**	**0.11983**	**0.12078**	**0.063**	**0.05025**	**32.612194**	**44.036556**	Karbala Center	second ary	Manar	**C364**	**54**
0.874	**2.6433**	**27.6073**	**0.057**	**0.08762**	**0.08432**	**0.087**	**0.12506**	**32.617917**	**44.003222**	Karbala Center	second ary	Fatima, the daughter of Asad	**C370**	**55**
0.811	**2.4351**	**27.6085**	**0.085**	**0.11983**	**0.12078**	**0.036**	**0.05025**	**32.624972**	**43.993083**	Karbala Center	second ary	Silks	**C373**	**56**
The most important high secondary schools to break the crowdedby use of TOPSIS														
0.867	**2.6218**	**27.6182**	**0.0566**	**0.11983**	**0.12078**	**0.00552**	**0.050249**	**32.6315**	**43.990972**	Karbala Center	Secon daryhigh	Osama bin Zaid	**C339**	**57**
0.825	**2.4872**	**27.6506**	**0.0566**	**0.02524**	**0.02292**	**0.00147**	**0.022353**	**32.588861**	**44.026417**	Karbala Center	High second ary	Success	**C340**	**58**
0.783	**2.351**	**27.6578**	**0.0566**	**0.02524**	**0.02292**	**0.00559**	**0.022353**	**32.610778**	**44.041556**	Karbala Center	High second ary	Kindergarten	**C415**	**59**
0.702	**2.087**	**27.6636**	**0.0566**	**0.02524**	**0.02292**	**0.00553**	**0.022353**	**32.578611**	**44.022694**	Karbala Center	High second ary	Sheikh Ahmed Al-	**C419**	**60**

												Waeli		
0.708	**2.1053**	**27.6232**	**0.00566**	**0.00252**	**0.00229**	**0.00979**	**0.022353**	**32.650444**	**44.108861**	**Al-Husseinia**	High secondary	The martyr Salam Al-Waznai	**C423**	**61**
0.783	**2.3508**	**27.6553**	**0.00283**	**0.00876**	**0.00843**	**0.00787**	**0.125058**	**32.651**	**43.975889**	**A-Hur**	High secondary	Windy	**C562**	**62**
0.777	**2.3275**	**27.6162**	**0**	**0.00876**	**0.00843**	**0.00258**	**0.125058**	**32.584361**	**44.025083**	Karbala Center	High secondary	Flag City	**C810**	**63**

Table (3-18) results of (TOPSIS) method

Number of schools that need to establish a school near them	**Degree of importance**	**Class classification**	**No**
42	maximum Importance	Primary	1
11	maximum Importance	Medium	2
3	maximum Importance	high school	3
7	maximum Importance	Junior high	4
63	Total		
329	Less important schools		

11- Conclusions

Through the outputs on the applied side, we reached the following conclusions:

1. Depending on the decision matrix, it was found that the most important criterion with the highest probability weights resulting from the criteria based on

the pairwise comparisons is the population according to age groups and it was 32.60 and then the number of students in the school which amounted to 31.60 which formed the largest effect of choosing the most massive schools.

2. The schools were classified according to the school's degree and the importance of the TOPSIS method, and the following was found:

A- 1th class: Primary schools, with 42 being the most populous of the total number of schools.

B- 2th class, middle schools, which are 11 of the most crowded out of the total number of schools.

C- 3th class secondary schools, which are the most populous 3 of the total number of schools.

D- 4th class, preparatory schools, being 7 the most crowded out of the total number of schools.

3. The study proved that geographic information systems (GIS) technology has great potential in the field of selecting sites for schools in which there is overcrowding, as well as preparing a geographical database, containing natural and human variables affecting the educational reality in addition to the great ability to diagnose defects according to statistical methods. As an indication of the link between neighborhood and standard distance and building educational databases aimed at facilitating the exchange and analysis of information and so on.

12- Recommendations

Based on the results and conclusions that have been reached, we recommend the following:

1. The necessity of using the geographic information systems program in identifying schools and comparing them with the results of the research, and using other statistical methods to analyze criteria. Expansion of the study area to all areas of the province or at the level of Iraq.

2. Update the educational map of the city and work according to the modern systems in force internationally in the field of education, such as the electronic system for students according to a process of spatial distribution appropriate to the needs of the city's residents, in a way that reduces the average distances traveled in order to obtain the service.

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