# Analysis of the Best High School Ranking

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# ANALYSIS OF THE BEST HIGH SCHOOL RANKING DETERMINATION WITH TECHNIQUE METHODS OR OTHERS PREFERENCE BY SIMILARITY TO IDEAL SOLUTION (TOPSIS)

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## ABSTRACT

*An educational quality depends heavily on the quality of the educational institution such as the senior high school and level above. The quality of senior high school level is often served as a benchmark for people to choose the right school for the community*

*through the educational institutions. This research aims to determine the best rank of senior high school in Pekanbaru using a Technique for others preference by similarity to ideal solution (TOPSIS) method. This method of weighted TOPSIS requires range criterions. To determine the weight of each criterion, this study uses AHP method as the supporter for determining the weight of each criterion and gives the rank to the senior high school in which majors are the natural science and the social science department. The results obtained are the best rank for natural science majors of senior high schools in Pekanbaru is SMAN 1 Pekanbaru and the best rank for social science majors of senior high schools in Pekanbaru is SMAN 8 Pekanbaru. For the private high school, it can be said that Pekanbaru Djuwita private high school becomes the first rank of science majors and the Private high school of Witama Nasional Plus Pekanbaru becomes the first rank of the social science Department. For the high school and the private high school, SMAN 8 Pekanbaru obtains the first rank in the science majors and the first rank in the social science department.*

# 1. INTRODUCTION

Education is a process in order to affect the learners so that they are able to adapt as best as possible with surroundings. It will cause a change in themselves who allow it to function adequately in the life of the community. The Educational activities are expected to encourage students to be more active and passionate in the study because the activities that are useful are intended to achieve the objectives of teaching or learning. In a globalization era, the education is required to have a high quality today. The educational quality depends on the quality of the educational institutions such as a senior high school level and higher educational institution than it is. The quality of senior high school level often is served as a benchmark for people to choose the right school for the community surrounding these institutions.

The System or the method for determining the rank of the best school systems or giving ranking at a school in region was made in the simple step, which was still based on the big names which had already obtained in a particular school. This of course making the assessment of the qualities of a school is not objective and impressed the other schools that have adverse experience increased quality that is quite significantly over time. Therefore, it needs a way to assess the achievements of schools. In this case, an ability to improve the quality of schools is seen from student' ability in understanding all of the lessons which would be deciding to the school's rank as objects that exist in an area. The assessment in giving rankings uncovers capability in Guaranteeing of schools in improving the educational quality.

Ranking is the process of structuring alternatives in order of priority. It is based on the criterion or attribute determined for each alternative involved. Evaluation of criteria are performed and then a composite index is composed for each of the alternatives for the purpose of ranking the alternatives according preference. This practice is known as multiple criteria decision making (MCDM). MCDM is one of the most widely used decision methodologies in the business, sciences, engineering, and government worlds. MCDM methods can help to improve the quality of decisions by making the decision making process more explicit, efficient and

rational. MCDM is regarded as a main part of modern decision science and operational research, which contains multiple decision criteria and multiple decision alternatives [1-9]. There are several common approaches to MCDM, one of the practice is known as TOPSIS (Technique for Order Preference by Similarity to Ideal Solution. However, objective of this research is to determine the best rank of senior high school in Pekanbaru using TOPSIS method.

## 2. MATERIAL AND METHODS

Research methods of this study as follow:

1. The secondary data on the value are gained from the national exam of senior high school in Pekanbaru based on the various of subjects such as, english, math, chemistry, biology, physics, economics, sociology and geography.

2. The primary data of the questionnaire results were obtained from 300 respondents on five schools in Pekanbaru to figure the value of the weights of each subjects in educational exam which uses AHP Method.

3. Processing data.

a. Defining the problem and determining the desired solution.

b. Creating a hierarchical structure is begun with a general purpose than it is followed by the criteria and the alternative option that will be ranked.

c. Determining the priorities are done by forming the paired comparison matrix with summing the overall assessment of the respondent and divides it by the number of respondents.

d. Synthesising or normalizing the data are done by dividing the value of each matrix element that is paired with a total value of each column.

e. Determining priority weighting $W_i$ for each criterion is done by summing the elements of each line and it is divided with the number of elements.

f. Making a decision matrix is normalized

$$r_{ij} \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}, \text{ where } i = 1,2,\dots,m; \text{ and } j = 1,2,\dots,n$$

a) Making a decision matrix weights normalization.
With weights $W = (w_1, w_2, \dots, w_n)$ then normalizing the weights matrix V:

$$v = \begin{bmatrix} w_{11}r_{11} & \cdots & w_{1n}r_{1n} \\ \vdots & \ddots & \vdots \\ W_{m1}r_{m1} & \cdots & w_{mn}r_{mn} \end{bmatrix}$$

b) Determining the ideal solution matrix of positive and negative ideal solution matrix. The positive ideal solution is given by the notation $A^+ = MAX(V^+, V^+, V^+, \dots)$ whereas the negative ideal solution is given by the notation $A^- = MIN(V^-, V^-, V^-, \dots)$.

c) Determining the distance the ideal solution for the positive and negative solution is ideal. Calculating separation distance from measurement is an alternative of the positive and negative the ideal solution. Mathematically, its calculation is as follows: calculating the ideal solution for positive separation $S_i^+$ is the distance (in view of Euclidean) alternative of the ideal solution.
Distance towards the positive ideal solution is defined as:

$$S_i^+ = \sqrt{\sum_{i=1}^{n} \left(v^+ - v_{ij}\right)^2}, \text{ with } 1 = 1,2,3,\dots,m$$

And the distance towards the negative was defined as the ideal solution:

$$S_i^- = \sqrt{\sum_{i=1}^{n}(v^- - v_{ij})^2}, with\ 1 = 1,2,3,...,m$$

a) Calculating the relative proximity towards the ideal solution.
Alternative relative closeness $A^+$ with ideal solution $A^-$ is represented:

$$C_i = \frac{s_i^-}{s_i^- + s_i^+}, with\ 0 < C_i^+ < 1\ where\ i = 1,2,3,...,m$$

b) Sorting the alternative champion.

## 3. RESULTS AND DISCUSSIONS

The method of AHP is a method used as decision makers. This method produces the weights or each the criteria and the alternatives. The first level is the goal that is the result of weight each criterion and it is criterion which is the subject (G). The second is a criterion for subjects ($K_1$). The third is an alternative which is the name of the high school ($A_1$). Computing the normalized matrix weights on the basis of the result of questionnaires which had been set, as shown in Table 1 to Table 3. By dividing the value in the criteria of the criteria of lessons with an average rating of each criteria found in the Table 4. Computing the matrix weighted normalized based on the results of the questionnaire has been established, multiplying the normalized matrix value with the value of the level of interest will become all of the values. It can be seen as Table 5.

**Table 1.** The values of the weight of each science major criterion

| A1 | A2 | A3 | A4 | A5 | A6 |
|----|----|----|----|----|----|
| 34.94 | 33.26 | 34.00 | 33.52 | 35.90 | 34.08 |

**Table 2.** The values of the weight of each criterion of social science department

| A1 | A2 | A3 | A4 | A5 | A6 |
|----|----|----|----|----|----|
| 0.4028 | 0.2077 | 0.0995 | 0.1140 | 0.1049 | 0.0706 |

**Table 3.** The average values of science majors criterion

| A1 | A2 | A3 | A4 | A5 | A6 |
|----|----|----|----|----|----|
| 0.3751 | 0.1957 | 0.3086 | 0.1011 | 0.1118 | 0.0771 |

**Table 4.** The values of normalized matrix to science majors at senior high school

| Alternative | A1 | A2 | A3 | A4 | A5 | A6 |
|-------------|------|------|------|------|------|------|
| SMAN 4 Pekanbaru | 0.2407 | 0.2477 | 0.2412 | 0.2387 | 0.2429 | 0.2304 |
| SMAN 8 Pekanbaru | 0.2501 | 0.2292 | 0.2559 | 0.2503 | 0.2448 | 0.2471 |
| SMAN 1 Pekanbaru | 0.2499 | 0.2526 | 0.2426 | 0.2461 | 0.2398 | 0.2444 |
| SMAN Plus Provinsi Riau | 0.2438 | 0.2526 | 0.2526 | 0.2518 | 0.2493 | 0.2491 |
| SMAN 5 Pekanbaru | 0.2413 | 0.2420 | 0.2274 | 0.2467 | 0.2451 | 0.2406 |
| SMAN 9 Pekanbaru | 0.2358 | 0.2420 | 0.2415 | 0.2452 | 0.2384 | 0.2380 |
| MAN 2 Model Pekanbaru | 0.2416 | 0.2372 | 0.2403 | 0.2261 | 0.2340 | 0.2344 |

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|---|---|---|---|---|---|---|
| SMAN 14 Pekanbaru | 0.2310 | 0.2357 | 0.2329 | 0.2360 | 0.2373 | 0.2344 |
| SMAN 7 Pekanbaru | 0.2381 | 0.2327 | 0.2391 | 0.2339 | 0.2390 | 0.2403 |
| SMAN 10 Pekanbaru | 0.2335 | 0.2333 | 0.2362 | 0.2321 | 0.2331 | 0.2344 |
| SMAN 11 Pekanbaru | 0.2350 | 0.2270 | 0.2353 | 0.2324 | 0.2309 | 0.2362 |
| SMAN 2 Pekanbaru | 0.2295 | 0.2282 | 0.2344 | 0.2306 | 0.2345 | 0.2321 |
| SMAN 3 Pekanbaru | 0.2338 | 0.2315 | 0.2321 | 0.2327 | 0.2334 | 0.2362 |
| SMAN 6 Pekanbaru | 0.2261 | 0.2297 | 0.2274 | 0.2306 | 0.2267 | 0.2295 |
| SMAN 12 Pekanbaru | 0.2318 | 0.2309 | 0.2318 | 0.2333 | 0.2337 | 0.2321 |
| MAN 1 Pekanbaru | 0.2310 | 0.2192 | 0.2312 | 0.2342 | 0.2331 | 0.2324 |
| SMAN 13 Pekanbaru | 0.2333 | 0.2198 | 0.2144 | 0.2202 | 0.2142 | 0.2210 |
| SMA Olahraga | 0.2187 | 0.2159 | 0.2126 | 0.2184 | 0.2298 | 0.2210 |

A1: Indonesia language, A2: English language, A3: Mathematics, A4: Physics, A5: Chemistry, A6: Biology
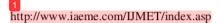
**Table 5.** The normalized matrix with weighted value of science majors

| Alternative | A1 | A2 | A3 | A4 | A5 | A6 |
|---|---|---|---|---|---|---|
| SMAN 4 Pekanbaru | 0.0970 | 0.0514 | 0.0240 | 0.0272 | 0.0255 | 0.0163 |
| SMAN 8 Pekanbaru | 0.1007 | 0.0476 | 0.0255 | 0.0285 | 0.0257 | 0.0174 |
| SMAN 1 Pekanbaru | 0.1007 | 0.0525 | 0.0241 | 0.0281 | 0.0252 | 0.0173 |
| SMAN Plus Provinsi Riau | 0.0982 | 0.0525 | 0.0251 | 0.0287 | 0.0262 | 0.0176 |
| SMAN 5 Pekanbaru | 0.0972 | 0.0503 | 0.0226 | 0.0281 | 0.0257 | 0.0170 |
| SMAN 9 Pekanbaru | 0.0950 | 0.0503 | 0.0240 | 0.0280 | 0.0250 | 0.0168 |
| MAN 2 Model Pekanbaru | 0.0973 | 0.0493 | 0.0239 | 0.0258 | 0.0245 | 0.0165 |
| SMAN 14 Pekanbaru | 0.0930 | 0.0409 | 0.0232 | 0.0269 | 0.0249 | 0.0165 |
| SMAN 7 Pekanbaru | 0.0959 | 0.0483 | 0.0238 | 0.0267 | 0.0251 | 0.0170 |
| SMAN 10 Pekanbaru | 0.0941 | 0.0485 | 0.0235 | 0.0265 | 0.0245 | 0.0165 |
| SMAN 11 Pekanbaru | 0.0947 | 0.0471 | 0.0234 | 0.0265 | 0.0242 | 0.0167 |
| SMAN 2 Pekanbaru | 0.0924 | 0.0474 | 0.0233 | 0.0263 | 0.0246 | 0.0164 |
| SMAN 3 Pekanbaru | 0.0942 | 0.0481 | 0.0231 | 0.0265 | 0.0245 | 0.0167 |
| SMAN 6 Pekanbaru | 0.0911 | 0.0477 | 0.0226 | 0.0263 | 0.0238 | 0.0162 |
| SMAN 12 Pekanbaru | 0.0934 | 0.0480 | 0.0231 | 0.0266 | 0.0245 | 0.0164 |
| MAN 1 Pekanbaru | 0.0930 | 0.0455 | 0.0230 | 0.0267 | 0.0245 | 0.0164 |
| SMAN 13 Pekanbaru | 0.0940 | 0.0457 | 0.0213 | 0.0251 | 0.0225 | 0.0156 |
| SMA Olahraga | 0.0881 | 0.0448 | 0.0212 | 0.0249 | 0.0241 | 0.0156 |

To determine the ideal solution is to find a positive value of normalized the highest weighted matrix of each criterion and the negative value of normalized the lowest weighted matrix of each criterion. The result can be seen as shown in Table 6 to Table 8. After finding the value of a preference of the overall, the results will be ranked by $s_i^+$ order from the highest to the lowest value, the following rank of school for science majors in Pekanbaru where 1st Senior High School obtains the first rank and the sport high school obtains the last rank. It can be seen as follows:

**Table 6.** The values of positive and negative from ideal solution on science majors

| | A1 | A2 | A3 | A4 | A5 | A6 |
|---|---|---|---|---|---|---|
| $A^+$ | 0.1007 | 0.0525 | 0.0255 | 0.0287 | 0.0262 | 0.0176 |

| $A^-$ | 0.0881 | 0.0448 | 0.0212 | 0.0249 | 0.0225 | 0.0156 |
|---|---|---|---|---|---|---|

**Table 7.** The values to distance of positive and negative from ideal solution on science majors

| Alternative | The positive ideal solution ($s_i^+$) | The negative ideal solution ($s_i^-$) |
|---|---|---|
| SMAN 4 Pekanbaru | 0.0046 | 0.0115 |
| SMAN 8 Pekanbaru | 0.0049 | 0.0134 |
| SMAN 1 Pekanbaru | 0.0018 | 0.0151 |
| SMAN Plus Provinsi Riau | 0.0025 | 0.0132 |
| SMAN 5 Pekanbaru | 0.0047 | 0.0111 |
| SMAN 9 Pekanbaru | 0.0065 | 0.0094 |
| MAN 2 Model Pekanbaru | 0.0061 | 0.0107 |
| SMAN 14 Pekanbaru | 0.0091 | 0.0071 |
| SMAN 7 Pekanbaru | 0.0070 | 0.0091 |
| SMAN 10 Pekanbaru | 0.0083 | 0.0077 |
| SMAN 11 Pekanbaru | 0.0086 | 0.0077 |
| SMAN 2 Pekanbaru | 0.0102 | 0.0059 |
| SMAN 3 Pekanbaru | 0.0084 | 0.0076 |
| SMAN 6 Pekanbaru | 0.0112 | 0.0051 |
| SMAN 12 Pekanbaru | 0.0091 | 0.0067 |
| MAN 1 Pekanbaru | 0.0109 | 0.0058 |
| SMAN 13 Pekanbaru | 0.0101 | 0.0066 |
| SMA Olahraga | 0.0152 | 0.0029 |

**Table 8.** The preferential values of science majors

| Alternative | The positive ideal solution ($s_i^+$) | The negative ideal solution ($s_i^-$) |
|---|---|---|
| SMAN 4 Pekanbaru | N | 0.8935 |
| SMAN 8 Pekanbaru | N | 0.8408 |
| SMAN 1 Pekanbaru | N | 0.7322 |
| SMAN Plus Provinsi Riau | N | 0.7142 |
| SMAN 5 Pekanbaru | N | 0.7025 |
| SMAN 9 Pekanbaru | N | 0.6369 |
| MAN 2 Model Pekanbaru | N | 0.5912 |
| SMAN 14 Pekanbaru | N | 0.5652 |
| SMAN 7 Pekanbaru | N | 0.4813 |
| SMAN 10 Pekanbaru | N | 0.4750 |
| SMAN 11 Pekanbaru | N | 0.4724 |
| SMAN 2 Pekanbaru | N | 0.3665 |
| SMAN 3 Pekanbaru | N | 0.4348 |
| SMAN 6 Pekanbaru | N | 0.4241 |
| SMAN 12 Pekanbaru | N | 0.3952 |
| MAN 1 Pekanbaru | N | 0.3473 |
| SMAN 13 Pekanbaru | N | 0.3129 |

| SMA Olahraga | N | 0.1602 |
| --- | --- | --- |

## 4. CONCLUSION

There are some conclusions from discussion that has been conducted in the research. It can be seen as follows:

1. The criteria used for the consideration to give rankings of high school is a national exam subject in 2011-2014

2. The weighting of the criteria for determining the influence in giving rankings to senior high school (alternative) and spread a detailed questionnaire in middle school over Pekanbaru with the AHP method to determine the weighting of each criterion.

3. It can be seen of the difference method using TOPSIS and rank manually. On the TOPSIS method to determine ranking by calculating the distance is the ideal solution for the positive of $s_i^+$ and the negative solution is the ideal distance $s_i^-$. The calculating values of the preference $C_i = \frac{s_i^-}{s_i^- + s_i^+}$ of each senior high school (alternative), and sorts the results for preference of alternative value, while the manual sum of average criteria of each alternative.

4. The results obtained in this study are as follows :

a) The 1st Senior High School is the first rank in the science majors and the 8th Senior High School is the first rank in both Social and Science majors

b) For ranking of Private high schools in Pekanbaru that Djuwita Private High School obtains the first rank of science majors and Private High School of National Plus Witama obtains the first rank in both Social and Science majors.

c) 8th Senior High School is the first rank in science majors and it becomes the first rank in Social and Science department.

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