Multi-Criteria Decision Making in Job Selection Problem Using Analytic Hierarchy Process Model

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ABSTRACT

Background: Career or job selection is an important decision making process for everyone. In the job selection problem, multiple criteria or factors are considered in the decision making process. Job selection problem is mostly significant to fresh graduates who are looking for suitable or better job after graduation. Therefore, a better decision making process is needed in job selection problem. Objective: The objective of this paper is to solve the multi-criteria decision making problem in choosing the most preferred job among the undergraduates from Statistical Computing and Operations Research courses using Analytic Hierarchy Process model. The decision alternatives in job selection are business analyst, lecturer, mathematician, economist, risk analyst, quality analyst, software engineer, management, public servant and researcher. Besides that, this paper aims to identify the priority of the decision criteria such as the income and benefit, academic qualification, work-life balance, working environment, family influence, personal aptitude, interest, demand, working experience and gender in job selection problem. Results: Business analyst is the most preferred job followed by risk analyst, lecturer, mathematician, economist, quality analyst, software engineer, management, researcher and public servant. Besides that, income and benefit is the most significant factor in the multi-criteria decision making process followed by personal aptitude, interest, demand, academic qualification, work life balance, working environment, family influence, working experience and gender in job selection problem. Conclusion: Business analyst is found to be the most preferred job while the income and benefit is the most essential criteria in the multi-criteria decision making process. The significant of this paper is to identify the most preferred job among the undergraduates as well as the most important criteria in decision making process.

INTRODUCTION

Career or job selection is an important decision making process for everyone. In the job selection problem, multiple criteria or factors are considered in the decision making process. Job selection problem is mostly significant to fresh graduates who are looking for suitable or better job after graduation. Therefore, a better decision making process is needed in job selection problem. In the past studies, the important factors or decision criteria in job selection problem are the income and benefit [1], past working experience [2], influence from parents [3], gender and age [4, 5], and personal aptitude [6, 7]. The objective of this paper is to solve the multi-criteria decision making problem in choosing the most preferred job among the undergraduates from Statistical Computing and Operations Research courses using Analytic Hierarchy Process (AHP) model. The decision alternatives in job selection are business analyst, lecturer, mathematician, economist, risk analyst, quality analyst, software engineer, public servant, management and researcher. Besides that, this paper aims to identify the priority of the decision criteria such as the income and benefit, academic qualification, work life balance, working environment, family influence, personal aptitude, interest, demand, working experience and gender in job selection problem. The rest of the paper is organized as follow. The next section describes the data and methodology. Section 3 discusses about the empirical results of this study. Section 4 concludes the paper.

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Data and Methodology:

Data:
In this research, the preference of job selection among the undergraduates from Statistical Computing and Operations Research course (Universiti Tunku Abdul Rahman) was studied. The decision criteria identified in this study are income and benefit, academic qualification, work life balance, working environment, family influence, personal aptitude, interest, demand, working experience and gender. AHP was utilized and applied in finding the weights and priority of the decision criteria as well as the job selection. The decision alternatives in the job selection problem are business analyst, lecturer, mathematician, economist, risk analyst, quality analyst, software engineer, public servant and researcher. Questionnaires were distributed to all 93 students and the mean for each entry in the pair-wise comparison matrices was obtained. Expert Choice™ software was used to analyze the data.

Analytic Hierarchy Process (AHP) Model:
Data analysis in the AHP model can be divided into five steps.
Step 1: State the goal or objective and distinguish the decision criteria and alternatives to build the hierarchy. The hierarchy structure for job selection problem is shown in Figure 1.

Fig. 1: Hierarchy structure for job selection problem.

Step 2: Develop pair-wise comparison matrices for the identified decision criteria and alternatives. The elements are compared in pairwise to obtain their relative importance to the problem. Table 1 shows the scale used for the pairwise comparison in AHP model.

Table 1: Scale used for pairwise comparison in AHP model.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Two elements have the same level of importance</td>
</tr>
<tr>
<td>3</td>
<td>One element has a slightly higher importance than the other</td>
</tr>
<tr>
<td>5</td>
<td>One element has a stronger level of importance compared to the other</td>
</tr>
<tr>
<td>7</td>
<td>One element has a slightly higher dominance to the other</td>
</tr>
<tr>
<td>9</td>
<td>The highest and most extreme dominance of an element</td>
</tr>
<tr>
<td>2,4,6,8</td>
<td>Intermediate ratings; when compromise is required</td>
</tr>
</tbody>
</table>

For $n$ number of decision criteria or decision alternatives, the number of pairwise comparison matrix can be obtained by using the formula $(0.5)n(n - 1)$. The matrix constructed will be as follows.
Step 3: Identify the weights that controls the decision criteria and Local weights of the alternatives from the matrices above by utilizing the Normalization Method. To determine the criteria and local weight of decision alternatives, calculate the total of the data of each row, \( \bar{t}_i = \sum_{j=1}^{n} c_{ij} \), \( i = 1, 2, 3, ..., n \) and normalizing the local weight \( \tau_i = \frac{\sum_{j=1}^{n} c_{ij}}{\sum_{k=1}^{n} \sum_{j=1}^{n} c_{kj}} \), \( i = 1, 2, 3, ..., n \). The results of the normalized vector of the local weight is \( y = [\tau_1, \tau_2, ..., \tau_n]^T \).

Step 4: Identify the Global weights of the decision alternatives by the local weights priority synthesis.

\[
A \times V = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix} \times \begin{bmatrix} v_1 \\ \vdots \\ v_n \end{bmatrix}
\]

Matrix \( A \) denotes the local weights attained by the decision alternatives and each column denotes the local weight obtained by each factor. The \( V \) matrix denotes the transpose of the local weight attained by the criteria. Therefore, global weight can be obtained by having matrix \( A \) multiply with matrix \( V \).

Step 5: Checking for consistency

In pairwise comparisons, consistency is always an issue. A small consistency ratio (CR) is always preferred. Therefore, repetition of the pairwise comparisons is encouraged until the CR attains the value 0.10 or lower [1]. CR is obtained in terms of the consistency index (CI) and random index (RI) as shown below.

\[
CI = \frac{\lambda_{\text{max}} - n}{n-1}
\]

\[
CR = \frac{CI}{RI}
\]

where \( \lambda_{\text{max}} \) assumed to be the maximum eigenvalue, and the RI values calculated by Saaty [8] as shown in Table 2.

<table>
<thead>
<tr>
<th>( n )</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>RI</td>
<td>0</td>
<td>0.58</td>
<td>0.90</td>
<td>1012</td>
<td>1.24</td>
<td>1.32</td>
<td>1.41</td>
<td>1.45</td>
<td>1.51</td>
</tr>
</tbody>
</table>

Empirical Results:

Figure 2 shows the weights and priority of all decision criteria in the job selection problem. Based on Figure 2, the undergraduates preferred income and benefit with the highest weights (0.240) followed by personal aptitude (0.122), personal interest (0.103), demand (0.102), academic qualification (0.098), work-life balance (0.082), working environment (0.075), family influence (0.065), past working experience (0.047), influence from friend (0.041) and gender (0.023). The consistency ratio (0.08) for the decision criteria in this study is less than 0.10. This implies that the pairwise comparison matrix does not exhibit any serious and significant inconsistency. Therefore, the judgments made by the students on the weights and priority of decision criteria in the job selection problem are reliable and acceptable. Finally, Figure 3 presents the overall weights and priority of the jobs.

As shown in Figure 3, the result shows that the undergraduates have chosen business analyst (0.188) as their most preferred job with respect to all decision criteria which are the income and benefit, academic qualification, work life balance, working environment, family influence, personal aptitude, interest, demand, working experience and gender. The priority or preference of the jobs is followed by risk analyst (0.118), lecturer (0.114), mathematician (0.113), economist (0.112), quality analyst (0.110), software engineer (0.092), management (0.066), researcher (0.047) and public servant (0.041). The overall consistency ratio is 0.08 which
is below 0.10. This implies that the pairwise comparison matrix does not exhibit any serious and significant inconsistency. Therefore, the best decision of selecting business analyst as the most preferred job by the undergraduates using AHP model is acceptable.

Fig. 2: Weights and priority of all decision criteria in the job selection problem.

![Weight and Priority of Decision Criteria]

Fig. 3: Overall weights and priority of jobs.

![Overall Weights and Priority of Jobs]

**Conclusion:**

In this study, business analyst is found to be the most preferred job among the undergraduates followed by risk analyst, lecturer, mathematician, economist, quality analyst, software engineer, management, researcher and public servant using AHP model. In this multi-criteria decision making process, the income and benefit are the most essential decision criteria in the job selection problem. The priority of the decision criteria is followed by personal aptitude, personal interest, demand, academic qualification, work-life balance, working environment, family's influence, past working experience, friend’s influence and gender. Other jobs or careers are recommended to improve the income and benefit which have been identified as the most important decision
criteria by the undergraduates in this study. The significant of this paper is to identify the most preferred job among the undergraduates as well as the most important criteria in decision making process.

REFERENCES


