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Fuzzy Analytical Hierarchy Process for Analysing the Factors that Influence the Career Choices of Graduate Students at UiTM Perlis

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ABSTRACT

There are various types of careers that graduated students can pursue today. However, the career selection could be quite confusing and challenging, due to some factors such as parental and academic influences, personal interest and work environment. This study is aimed to rank the main factor and sub-factor that influence the students' career choices of graduate students at UiTM Perlis. Interviews are conducted in obtaining the input for the study. Based on the input obtained, the study utilized the approach based on Saaty's scale and fuzzy analytic hierarchy process (AHP). The factor that has the highest value of the normalized weight is that most influences factor, which is the personal interest factor. For sub-factors, workplace is the most influential factor, while the sub-factor with the least influence is safety under the parental factor, which is also the least ranked of the factors influencing students' career choices.

1. INTRODUCTION

Choosing a suitable career is crucial for the graduate student that can have a profound impact on various aspects of their future life. With an increasing number of job scope available, some students especially for those who are maintain a good Cumulative Grade Point Average (CGPA) for every semester, would be expecting that they can be easily choosing their career according to their qualifications. However, after they graduated, they actually might have difficulty in getting or choosing their job, due to some factors.

Numerous elements, including the graduate student's working environment, personal interests, academic influence, and familial influence, may play a role in their employment decisions. Koçak et al. (2021) claim that graduate students' academic and familial backgrounds have a big impact on their self-efficacy in choosing a career. Parents are important because they can affect their children's career choices in a variety of ways, including direct inheritance and role modelling. Furthermore, since academic

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accomplishment shows the results of students' labour during their academic careers, it also has an impact on employment. Academic influence encompasses various aspects, including maintaining a high CGPA level, considering scholarship opportunities for financial support, and factoring in the perceived difficulty of academic pursuits.

On the other hand, personal interest or self-interest is also a major consideration when choosing a career. Afzaal Humayun et al. (2018) assert that a person will be inspired and motivated to work hard by whatever it is that they are truly interested in. This factor correlates with a personal passion for the chosen career, aligning workplace preferences with cultural fit, and factoring in salary considerations to meet financial aspirations. Besides that, the work environment is also crucial since it affects output and promotes happier working conditions. A decent workplace embodies a culture of mutual respect, empathy, and understanding among coworkers. It is important to take into account environmental factors including friends, race, and gender. Gender roles in the workplace have historically been unfair and discriminatory (Fizer, 2013). Nonetheless, a growing number of people are realizing that gender disparities are acceptable in demanding professions like networking and engineering.

Based on the outlined constraints and factors, it is apparent that choosing an appropriate career poses a significant challenge. Additionally, there are sub-factors that exert influence on graduate students' career choices. Elements like family tradition, scholarship opportunities, salary considerations, gender-related factors, and more are closely connected to the previously mentioned overarching factors. These intricacies add complexity to the career decision-making process, making it more demanding and stressful.

Therefore, in this study, our goal is to determine and rank the main factors and sub-factors that have the most impact on graduate students when they choose their careers. The scope of this study focuses solely on graduate students from UiTM Perlis. The method utilized fuzzy Analytic Hierarchy Process (FAHP) to reach this goal. Previously, some studies have already been done on figuring out what factors influence students' career choices, like the ones by Kilic and Cevikcan (2011) and Chen et al. (2018). They also used fuzzy Analytic Hierarchy Process (FAHP) and another method called TOPSIS with fuzzy cognitive map. However, these studies focused only on identifying the factors, without ranking them. Ranking the factors is important because it helps graduate students make the best decisions based on their own situations related to these factors. So, our study aims to fill this gap by not only identifying but also ranking the factors. This ranking will be useful for graduate students in choosing a sensible professional path.

The rest of the paper is organized as follows. In Section 2, some definitions provided on the theory of fuzzy number and FAHP. The methodology used for the study is provided in Section 3. The results are presented in the Section 4 and finally in Section 5, the conclusion is drawn.

2. PRELIMINARIES

This section provides some theories behind the two key concepts used in our study: fuzzy numbers and FAHP.

2.1 Fuzzy Number

Zadeh (1965) introduced the idea of a fuzzy set, considering objects that can belong to a category with varying degrees of membership (Zadeh, 1965, as mentioned in Rezaei & Ketabi, 2016). This concept uses a scale from zero to one to express membership grades. Fuzzy sets help capture and process human decisions and judgments by assigning meaningful values, especially when dealing with uncertain or ambiguous data. There are two main aspects of this theory: one views fuzzy sets as precisely defined

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mathematical objects following classical logic, and the other adopts a linguistic approach (Sattar et al., 2018). The concept is widely applied in decision support literature to handle subjectivity in challenging decision-making situations. In this study, one of the common types of fuzzy number which is triangular fuzzy number (TFN) is used to represent the fuzzy number. Here, the definition of TFN is provided.

Definition 1: (Zadeh, 1965) A triangular fuzzy number (TFN) of $\tilde{A}=(l,m,u)$ has a membership function of $\mu_{\tilde{A}}$ provided by

$$\mu_{\tilde{A}}(x)=\begin{cases}\dfrac{x-l}{m-l}, & l\le x\le m,\\ \dfrac{u-x}{u-m}, & m\le x\le u,\\ 0, & \text{otherwise.}\end{cases}$$

where l and u stand for the fuzzy number's lower and upper bounds, respectively, while m is the median value. Fig. 1 illustrates the TFN in its standard form.

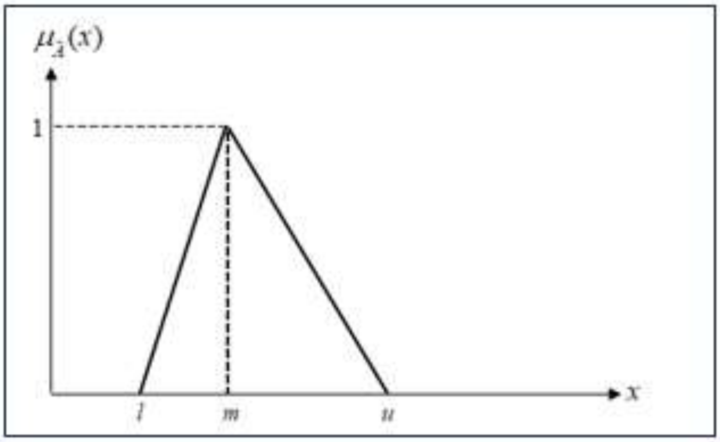

Fig. 1. Representation of a TFN (l,m,u).

Some important arithmetic operations of TFN are provided as follows.

Definition 2: (Dubois & Prade, 1980) Given two TFN of $\tilde{A}_1=(l_1,m_1,u_1)$ and $\tilde{A}_2=(l_2,m_2,u_2)$. The arithmetic operators that related to $\tilde{A}_1$ and $\tilde{A}_2$ are:

i) Addition: $\tilde{A}_1+\tilde{A}_2=(l_1,m_1,u_1)+(l_2,m_2,u_2)=(l_1+l_2,m_1+m_2,u_1+u_2)$

ii) Subtraction: $\tilde{A}_1-\tilde{A}_2=(l_1,m_1,u_1)-(l_2,m_2,u_2)=(l_1-l_2,m_1-m_2,u_1-u_2)$

iii) Scalar multiplication:
Let $\lambda \in \mathbb{R}$, then

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$$\lambda(l,m,u) = (\lambda l, \lambda m, \lambda u)$$

2.2 Fuzzy Analytical Hierarchy Process (FAHP)

Since 1983, fuzzy set theory has been seamlessly incorporated into the conventional Analytic Hierarchy Process (AHP), initially introduced by Saaty (1980) for its simplicity, user-friendliness, and remarkable adaptability (Van Laarhoven & Pedrycz, 1983). The FAHP technique has proven to be a practical approach for addressing real-world decision-making challenges involving multiple criteria. By incorporating perspectives from decision makers, the fuzzy AHP method helps determine the importance of each criterion. Research conducted by Kabir and Ahsan (2011) demonstrated the advantage of capturing the vagueness of human thought, aiding in addressing study challenges in a clear and systematic manner.

In applying the FAHP method, data is collected through a questionnaire, facilitating pairwise comparisons of all boundaries and categories for analysis and ranking. This crucial data collection is conducted by subject-matter experts who possess the qualifications to provide insights relevant to the study's topic, utilizing a judgmental sampling technique. As highlighted by Saaty and Ozdemir (2015), FAHP typically relies on a model of expert opinions rather than a strict statistical approach. Consequently, the adequacy of the number of experts required to obtain valid and consistent judgments in AHP depends on the participants' level of expertise in the specific field.

Moreover, FAHP employs pairwise comparisons to manage hierarchical relationships between factors, as emphasized by Zabihi et al. (2020). Recognized for its ability to assess human judgment and opinions that might be overlooked by other approaches, the Analytic Hierarchy Process method is frequently chosen as an alternative for outlining and modeling challenges involving multiple criteria.

Numerous studies have explored the application of FAHP in addressing various multiple criteria decision-making challenges. Recent investigations include the selection of effective strategies to prevent COVID-19 (Idris et al., 2023), assessment of nasyid competitions (Aziz et al., 2023), and the selection of the best student award (Aziz et al., 2023), among others. FAHP proves particularly relevant in real-world scenarios characterized by vague and unclear conditions, especially in decision-making processes.

3. METHODOLOGY

The methodology of this study involves a structured framework as illustrated in the Fig. 2.

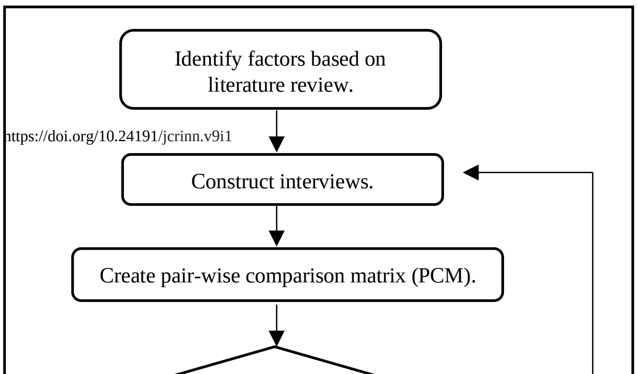

Fig. 2. Framework of the study

Source: Emrouznejad and Ho (2022)

Details of the framework are given in the following steps.

Step 1: The methodology of the study begins with the identification of the factors involved in students' career choice. Based on literature reviews, the most common factors and sub-factors contributing to career choice are presented in the following Table 1.

Table 1. Factors and subfactors influencing students' career choice

Factor	Sub-factors	Source
Parental Influence	• Parents' Expectations • Family Tradition • Safety	Afzal et al. (2018); Leung et al. (2011)
Academic Influence	• CGPA level • Scholarship • Difficulty	Kass and Miller (2018); Kazi and Akhlaq (2017)
Self-Interest	• Passion • Workplace • Salary	Afzal et al. (2018); Dyrbye et al. (2020)
Work Environment	• Gender	Twidwell et al. (2022);

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	• Race • Friends	Kazi and Akhlaq (2017)

Using the identified factors and sub-factors, interviews were conducted with two experts. The first expert is a psychological officer from the Career and Counselling Department of UiTM Perlis. In her role as a counselor, this expert possesses a deep understanding of the academic environment and provides valuable insights into the concerns, aspirations, and career preferences of UiTM students. Meanwhile, the second expert is an executive officer from the Human Resources Department of Safwa Clinic, Kangar, Perlis, who is also an alumna of UiTM Perlis. Her professional journey from being a UiTM graduate to a human resources executive equips her with a unique perspective on career transitions and decision-making processes. Additionally, she is well-positioned to articulate the subtleties involved in career decision-making faced by UiTM graduates.

The interview involved several questions related to the experts such as demographic profile, including his or her gender, age, and education level, and also some questions related to the factors and subfactors that have influenced the career choice based on the experts' experience.

Step 2: The input from the interviews is transformed into the pairwise comparison matrices (PCM), according to the number of experts. The general form of the PCM is given as follows.

$$P=\begin{bmatrix} 1 & p_{12} & \cdots & p_{1n} \\ p_{21} & 1 & \cdots & p_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ p_{n1} & p_{n2} & \cdots & 1 \end{bmatrix} \tag{1}$$

where $p_{11}, p_{12}, \ldots, p_{nn}$ represents the input or value for each factor given by the experts in the scale of 1 to 9. It should be noted that $p_{ji} = 1/p_{ij}$ and $p_{ii} = 1$ for every $i, j = 1,2,3,\ldots,n$. In other words, if the essential preferences p_{ij} is in the upper triangle of the matrix, then the reciprocal value $p_{ji} = 1/p_{ij}$ must be at the lower triangle or vice versa. Hence, the PCM or the matrix A in Eq. (1) is always positive and symmetric (Bozanic, et al., 2013).

Step 3: The consistency ratio (CR) is calculated in order to make sure that the input obtained from the experts is acceptable. It should be noted that CR should be less than or equal to 10% (0.1), then verifies that the results of comparison are acceptable (Saaty, 1980). The CR is computed using the equation below:

$$\text{CR} = \frac{\text{Consistency index (CI)}}{\text{Random consistency index (RI)}} \tag{2}$$

where

$$\text{CI} = \frac{\lambda_{\max} - n}{n-1} \tag{3}$$

and $\lambda_{\max}$ is the largest eigenvalue of the comparison matrix and n is the number of factors. While, the random consistency index (*RI*) is based on the number of factors (Saaty, 1980), as given in Table 2.

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Table 2. Random consistency index

Number of factors, *n*	1	2	3	4	5	6	7	8	9	10
Ratio Index, *RI*	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

Next, the entries of the PCM for both experts are fuzzified. In other words, all the entries are transformed to be in the form of the triangular fuzzy number (TFN) of (l,m,u).

On the other hand, the scales of 1 to 9 that are given by the experts that corresponds to its TFN, reciprocal TFN and linguistic variables are given the following Table 3.

Table 3. Linguistic variable for pairwise comparison of each criterion

Classical/Non-fuzzy Number	Triangular Fuzzy Number	Triangular Fuzzy Reciprocal Number	Linguistic Variables
1	(1, 1, 1)	(1, 1, 1)	Equally Important
3	(2, 3, 4)	(1/4, 1/3, 1/2)	Moderate Important
5	(4, 5, 6)	(1/6, 1/5, 1/4)	Strong Important
7	(6, 7, 8)	(1/8, 1/7, 1/6)	Very Strong Important
9	(9, 9, 9)	(1/9, 1/9, 1/9)	Extremely Strong Important
2	(1, 2, 3)	(1/3, 1/2, 1)	Intermediate Values
4	(3, 4, 5)	(1/5, 1/4, 1/3)	
6	(5, 6, 7)	(1/7, 1/6, 1/5)	
8	(7, 8, 9)	(1/9, 1/8, 1/7)	

Source: Kannan et al (2013)

Thus, the PCM becomes a fuzzy PCM, $\tilde{P}=(l,m,u)$ as follows.

$$\tilde{P}=\begin{bmatrix}(1,1,1) & \tilde{p}_{12} & \cdots & \tilde{p}_{1n}\\ \tilde{p}_{21} & (1,1,1) & \cdots & \tilde{p}_{2n}\\ \vdots & \vdots & \ddots & \vdots\\ \tilde{p}_{n1} & \tilde{p}_{n2} & \cdots & (1,1,1)\end{bmatrix} \tag{4}$$

From that, the average of all factors provided by the experts which already in the form of TFN and reciprocal TFN are calculated.

$$Average\left(l_{ij},m_{ij},u_{ij}\right)=\frac{\sum_{k=1}^{k}\left(l_{nn}^{k},m_{nn}^{k},u_{nn}^{k}\right)}{k} \tag{5}$$

where k represents the number of experts.

Step 4: Calculation of fuzzy geometric mean $\tilde{r}_i$ of each factor *i* is performed using the following Eq. (6).

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$$\tilde{r}_i = \left(\tilde{p}_{i1} \times \tilde{p}_{i2} \times \ldots \times \tilde{p}_{in}\right)^{\frac{1}{n}} \tag{6}$$

where n is the number of factors. Subsequently, calculate the vector summation of the geometric mean and its reciprocal using the following Eq. (7) and (8) respectively.

$$\text{Vector summation} = \sum_{i=1}^{n} \tilde{r}_i = \left(\sum l_{r_i}, \sum m_{r_i}, \sum u_{r_i}\right) \tag{7}$$

$$\text{Reciprocal} = \left(\sum_{i=1}^{n} \tilde{r}_i\right)^{-1} = \left(\frac{1}{\sum u_{r_i}}, \frac{1}{\sum m_{r_i}}, \frac{1}{\sum l_{r_i}}\right) \tag{8}$$

Step 5: Compute the fuzzy weight $\tilde{w}_i$ of each factor i using:

$$\tilde{w}_i = \tilde{r}_i \times \left(\sum_{i=1}^{n} \tilde{r}_i\right)^{-1} \tag{9}$$

where $\tilde{r}_i = (l_i, m_i, u_i)$.

Step 6: Defuzzified the fuzzy weight $\tilde{w}_i = (l_i, m_i, u_i)$ to obtain the non-fuzzy weight, using:

$$w_i = \frac{l_i + m_i + u_i}{3} \tag{10}$$

Step 7: Normalized the non-fuzzy weight, so that the factor can be ranked, based on the following formula.

$$Z_i = \frac{w_i}{\sum_{i=1}^{n} w_i} \tag{11}$$

where Z_i is the normalized weight.

Apart from that, the normalized weight of sub-factors is obtained by multiplying the normalized weight of each factor to the weight of each sub-factor. It should be noted that both factors and sub-factors are ranked from the highest value to the lowest value of the normalized weight (Nobanee & Ellili, 2018). Hence, the highest value would be the most influence factor or sub-factor that contributes to the students' career choice.

4. RESULT AND DISCUSSION

This section provides some results and discussions in analysing the factors and sub-factors that influence the student's career choice. Table 4 and 5, provides the PCM for factors and sub-factors respectively, and their consistency ratios of each expert.

Table 4. Pairwise comparison matrix for factors for both experts and their consistency ratios

Expert 1					
Pair Comparison	Parental Influence	Academic Influence	Self-Interest	Work Environment	**Consistency Ratio**
Parental Influence	1	1/3	1/7	¼	0.0854
Academic Influence	3	1	1/7	1/3	
Self-Interest	7	6	1	5	

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Work Environment	4	3	1/5	1	
Expert 2					
Pair Comparison Subfactor 2	Parental Influence	Academic Influence	Self-Interest	Work Environment	**Consistency Ratio**
Parental Influence	1	1/3	1/6	1/3	0.0605
Academic Influence	3	1	1/5	½	
Self-Interest	6	5	1	4	
Work Environment	3	2	¼	1	

Table 5. Pairwise comparison matrices for sub-factors of each expert and their consistency ratios

Expert 1				
Pair Comparison Sub-factor 1	Parents Expectation	Family Tradition	Safety	**Consistency Ratio**
Parents Expectation	1	1/5	1/3	0.0836
Family Tradition	5	1	4	
Safety	3	¼	1	
Pair Comparison Sub-factor 2	CGPA Level	Scholarship	Difficulty	**Consistency Ratio**
CGPA Level	1	½	2	0.0517
Scholarship	2	1	2	
Difficulty	½	½	1	
Pair Comparison Sub-factor 3	Passion	Workplace	Salary	**Consistency Ratio**
Passion	1	½	5	0.0518
Workplace	2	1	5	
Salary	1/5	1/5	1	
Pair Comparison Sub-factor 4	Gender	Race	Friends	**Consistency Ratio**
Gender	1	1	¼	0.0177
Race	1	1	1/6	
Friends	4	6	1	
Expert 2				
Pair Comparison Sub-factor 1	Parents Expectation	Family Tradition	Safety	**Consistency Ratio**
Parents Expectation	1	7	5	0.0744
Family Tradition	1/7	1	1/5	
Safety	1/5	4	1	
Pair Comparison Sub-factor 2	CGPA Level	Scholarship	Difficulty	**Consistency Ratio**
CGPA Level	1	6	4	0.0521
Scholarship	1/6	1	1/3	
Difficulty	¼	3	1	
Pair Comparison Sub-factor 3	Passion	Workplace	Salary	**Consistency Ratio**
Passion	1	1/7	1/5	0.0630
Workplace	7	1	3	
Salary	5	1/3	1	
Pair Comparison Sub-factor 4	Gender	Race	Friends	**Consistency Ratio**
Gender	1	1	2	0.0516
Race	1	1	1	
Friends	½	1	1	

As shown in the above tables, the consistency ratio for each factor and sub-factor is less than 0.1, which means that the comparisons made by the experts are acceptable. Hence the calculation is proceeded. First, calculate the average of all values in the fuzzy PCM, which all the entries are in the form of triangular fuzzy numbers (l,m,u), as shown in the following Table 6 and 7.

Table 6. Average pairwise comparison matrix for all experts

Pair Comparison	Parental Influence	Academic Influence	Self-Interest	Work Environment
Parental Influence	(1, 1, 1)	(0.29, 0.42, 0.75)	(0.12, 0.13, 0.15)	(0.20, 0.25, 0.33)
Academic Influence	(1.50, 2.50, 3.50)	(1, 1, 1)	(0.15, 0.18, 0.23)	(0.29, 0.42, 0.67)

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Self-Interest	(6.50, 7.50, 8.50)	(4.50, 5.50, 6.50)	(1, 1, 1)	(3, 4, 5)
Work Environment	(3, 4, 5)	(1.50, 2.50, 3.50)	(0.25, 0.35, 0.38)	(1, 1, 1)

Table 7. Average pairwise comparison matrix for sub-factors in the triangular fuzzy number form

Pair Comparison Sub-factor 1	Parents Expectation	Family Tradition	Safety
Parents Expectation	(1, 1, 1)	(3.08, 3.60, 4.13)	(2.13, 2.67, 3.25)
Family Tradition	(2.06, 2.57, 3.08)	(1, 1, 1)	(1.58, 2.10, 2.63)
Safety	(1.08, 1.60, 2.13)	(1.60, 2.13, 2.67)	(1, 1, 1)
Pair Comparison Sub-factor 2	CGPA Level	Scholarship	Difficulty
CGPA Level	(1, 1, 1)	(2.67, 3.25, 4.00)	(2, 3, 4)
Scholarship	(0.57, 1.08, 1.60)	(1, 1, 1)	(0.63, 1.17, 1.75)
Difficulty	(0.27, 0.38, 0.67)	(1.17, 1.75, 2.50)	(1, 1, 1)
Pair Comparison Sub-factor 3	Passion	Workplace	Salary
Passion	(1, 1, 1)	(0.23, 0.32, 0.58)	(2.08, 2.60, 3.13)
Workplace	(3.50, 4.50, 5.50)	(1, 1, 1)	(3, 4, 5)
Salary	(2.08, 2.60, 3.13)	(0.21, 0.27, 0.38)	(1, 1, 1)
Pair Comparison Sub-factor 4	Gender	Race	Friends
Gender	(1, 1, 1)	(1, 1, 1)	(0.60, 1.13, 1.67)
Race	(1, 1, 1)	(1, 1, 1)	(0.57, 0.58, 0.60)
Friends	(1.17, 1.75, 2.50)	(3, 3.50, 4)	(1, 1, 1)

Next, calculation of the fuzzy geometric mean of each factor and sub-factor are performed using the Eq. (5). The results are presented in Table 8 and 9.

Table 8. Fuzzy geometric mean for all factors

Factors	l	m	u
Parental Influence, $\tilde{r}_1$	0.2881	0.3437	0.4435
Academic Influence, $\tilde{r}_2$	0.5101	0.6611	0.8512
Self-Interest, $\tilde{r}_3$	3.0606	3.5840	4.0769
Work Environment, $\tilde{r}_4$	1.0299	1.3679	1.6059
Vector summation, $\sum_{i=1}^{4}\tilde{r}_i$	4.8870	5.9565	6.9721
Reciprocal of vector summation, $\left(\sum_{i=1}^{4}\tilde{r}_i\right)^{-1}$	0.1434	0.1679	0.2046

Table 9. Fuzzy geometric means for all sub-factors

Sub-factors of Factor 1 (Parental Influence)			
Parents Expectation, $\tilde{r}_1$	1.8712	2.1253	2.3756
Family Tradition, $\tilde{r}_2$	1.4836	1.7544	2.0078
Safety, $\tilde{r}_3$	1.2012	1.5037	1.7828
Vector summation, $\sum_{i=1}^{3} r_i$	4.5561	5.3834	6.1662

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Inverse of vector summation, $\left(\sum_{i=1}^{3} r_i\right)^{-1}$	0.1622	0.1858	0.2195
Sub-factors of Factor 2 (Academic Influence)			
CGPA Level, $\tilde{r}_1$	1.7472	2.1363	2.5198
Scholarship, $\tilde{r}_2$	0.7095	1.0812	1.4095
Difficulty, $\tilde{r}_3$	0.6776	0.8690	1.1856
Vector summation, $\sum_{i=1}^{3} r_i$	3.1343	4.0865	5.1149
Inverse of vector summation, $\left(\sum_{i=1}^{3} r_i\right)^{-1}$	0.1955	0.2447	0.3191
Sub-factors of Factor 3 (Self-Interest)			
Passion, $\tilde{r}_1$	0.7816	0.9419	1.2216
Workplace, $\tilde{r}_2$	2.1898	2.6207	3.0184
Salary, $\tilde{r}_3$	0.7571	0.8851	1.0543
Vector summation, $\sum_{i=1}^{3} r_i$	3.7285	4.4477	5.2943
Inverse of vector summation, $\left(\sum_{i=1}^{3} r_i\right)^{-1}$	0.1889	0.2248	0.2682
Sub-factors of Factor 4 (Work Environment)			
Gender, $\tilde{r}_1$	0.8434	1.0400	1.1856
Race, $\tilde{r}_2$	0.8298	0.8355	0.8434
Friends, $\tilde{r}_3$	1.5183	1.8297	2.1544
Vector summation, $\sum_{i=1}^{3} r_i$	3.1916	3.7052	4.1835
Inverse of vector summation, $\left(\sum_{i=1}^{3} r_i\right)^{-1}$	0.2390	0.2699	0.3133

Following this, Tables 10 and 11 present the calculated fuzzy weight, non-fuzzy weight, and normalized weight using Eqs. (6-8). Subsequently, based on the normalized weight, the factors and subfactors are ranked.

Table 10. Fuzzy weight, non-fuzzy weight, and normalized weight of all factors

Factor	**Fuzzy Weight**	**Non-Fuzzy Weight**	**Normalized Weight**	**Rank**
Parental Influence	(0.0413, 0.0566, 0.0908)	0.0633	0.0607	4
Academic Influence	(0.0732, 0.1110, 0.1742)	0.1194	0.1146	3
Self-Interest	(0.4390, 0.6017, 0.8342)	0.6250	0.5995	1
Work Environment	(0.1475, 0.2296, 0.3275)	0.2349	0.2253	2
	SUM	1.0495		

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Based on the above Table 10, self-interest holds the highest significance in influencing students' career decisions, indicated by a normalized weight of 0.5995 in the fuzzy AHP analysis. Following closely is the work environment, carrying a normalized weight of 0.2253, succeeded by academic influence at 0.1146, and parental influence at 0.0607. Experts unanimously emphasize the vital role of personal interests, acknowledging its power to empower students in pursuing careers aligned with their passions. This autonomy allows students to make decisions based on what they believe is best for their future, guided by personal preferences and advice from close associates. Prioritizing self-interest over external expectations alleviates pressure, fostering courage and conscientious decision-making.

Considering the rankings of these factors, there is a call to action to fully support students and value their opinions in shaping their careers based on individual abilities. Acknowledging their voice becomes crucial as they navigate the challenges and hard work inherent in their chosen paths. Notably, parental influence emerges as the least impactful factor in shaping students' career decisions.

On the other hand, the rank of the sub-factors is presented in the following Table 11.

Table 11. Fuzzy weight, non-fuzzy weight, and normalized weight of all sub-factors

Factor	Weight of Factor	Sub-factor	Fuzzy Weight of Sub-factor	Weight of Sub-factor	Normalized Weight of Factor × Weight of Sub-factor	Normalized Weight of Sub-factor	Rank
Parental Influence	0.0658	Parents Expectation	(0.3035, 0.3948, 0.5214)	0.4066	0.0268	0.0251	10
		Family Tradition	(0.2406, 0.3259, 0.4407)	0.3357	0.0221	0.0207	11
		Safety	(0.1948, 0.2793, 0.3913)	0.2885	0.0190	0.0178	12
Academic Influence	0.1242	CGPA Level	(0.3416, 0.5228, 0.8040)	0.5561	0.0691	0.0647	5
		Scholarship	(0.1387, 0.2646, 0.4497)	0.2843	0.0353	0.0330	8
		Difficulty	(0.1325, 0.2127, 0.3783)	0.2411	0.0299	0.0280	9
Self Interest	0.6526	Passion	(0.1476, 0.2118, 0.3276)	0.2290	0.1494	0.1398	2

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		Workplace	(0.4136, 0.5892, 0.8096)	0.6041	0.3942	0.3690	1
		Salary	(0.1430, 0.1990, 0.2828)	0.2083	0.1359	0.1272	3
Work Environment	0.1806	Gender	(0.2016, 0.2807, 0.3715)	0.2846	0.0514	0.0481	6
		Race	(0.1984, 0.2255, 0.2643)	0.2294	0.0414	0.0388	7
		Friends	(0.3629, 0.4938, 0.6750)	0.5196	0.0938	0.0878	4
				SUM	1.0683		

Table 11 reveals that the workplace has the most influence on students' career choices, with a normalized weight of 0.3690. Following closely are passion, with a weight of 0.1398, and salary, with a weight of 0.1272. These three sub-factors all fall under the personal interest category. With today's higher cost of living and economic concerns, experts acknowledge that personal interests can play a role in students' job decisions. The workplace is especially vital as it helps students save money on rent and transportation, and living with parents provides care for them. Passion and salary are crucial factors in career decisions, as passion keeps people in careers they enjoy, and salary boosts motivation and productivity.

Experts noted that friends, a sub-factor under the work environment category with a normalized weight of 0.0878, carry more weight than CGPA level, gender, with weights of 0.0647 and 0.0481, respectively. A comfortable work environment with friends helps reduce stress and enhances productivity. Outstanding academic achievements provide students the freedom to choose their favored career path. The competitive job market compels students to strive for academic excellence to achieve their career goals.

Table 11 also indicates that race, under the work environment category, has more impact on students' career choices than scholarship and difficulty, with normalized weights of 0.0388, 0.0330, and 0.0280, respectively. Recognizing everyone's right to equality, race impacts various career-related activities. Scholarships, on the other hand, are tied to specific professions, allowing students to focus on their studies without job worries.

All sub-factors under the parental influence category, which are parents' expectations, family tradition, and safety, are ranked as the three least influential factors on students' career choices, with normalized weights of 0.0251, 0.0207, and 0.0178, respectively. While parents have expectations for their children, not all children can meet them. Family tradition, though least influential, broadens students' awareness of alternative careers. Safety, as a sub-factor, reflects the fearlessness to explore new career options.

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In conclusion, students now have a clearer understanding of which factors and sub-factors to consider in making career decisions, with the workplace being the most crucial. Within the parental influence category, safety emerges as the least impactful sub-factor influencing students' career choices.

5. CONCLUSION

This study aims to analyse the main factors and sub-factors that influence graduated students' career decisions using fuzzy AHP by selecting certain factors, which are parental influence, academic influence, personal interest, and work environment. Additionally, the study uses fuzzy AHP to rank the factors and sub-factors that affect the career decisions of graduates. The information utilized was gathered through interviews with two professionals; a psychological officer from the career and counselling department of UiTM Arau, Perlis, and also an executive officer from the human resources department of Safwa Clinic. The judgments provided by these two experts are deemed reliable due to their substantial experience in the relevant area. However, it is not deniable that having larger number of experts can contribute to a more comprehensive and diverse set of perspectives.

The study's conclusions indicate that the most crucial factors are personal interest, followed by the work environment, academic influence, and parental influence. Meanwhile, the workplace is the sub-factor that matters the most, followed by passion, salary, friends, CGPA level, gender, race, scholarship, difficulty, parents' expectations, family tradition, and safety.

Future studies are advised to analyse the variables impacting students' profession choices using a more pertinent methodology, such as Preference Ranking Organization Method for Enrichment of Evaluations (PROMETHEE) or fuzzy inference system. On the other hand, future studies can also look into the variables impacting students' career decisions for particular faculties. Faculty mathematics students, for instance, can choose to shift occupations or go into actuarial science, statistics, or mathematics. Students from various faculties may hold varying views regarding the elements that influence their choice of employment. Therefore, more research can yield more accurate results regarding the elements that affect students' career decisions across various faculties. New factors and sub-factors, such as work-life balance, travel needs, abilities and skills, job opportunities, and personality-driven factors, can also be added by future researchers. These would aid in obtaining more precise outcomes.

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7. CONFLICT OF INTEREST STATEMENT

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders.

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