FACTORS CONTRIBUTING TO RAPE CASES IN MALAYSIA USING A FUZZY ANALYTIC HIERARCHY PROCESS

Muhamad Firdaus Mohd Jamizar[1], Muhammad Fauzi Embong[2*] and Erni Fazlina Mohd Akhir[3]

[1,2,3]*Faculty of Computer and Mathematical Sciences,*
Universiti Teknologi MARA (UiTM) Cawangan Terengganu,
Kampus Kuala Terengganu, 21080 Kuala Terengganu, Terengganu, Malaysia

[1*]firdauscuber27@gmail.com, [2]muham303@uitm.edu.my, [3]noore800@uitm.edu.my

(indicates the corresponding author)*

ABSTRACT

Sexual issues in society are growing increasingly severe, notably rape offences. Rape is described in Malaysian penal code section 375 as a sexual assault which means doing sexuality without the individual will. Besides, sexual intercourse with or without the willing of a girl under the age of 16 is described as statutory rape. This research helps to open people's thoughts and raise awareness of the problem and effects of this type of crime in Malaysia. There are far too many contributing elements, and this study highlights the most important ones in rape cases. The seven key contributing variables are ranked in this study. To overcome this issue, the Fuzzy Analytic Hierarchy Process (FAHP) technique is utilized, which allows the seven contributing elements to be prioritized.

Keywords: *Analytical Hierarchy Process, Decision Making, Rape Cases, Factors of Rape Cases, Rank of the Factors*

Received for review: 10-04-2022; Accepted: 17-04-2022; Published: 30-04-2022

1. Introduction

According to the Global Peace Index (GPI) 2020, Malaysia is the world's 20th most peaceful country. This annual rating has been conducting by the Institute for Economics and Peace (IEP) since 2008 (Badri, 2020). Despite that peace, society still faces a growing problem of rape cases. Even though offenders are subject to severe punishments including the death penalty, but rape cases continue to be a serious issue in many parts of the world (Nadesan, 2002).

The victims of these rape cases are not only women, but they also involve young children. Some sources are shown that men are also one of the victims of rape cases. However, such cases are very rarely reported to the authorities. Since rapes and sexual assault crimes affect our overall sense of safety, they have an impact on how we live our lives and raise our children. When a high-profile sex crime involves a well-known victim or offender, or when there are particularly gruesome aspects of the crime, media coverage of sex crimes becomes particularly saturated. However, the issue of rape and sexual offences is far more complicated than the horrific nature of the crimes and the fear they instill in so many people. The combination of the crimes and the community's reaction, as well as numerous myths and victim stereotypes, make this type of crime extremely difficult to investigate and prosecute.

Furthermore, the consequences of all these crimes are devastating, ranging from unwanted pregnancy to sexually transmitted infections, sleep and eating disorders, and other emotional and physical issues. Knowing the frequency and context of rape and sexual assault is essential for directing law enforcement resources and providing support to victims. These data have the potential to influence public health and mental health policies, as well as aid in the identification of interventions that will reduce the chances of future attacks.

Therefore, in Malaysia we have government organization such as the department of Social Welfare Malaysia where they are served to provide the solution for this kind of problems (O'Connor, 2021). Besides, we also have the non-government organization such as Women's Aid Organization (WOA), Women's Centre for Change (WCC) and others. Based on this study, there are some effects that affect the victims after the rape cases happened such as health problems, mental illness, and psychological problem.

2. Methodology/Implementation

The data have been collected from the experts which is the Family Counseling Officers. The data is required to demonstrate the ranking of each factor respectively start with the highest frequency. There are several factors that contribute to the rape crime, including victim itself, parents, internet and technology, family background, education, peer influence, and society and government.

1. The first step in this research is to determine the problem and analyze the factors of rape crimes. It is important to know which factors is most contribute to the rape crimes. We must describe the issue in terms of the criteria used to assess the factor of rape offences.

2. This study makes use of primary data. The information was gathered from three Family Counseling Officers professionals. Before commencing this portion, the questionnaire was distributed in adequate papers. All the questions are tied to one of seven variables. Each question was assigned a Likert scale score ranging from one to nine.

Table 2.1: Data Name

Factors	**Abbreviation**
Victim Itself	VI
Parents	P
Internet & Technology	I&T
Family Background	FB
Education	E
Peer Influence	PI
Society & Government	S&G

3. We need to develop a comparison matrix after we get the data and criteria. The utilized matrix is straightforward, has a strong position for the consistency framework, gathers other information that may be necessary with all conceivable comparisons, and can examine the overall priority sensitivity to changes in consideration. The following equations are used to define pairwise comparisons:

$$a_{ij} = \frac{w_i}{w_j}, \qquad i, j = 1, 2, \dots, n$$

Table 2.2: Pairwise Comparison

Factors	**VI**	**P**	**I&T**	**FB**	**E**	**PI**	**S&G**
VI	1.00	5.00	1.00	2.00	2.00	1.00	1.00
P	0.20	1.00	1.00	1.00	2.00	0.50	1.00
I&T	1.00	1.00	1.00	0.33	3.00	0.50	1.00
FB	0.50	1.00	3.00	1.00	3.00	1.00	2.00
E	0.50	0.50	0.33	0.33	1.00	0.50	1.00

PI	1.00	2.00	2.00	1.00	2.00	1.00	2.00
S&G	1.00	1.00	1.00	0.50	1.00	0.50	1.00
Sum	5.20	11.50	9.33	6.16	14.00	5.00	9.00

where n is the number of criteria compared w_i are weights for the i criterion, and a_{ij} is the weight of the i-criterion divided by the weight of j. Following the comparison of its criteria, each column is normalized into matrix form by dividing each value in column I and row j by the greatest value in column i.

$$a_{ij} = \frac{a_{ij}}{\max a_{ij}}, \qquad \forall i, j$$

Table 2.3: Normalize Comparison

Factors	**VI**	**P**	**I&T**	**FB**	**E**	**PI**	**S&G**	**CW**
VI	0.1923	0.4348	0.1072	0.3247	0.1429	0.2000	0.1111	0.2161
P	0.0385	0.0870	0.1072	0.1623	0.1429	0.1000	0.1111	0.1070
I&T	0.1923	0.0870	0.1072	0.0536	0.2143	0.1000	0.1111	0.1236
FB	0.0962	0.0870	0.3215	0.1623	0.2143	0.2000	0.2222	0.1862
E	0.0962	0.0435	0.0354	0.0536	0.0714	0.1000	0.1111	0.0730
PI	0.1923	0.1739	0.2144	0.1623	0.1429	0.2000	0.2222	0.1869
S&G	0.1923	0.0870	0.1072	0.0812	0.0714	0.1000	0.1111	0.1072

4. There is a comparison of the consistency index with a random generator (RI) value. This value is determined by the matrix order n.

Table 2.4: Random Index (RI) Table

n	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

To obtain a conclusion that is close to legitimate, consistency must be near faultless. Here is the formula for calculating the value of consistency. First, we must recognize the value of the eigenvector, which is the criterion's weighted value. We use the following equation to calculate the eigenvector:

$$w_i = \frac{\hat{a}_i}{n}, \qquad \forall i$$

Table 2.5: Consistency

Factors	**VI**	**P**	**I&T**	**FB**	**E**	**PI**	**S&G**	**WSV**	**WSV/CW**
VI	0.0416	0.0465	0.0133	0.0605	0.0104	0.0374	0.0119	0.2215	1.0248
P	0.0083	0.0093	0.0133	0.0302	0.0104	0.0187	0.0119	0.1021	0.9545
I&T	0.0416	0.0093	0.0133	0.0100	0.0156	0.0187	0.0119	0.1203	0.9733
FB	0.0208	0.0093	0.0398	0.0302	0.0156	0.0374	0.0238	0.1769	0.9500
E	0.0208	0.0047	0.0044	0.0100	0.0052	0.0187	0.0119	0.0756	1.0352
PI	0.0416	0.0186	0.0265	0.0302	0.0104	0.0374	0.0238	0.1885	1.0089
S&G	0.0416	0.0093	0.0133	0.0151	0.0052	0.0187	0.0119	0.1150	1.0734
								TOTAL	7.0201

w_i is the eigen vector, and $\hat{a}_i$ denotes the total of the matrix normalisation values divided by the number of criteria (n). The greatest eigenvalue is the number of times the number of columns is multiplied by the primary

eigenvector. As a result, the equation may be used to calculate it.

$$\lambda \max = \left(\sum GM_{11-n1} \times \bar{X}\,1\right) + \cdots + \left(\sum GM_{1n-ni} \times \overline{Xn}\right)$$
$$\lambda max = 1.0029$$

The value of CI may be calculated after getting the greatest lambda value.

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

$$CI = \frac{1.0029 - 7}{7-1}$$

$$CI = -0.9995$$

where CI is the consistency index and maximal lambda is the n-order matrix's biggest eigenvalue. When the value of CI is zero (0), the matrix is consistent. If the value of CI obtained is more than 0 (CI> 0), Saaty's limit of inconsistency is tested. Testing is evaluated using the Consistency Ratio (CR), which is an index number or a comparison of CI and RI.

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

$$CR = \frac{-0.9995}{1.32}$$

$$CR = -0.7572$$

The RI value chosen is consistent with the order n matrix. If the CR of a smaller matrix is 10% (0,1), this indicates that the discrepancy of each viewpoint is acceptable. Therefore, the value of CR is consistent.

5. The fuzzy analytic hierarchy process scale has three values, such that the lowest (lower, L), the middle (median, M), and the highest (upper, U). So, except for the identical comparison set, each fuzzy set will be separated into two (see Figure 2), as can be seen on the triangular fuzzy number scale.

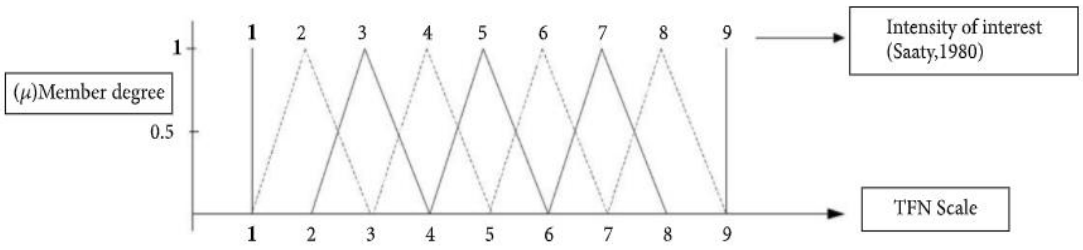

Figure 2.1: Graph of Fuzzy Triangle Set

6. The fuzzy synthesis value is calculated when the AHP comparison value is translated to the FAHP scale value. The following equation is used to illustrate the process of obtaining a fuzzy synthesis value:

$$S_i = \sum_{j=1}^{m} M_{gi}^{j} X \frac{1}{\left[\sum_{i=1}^{n}\sum_{j=1}^{m} M_{gi}^{j}\right]}$$

where, S_i is fuzzy synthesis value, $\sum_{j=1}^{m} M_{gi}^{j}$ is summing the cell value in that column starting from column 1 in each row matrix, i = row and j = column. We will obtain the defuzzification ordinate value (d') after comparing fuzzy synthesis values. The values of v and d' may be calculated using the above formula. We use the equation of the following formula to determine V'.

$$V(M_2 \geq M_1) = \begin{cases} 1, & if\, m_2 \geq m_1 \\ 0, & l_1 \geq u_2 \\ \dfrac{(l_1 - u_2)}{(m_2 - u_2) - (m_1 - l_1)}, & otherwise \end{cases}$$

Table 2.6: Weight Vector Calculation

Factors	**L**	**M**	**U**
VI	1.86	2.31	2.74
P	1.18	1.35	1.69
I&T	2.06	2.39	2.71
FB	1.38	1.70	2.05
E	1.06	1.24	1.47
PI	0.66	0.93	1.20
S&G	0.88	1.02	1.18
Total	9.08	10.93	13.04
Inverse	0.11	0.09	0.08
Increase	0.08	0.09	0.11

Calculating the value of the fuzzy vector weight (W'), the computation of the fuzzy weight value is presented using the equation of the following formula.

$$d'^{(Ai)} = \min V(Si > Sk)$$

By gathering previously acquired ordinate values, as seen below,

$$\sum W' = (vsk1, vsk2, \ldots, vskn)$$

Table 2.7: Fuzzy Weight

Factors	**L**	**M**	**U**
VI	0.15	0.21	0.30
P	0.09	0.12	0.19
I&T	0.17	0.21	0.30
FB	0.11	0.15	0.23
E	0.08	0.11	0.16
PI	0.05	0.08	0.13
S&G	0.07	0.09	0.13

The following formula, when applied to vector weight values, yields normalisation.

$$W' = \big(d'(A1), d'(A2), \ldots, d'(An)\big)T$$

Table 2.8: Defuzzification and Normalization

Factors	**Defuzzy**	**Normalize**
VI	0.22	0.209
P	0.13	0.128
I&T	0.23	0.216
FB	0.16	0.155
E	0.12	0.114
PI	0.09	0.085
S&G	0.10	0.093
Total	1.05	1.00

7. The next stage is to do an alternative value calculation in which the alternative settlement measures are the same as the criterion completion steps. The weight value of each alternative element will be determined by the weight of the criteria element and directed to obtain the choice result.

Table 2.9: Ranking

Factors	**Rank**
I&T	1
VI	2
FB	3
P	4
E	5
S&G	6
PI	7

The FAHP technique was employed in this study to generate the weight values used to rank the components. Before converting to fuzzy numbers, the FAHP technique went through five phases, including the AHP methodology. The actual processes required were to select factors and calculate the AHP technique to obtain the pairwise comparison matrix number, to change these numbers to fuzzy numbers, to derive the hierarchy structure, and to compute the fuzzy mean.

3. Results and Discussion

The purpose of utilizing FAHP is to eliminate uncertainty from the decision making model. Fuzzy numbers, as opposed to crisp numbers, are used in FAHP computations. This strategy has shown to be effective in every discipline, as well as in real-world scenarios for making wise judgments. FAHP is employed in this study due to its advantages and efficacy. In addition to fuzzy judgements, fuzzy numbers are employed.

The data's ambiguity and human subjectivity were then managed using Fuzzy set theory to compute utilizing the FAHP method and conclude the hierarchical structure.

Table 3.1: Aggregate Fuzzy for Criteria

Factors	**VI**			**P**			**I&T**			**FB**		
VI	1.00	1.00	1.00	4.00	4.67	5.33	2.04	2.38	2.72	2.00	2.67	3.33
P	0.43	0.44	0.98	1.00	1.00	1.00	2.33	2.67	3.00	0.71	0.71	0.72

I&T	2.38	2.72	3.07	0.71	0.72	0.73	1.00	1.00	1.00	3.08	3.78	4.50
FB	0.50	0.57	0.75	2.67	3.00	3.33	0.77	1.12	1.48	1.00	1.00	1.00
E	2.17	2.57	3.08	2.17	2.57	3.08	0.19	0.23	0.32	0.47	0.51	0.58
PI	0.50	0.56	0.67	1.06	1.73	2.42	0.44	0.79	1.15	0.48	0.53	0.61
S&G	0.71	0.71	0.72	1.72	2.07	2.42	1.05	1.39	1.73	0.50	0.57	0.75

Table 3.2: Aggregate Fuzzy for Criteria

Factors	**E**			**PI**			**S&G**		
VI	1.04	1.71	2.39	1.67	2.33	3.00	2.67	3.00	3.33
P	1.71	2.38	3.06	1.53	1.94	2.50	1.72	2.07	2.42
I&T	3.67	4.67	5.67	3.11	3.83	4.67	2.67	3.33	4.00
FB	2.33	3.00	3.67	2.00	2.67	3.33	2.00	2.67	3.33
E	1.00	1.00	1.00	2.11	2.83	3.67	1.67	2.00	2.33
PI	0.47	0.84	1.25	1.00	1.00	1.00	1.08	1.78	2.50
S&G	0.73	0.75	0.78	0.86	1.28	1.83	1.00	1.00	1.00

This tables shows the update pairwise comparison for criteria. All the values in this table are average of data of three experts according to fuzzy triangular number.

Table 3.3: Geometric Mean

Factors	**L**	**M**	**U**
VI	1.86	2.31	2.74
P	1.18	1.35	1.69
I&T	2.06	2.39	2.71
FB	1.38	1.70	2.05
E	1.06	1.24	1.47
PI	0.66	0.93	1.20
S&G	0.88	1.02	1.18
Total	9.08	10.93	13.04
Inverse	0.11	0.09	0.08
Increase	0.08	0.09	0.11

As we can see in this table, we have to find the geometric mean from the table 3.2 based on the lower section median section and the upper section respectively. Then, we find the summation for each section. After that, we find the inverse of the summation. Then, we rearrange into ascending orders.

Table 3.4: Fuzzy Weight of Criteria

Factors	**L**	**M**	**U**
VI	0.15	0.21	0.30
P	0.09	0.12	0.19
I&T	0.17	0.21	0.30
FB	0.11	0.15	0.23
E	0.08	0.11	0.16

PI	0.05	0.08	0.13
S&G	0.07	0.09	0.13

In this table, we need to find the fuzzy weight. For examples, all the value in each column needs to be divided with the inverse values that already rearrange in ascending order with the same column.

Table 3.5: Defuzzification and Normalization

Factors	**Defuzzy**	**Normalize**
VI	0.22	0.209
P	0.13	0.128
I&T	0.23	0.216
FB	0.16	0.155
E	0.12	0.114
PI	0.09	0.085
S&G	0.10	0.093
Total	1.05	1.00

This table shows defuzzification and normalization. For defuzzification, we need to calculate the average of all section which are lower, median and upper sections. After that, we calculate the summation of the defuzzification. For the normalization, the value of defuzzification need to be divided with the summation of the defuzzification. To check whether our values of normalization is correct is we total up all the values of normalization and we will get the value of 1. Therefore, our normalization is correct.

Table 3.6: Ranking

Factors	**RANK**
I&T	1
VI	2
FB	3
P	4
E	5
S&G	6
PI	7

This table shows the ranking of the factors. This ranking is based on the value of the normalization. Based on the Table 3.6, the highest ranking of the factors that contribute to the rape crime is internet and technology. The usage of the internet and the rapid growth of technology have a detrimental influence on society, particularly on adolescents, who are more prone to undesirable behaviors and attitudes. Smartphones make it far too easy to access sex and pornographic information. Furthermore, spreading an improper information among teenagers are very unhealthy culture, because they will explore and easy to expose with the negative social media sites. Therefore, they will be very complacent and will make their life worst. It is not unusual for teenagers to be aware of sex as early as the age of twelve.

In the era of modernity, all the children nowadays have their own mobile phones. So, they are exposed to the many things that can affect them. For those who did not have been watched by their parents or someone older, they intend to make their own decision such as try to be in a relationship. Because of their immaturity and shallow thinking, both victims and offenders are readily enticed and subjected to rape or sexual actions for a variety of

reasons.

Aside from that, teenagers are forced to face the real problem which is cause from the bad family social and communication. Family economy is important in order to make and have a visionary child and have a good opportunity in the future (Maes, 2019). Therefore, a good family must give their support to their children and have a good communication skill, so they will gain our respect and take a big responsibility to become the best human in his or her family by achieving their pure objectives and goals. Then, they will not be spending their time into something unappropriated or something with no good impact on them.

4. Conclusion and Recommendation

In this study, the FAHP technique was employed to help reach the objectives of study. By utilized FAHP method we now can know the highest factors that contribute to the rape crime. Then, we already know what the best solution to cope the rape crime. We hope that in this way we can help in spreading awareness about the crime of rape in a more logical way that is by using the FAHP approach in this study.

The study's goal was to identify and analyze data of the factors. Then, the factors will be ranked based on the highest and the lowest factors that contribute the rape crime in Malaysia. As a result of the systematic study, several actions to minimize rape instances in the community can be implemented. The TFN recognizes quantitative scales as a means of capturing the linguistic subjectivity of variables. The FAHP approach employs the pairwise comparison matrix computation. The fuzzy technique was utilized to determine the major elements that contributed to the pairwise comparison matrix using relative weights. In this way, the authorities can organize and be prepared in taking any action to alleviate this situation. Indirectly, a responsible society will also help in calming this down. It also provides a practical solution by allowing authorities to thoroughly examine the components involved in case settlement. As a conclusion, the appropriate procedures to address it can be done.

This article offers solutions for analyzing and prioritizing the elements for decision-makers. If the hierarchical structure is maintained, the model may be adapted to practically any industry. In the current study, an FAHP technique with seven criteria was employed to analyze the rankings. The factors' relative weights were utilized to analyze them. Given that the elements alter based on demographic and environmental situations, the data presented is analyzed to promote awareness in society. TOPSIS analysis is a compensatory aggregation approach that analyses a group of alternatives by determining weights for each criterion, normalizing scores for each criterion, and computing the geometric distance between each alternative and the ideal option, which has the highest score in each criterion.

Acknowledgements

The authors express their heartfelt gratitude to the editors and referees for their helpful suggestions and constructive comments.

References

Ebrahimi, S., & Bridgelall, R. (2021). A fuzzy Delphi analytic hierarchy model to rank factors influencing public transit mode choice: A case study. *Research in Transportation Business & Management, 39,* 100496.

Khanmohammadi, E., Malmir, B., Safari, H., & Zandieh, M. (2019). A new approach to strategic objectives ranking based on fuzzy logarithmic least squares method and fuzzy similarity technique. *Operations Research Perspectives, 6,* 100122.

Lorenz, K., & Ullman, S. E. (2016). Alcohol and sexual assault victimization: Research findings and future directions. *Aggression and Violent Behavior, 31,* 82-94.

Maes, C., Schreurs, L., van Oosten, J. M., & Vandenbosch, L. (2019). #(Me) too much? The role of sexualizing online media in adolescents' resistance towards the metoo-movement and acceptance of rape myths. *Journal of adolescence, 77,* 59-69.

Nadesan, K., & Omar, S. Z. (2002). Rape--the Malaysian Scenario. *The Malaysian journal of pathology, 24*(1),

9-14.

O'Connor, J., McMahon, S., Cusano, J., Seabrook, R., & Gracey, L. (2021). Predictors of campus sexual violence perpetration: A systematic review of research, sampling, and study design. *Aggression and Violent Behavior*, *58*, 101607.

Rudin, M. A. F. M., & Jusoh, A. J. (2020). FACTORS THAT CONTRIBUTE TO RAPE IN MALAYSIA. *PalArch's Journal of Archaeology of Egypt/Egyptology*, *17*(6), 11952-11965.

Sharma, Y. K., Yadav, A. K., Mangla, S. K., & Patil, P. P. (2018). Ranking the success factors to improve safety and security in sustainable food supply chain management using fuzzy AHP. *Materials Today: Proceedings*, *5*(5), 12187-12196.

Wen, M., You, C., & Kang, R. (2010). A new ranking method to fuzzy data envelopment analysis. *Computers & mathematics with applications*, *59*(11), 3398-3404.