SOCIAL MEDIA USAGE FOR BUSINESSES BASED ON THE PREFERENCES OF STUDENTS OF UNIVERSITI TEKNOLOGI MARA (UiTM) SELANGOR BRANCH BY USING FUZZY TOPSIS

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Abstract: As technology and trends have changed so quickly in the last few years, social media and digital networks seem to be becoming more important to how people act, and businesses can make money off of that. Consumers can find anything they want on social media websites and comparing which products and services are good based on their own preferences, which will make it more difficult for businesses to compete with each other. The choice of the appropriate social media platform by users has a significant impact on businesses, particularly those that utilize social media to sell their products and connect with prospective customers. Companies will benefit from this data, as well as recommendations on which social media sites they should use, as a result of this study. Furthermore, our insights can help them create successful tactics for maximizing earnings, minimizing costs, and eventually growing sales among their target customers. Students from Universiti Teknologi MARA (UiTM) Selangor branch will be the decision makers on which of the four social media options to use based on four key criteria. The Fuzzy Technique for Order Preference by Similarity to Ideal Situation (TOPSIS) technique is proposed in this study to rate the options and accomplish the study's objectives. As a result, Instagram is ranked first among UiTM students, followed by TikTok, Twitter, and Facebook. Instagram is the most appropriate and popular medium for businesses and enterprises to sell their products. Firms benefit from this since the young generation use Instagram as a platform for product research, and this allows them to have a better understanding of their products in a short period of time. Indirectly, it makes it easier for businesses to meet with potential customers.

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INTRODUCTION

The Internet is a global network of computer networks that connects computers in over 150 nations. On the Internet, there are hundreds of networks, a couple thousand computers, and millions of users, and this number is growing every day. You may send electronic mail, talk with colleagues all over the world, and get knowledge on a wide range of topics via the Internet. A lot has changed in a decade about how much it costs to use the internet. In most businesses, it is now a must to have internets in order to be successful. Through the usage of the Internet, all businesses and people may communicate with one another regardless of their location or time of day. The Internet provides access to a vast amount of information and most of it is free (An Introduction to the Internet, 1995, September).

The internet and social media offer a variety of advantages and possibilities for teenagers to promote themselves in a number of different ways according to Uhls, Y. T., Ellison, N. B., and Subrahmanyam, K. (2017). Young adults can retain close relationships and support systems that they would not have been able to maintain otherwise, and they have access to more knowledge than ever before. The online groups and social connections that young people create can be quite beneficial to their development and boost young people's self-esteem and social abilities.

Social media and digital networks appear to be playing an increasingly essential part in the lives of people all over the globe. It is an internet-based form of communication. There are some people debating whether it is improving communication skills or not (Syed Noman Ali, 8 August 2012). In the past decade, social media has been among the most significant effects on the way people engage with one another. As technology becomes more popular and is used more often, social media has emerged as the new standard for communicating everything. For example, people would post pictures during engagement.

There has been a worldwide increase in the use of social networking sites and these networks serve as an example of efficient communication. Students, parents, corporations, and religious groups all make use of social media platforms. It is utilized in a variety of ways by different platforms for a variety of purposes. For example, Facebook, Twitter, Instagram, Snapchat, Blogger, and others (Griffith and Tengnah, 2009). Social media uses many delivery devices, including mobile devices and computers. In a modern era, having an account on social media is a must in our society. If we do not have this type of platform, we are considered as a person not up to date or outdated. Indirectly, the use of these social sites has a positive and negative impact on the society's lifestyle.

According to Alison Coleman (2012), social media has several benefits for businesses. The researcher developed a presence on Twitter and Facebook, and tracked activity using call tracker numbers, exploring the importance it provided to enhance the practice's visibility and engage and educate current patients. By linking both feeds to the website, the practice has remained consistently high in local dental searches. The use of social media by small businesses to market themselves and connect with their customers is becoming more common. In terms of business, social media also is a type of internet communication that enables us to communicate with consumers and exchange real - time information. Based on business.gov.au website, social media may assist a business in attracting consumers, receiving feedback from customers, and building customer loyalty, expanding its market reach to include foreign markets, and recruiting talented employees, for example, through employment network sites such as LinkedIn. Therefore, to find out which type of social media the students of Universiti Teknologi MARA (UiTM) Selangor branch like to use for businesses, this project was done by using Fuzzy TOPSIS (Technique for Order Preference by Similarity to Ideal Solution).

Fuzzy logic is intended to make people resolve issues by taking into account all the information they have and attempting to make the optimal choice based on that information. It was first invented by Lofti Zadeh in 1965. On the other hand, TOPSIS was developed by Hwang and Yoon in 1981 and was the first to be used. A lot of people have been working on how to rank options of alternatives in a MCDM (Multi Criteria Decision-making) process based on the opinions of different decision makers. The goal of these studies was to figure out which alternatives the decision maker should choose based on a variety of criterions. The alternatives are ranked in order of how desirable they are based on a number of different criterions, and also on the decision makers' options. The best rated performance is selected and listed as the first alternative with the highest preference. The alternatives with another highest preference come in second, and etc.

The combination of MCDM method and fuzzy method brings to a new decision theory. This new type of theory allows us to make decisions when we have an incomplete and lack of information or knowledge. However, in this project, Fuzzy TOPSIS methods will be used. The list of criteria that was used are Content, Functionality, Usability, and Privacy which was referred to previous research by Nor Nazuin Nazarail and Zurina Kasim on 29 September 2020. As for the alternatives also based on the same paper but change Snapchat into TikTok. So, the list of alternatives are Facebook, Instagram, Twitter and TikTok.

OBJECTIVE

The purpose of this study is to determine which social media should business companies use to market their products and are popular among students of Universiti Teknologi MARA (UiTM) Selangor branch based on certain chosen criteria. This study used Fuzzy TOPSIS to determine the relative importance and to rank the social media platforms based on their criteria.

SIGNIFICANCE OF THE PROJECT

The Fuzzy TOPSIS model is applied in our study to rank social media networks depending on the user's choice. Companies and enterprises interested in advertising on social media platforms could benefit from this project. The findings give them benefits as well as recommendations on which social media site they should use. Moreover, our insights can assist them to plan effective strategies in maximizing earnings, lowering costs, and ultimately increasing sales among their target clients. Therefore, choosing the best social media platforms would be easier for businesses, companies and other parties involved.

SCOPE AND LIMITATION OF THE PROJECT

The scope of this study is limited to students of UiTM Selangor branch. This research is specified among UiTM students who are at least 18 years old and are enrolled in a foundation, diploma, degree, or master's program to participate in this survey. 20 respondents were picked from this survey as our decision maker. We applied the Fuzzy TOPSIS method and used it to rank the alternatives of social media which are Facebook, Instagram, Twitter, and TikTok.

METHODOLOGY

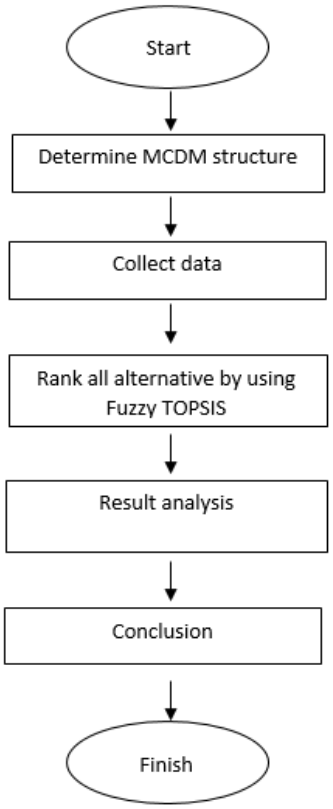

Figure 1: The process of how the research was done

Figure 1 illustrates a flowchart of how our research was carried out step by step. This study used the Fuzzy TOPSIS technique to evaluate different alternatives to the given criteria. This technique is regarded as a straightforward and practical MCDM technique (Mohamed Abdel-Basset et al., 2020). This project used the Fuzzy TOPSIS approach because it is one of the easiest Multi-Criteria Decision-Making MCDM methods to implement. Our study collected data and references from primary data utilizing an online questionnaire and the Fuzzy TOPSIS method.

MCDM structure

Multi-criteria decision making (MCDM) is also a research area that involves the analysis of various available choices in a situation or research area. MCDM will identify whether the choice of criteria given is favourable or unfavourable based on the result from the decision maker. To determine the best alternative with the greatest number of advantages, a committee of decision-makers will evaluate all available alternatives and criteria. In this research, the decision makers are the students who responded to the given questionnaire.

The set of alternatives $A = \{A_i,\ i = 1,2, \dots, m\}$ represents the available choices for the decision-maker which needs to be ranked. The set of criteria $C = \{C_j,\ j = 1,2, \dots, n\}$ represents the aspect influencing the decision maker's choice while ranking the alternatives. The performance A_i rating illustrates $x_{ij} = (i = 1,2, \dots, m; j = 1,2, \dots, n)$ the preference of the decision-maker for every alternative A_i against every criterion C_j. The performance ratings for each alternative A_i for every criterion C_j can be obtained in the form of a decision matrix which can be seen as below ;

$$X_{ij} = \begin{matrix} * \\ A_1 \\ A_2 \\ \vdots \\ A_i \end{matrix} \begin{matrix} C_1 & C_2 & \cdots & C_j \end{matrix} \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1j} \\ x_{21} & x_{22} & \cdots & x_{2j} \\ \vdots & \vdots & \ddots & \vdots \\ x_{i1} & x_{i2} & \cdots & x_{ij} \end{bmatrix} \quad (1)$$

Furthermore, the table below contains a description of each criterion used ;

Table 1: Description for each criterion

Criteria	**Description**
Content	What the user chooses to share and publish with their audience.
Functionality	Social interaction and access to news and information, and decision making.
Usability	Effectiveness, efficiency and the overall satisfaction of the user.
Privacy	The extent whereby a service is secure and safeguards consumer information

Data collection

Our data comprises five UiTM branches in Selangor: Dengkil campus, Shah Alam campus, Puncak Alam campus, Sungai Buloh campus, and Puncak Perdana campus. The data was derived from primary sources, which were collected via an online survey given via Google Forms and distributed across online platforms and social media platforms. Our respondents are students who are currently enrolled in a foundation, diploma, degree, or master's programme. This questionnaire is divided into two sections: Part A, which contains demographic data, and Part B, which contains information evaluation. After reviewing all of the 103 responses, 20 respondents were selected and ranked in order to assess the relative importance of each criterion and alternative. This is because, it aims to select inclusive respondents from each campus.

Fuzzy TOPSIS Method

The TOPSIS method determines the option that is closest to the Fuzzy Positive Ideal Solution (FPIS) and farthest from the Fuzzy Negative Ideal Solution (FNIS). The best performance values for each alternative represent approximately an FPIS, whilst the poorest performance values make up the FNIS.

This method establishes and applies fuzzy set theory for the purpose of improving literacy. In our research, triangular fuzzy numbers are applied and are represented by five language terms: "very low", "low", "average", "high", and "extremely high". This linguistic term is used in combination with a five-point fuzzy numeric scale ranging from 1 to 9 to rate the criteria and alternatives. The approximate value is represented by triangular fuzzy numbers, labelled as (a_1, a_2, a_3) where $1 \leq a_1 \leq a_2 \leq a_3 \leq 9$. Linguistic variable fuzzy ratings for each criterion is shown in Table 4. This linguistic variable is derived from a previous article by Balwinder Sodhi and Prabhakar T.V (2012) titled A Simplified Description of Fuzzy TOPSIS.

This research employed four criteria and four alternatives. Our alternative is based on the four most popular social media networks, including Facebook, Twitter, Instagram, and Tiktok. While the alternatives selection is based on the previous studies, Nor Nazuin Nazarail and Zurina Kasim (2021) on The Selection of Social Networking Sites Using Fuzzy Analytical Hierarchy Process. The steps involved in the fuzzy TOPSIS approach are as follows:

Step 1: The first stage is to form a panel of decision makers who are knowledgeable with the social media selecting process in a group that has K decision-makers $(D_1, D_{2,} \dots, D_k)$ are responsible for ranking $(A_1, A_{2,} \dots, A_i)$of each criterion $(C_1, C_{2,} \dots, C_j)$ in increasing order.

Step 2: Construct a combined fuzzy decision matrix to rank options which can be derived as $\tilde{x}_{ij} = (a_{ij}, b_{ij}, c_{ij})$ with following equation ;

$$a_{ij} = \min_k\{a^k{}_{ij}\},\ b_{ij} = \frac{1}{K}\sum_{k=1}^{K} b^k{}_{ij}\,, c_{ij} = \max_k\{a^k{}_{ij}\} \tag{2}$$

Step 3: The aggregated fuzzy weights for criterion which denoted as $\widetilde{w}_j = (w_{j1}, w_{j2}, w_{j3})$ and can be calculated using the equation below ;

$$w_{j1} = \min_k\{w^k{}_{j1}\},\ w_{j2} = \frac{1}{K}\sum_{k=1}^{K} w^k{}_{j2}\,, w_{j3} = \max_k\{w^k{}_{j3}\} \tag{3}$$

Step 4: The normalized fuzzy decision matrix can be calculated with two different formulas, where the normalized value $\tilde{R}_{ij}$ is calculated as ;

$$\tilde{r}_{ij} = \left(\frac{a_{ij}}{c^*{}_j}, \frac{b_{ij}}{c^*{}_j}, \frac{c_{ij}}{c^*{}_j}\right) \text{and } c^*{}_j = \max_i\{c_{ij}\} \quad \textbf{(benefit criteria)} \tag{4}$$

or

$$\tilde{r}_{ij} = \left(\frac{a^-{}_j}{a_{ij}}, \frac{a^-{}_j}{b_{ij}}, \frac{a^-{}_j}{c_{ij}}\right) \text{and } a^-{}_j = \min_i\{c_{ij}\} \quad \textbf{(cost criteria)} \tag{5}$$

Step 5: Calculate the weighted normalized fuzzy decision matrix. The weighted normalized value $\tilde{V}_{ij}$ is calculated as ;

$$\tilde{V}_{ij} = \tilde{r}_{ij} \times w_j, \qquad i = 1,2, \dots, m, \qquad j = 1,2, \dots, n \tag{6}$$

Step 6: Determine the fuzzy positive-ideal solution (FPIS, A*) and fuzzy negative-ideal solution (FNIS, A^-) of the alternatives as follows ;

$$A^* = \{\tilde{v}_1^*, \tilde{v}_2^*, \dots, \tilde{v}_n^*\}, \qquad where\ \tilde{v}_j^* = \max_i\{v_{ij3}\} \tag{7}$$

$$A^- = \{\tilde{v}_1^-, \tilde{v}_2^-, \dots, \tilde{v}_n^-\}, \qquad where\ \tilde{v}_j^- = \min_i\{v_{ij1}\} \tag{8}$$

$\tilde{v}_i^*$ is the maximum value for all alternatives and $\tilde{v}_i^-$ is the minimum value for all alternatives.

Step 7: Since the linguistic values is represented by triangular functions, then the following equation is derived ;

$$d(A_1, A_2) = \sqrt{\frac{1}{3}[(a_1 - a_2)^2 + (b_1 - b_2)^2 + (c_1 - c_2)^2]} \tag{9}$$

Step 8: Compute the distance between each alternative from the FPIS and FNIS, respectively as follows:

$$D_i^* = \sum_{j=1}^{n} d\left(\widetilde{v_{ij}}, \tilde{v}_j^*\right) , i = 1, 2, \dots, m \tag{10}$$

$$D_i^- = \sum_{j=1}^{n} d\left(\tilde{v}_{ij}, \tilde{v}_j^-\right) , i = 1, 2, \dots, m \tag{11}$$

D represents the distance between two fuzzy numbers.

Step 9: The closeness coefficient of each alternative is calculated as:

$$CC_i = \frac{D_i^-}{D_i^* + D_i^-} , i = 1, 2, \dots, m \tag{12}$$

Step 10: Rank all the alternatives in order according to the closeness coefficient.

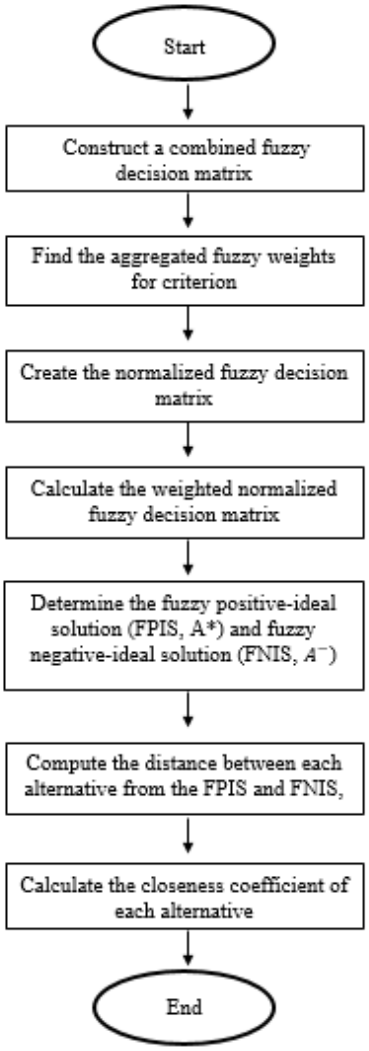

Figure 2: The flowchart of the fuzzy TOPSIS process

IMPLEMENTATION

In this section, in order to find the perfect solutions from a large number of comparable possibilities, Fuzzy TOPSIS (Technique for Order Preference by Similarities to Ideal Solution) is considered to be one of the finest methods. Additionally, it may be used to systematize the process and eliminate ambiguity and confusion in the selecting process, among other things.

Data collection

This data collection starts with the construction of a multi-criteria decision-making (MCDM) structure. To construct this structure, a list of alternatives and criteria were determined to achieve this project's main objective, which is to identify the relative importance of social media platforms based on their alternatives. In this project, the MCDM method that was applied was the Fuzzy TOPSIS technique. This technique will follow the decision from a set of decision maker which alternative is important based on the relative criteria chosen.

A questionnaire was created to obtain information from decision makers about their preferences for social media based on specific criteria. This data was gathered using an online questionnaire created with Google Forms. It is divided into two parts: part A and part B. In the second section of this questionnaire, descriptive rating scale questions were asked to discover which alternative ranked the highest based on criteria. This online survey was issued to UiTM students in the Selangor branch using various social media platforms such as WhatsApp, Instagram, Twitter and Facebook. 20 respondents were selected in this Fuzzy TOPSIS technique to determine which alternative had the greatest rank.

Fuzzy Multiple criteria decision making (MCDM) with linguistic terms

Fuzzy MCDM (Chen & Hwang, 1992) represents performance evaluations and weights as fuzzy numbers. The functionality of an alternative is derived by summing all criterion weights and alternative ratings. To assess each linguistic variable's degree of importance to each requirement, we employ a fuzzy five level scale.

Varieties of methods for ranking competitive alternatives, but the employment of Fuzzy TOPSIS technique in a fuzzy environment makes it feasible to rank competing alternatives in terms of their overall performance with regard to a number of criteria. We collect the data through distribute questionnaires. The linguistic variables used based on previous research by Balwinder Sodhi and Prabhakar T.V. in the year 2017. The following Table 2 shows the list of criteria, Table 3 shows selection of alternatives, Table 4 and Table 5 shows the linguistic variable fuzzy rating for each criterion and alternative.

Table 2: Selection criteria for preference of social media

Criteria	Code	Types
Content	C1	Beneficial
Functionality	C2	Beneficial
Usability	C3	Beneficial
Privacy	C4	Beneficial

Table 3: Selection alternative

Alternative	Code
Facebook	A1
Instagram	A2
Twitter	A3
TikTok	A4

Table 4: Linguistic variable fuzzy ratings for each criterion

Importance	Short form	Fuzzy Number
Very Low	VL	(1,1,3)
Low	L	(1,3,5)
Average	A	(3,5,7)
High	H	(5,7,9)
Very High	VH	(7,9,9)

Table 5: Linguistic variable fuzzy ratings for each alternative

Importance	Short form	Fuzzy Number
Not Important	NI	(1,1,3)
Slightly Important	SI	(1,3,5)
Moderately Important	MI	(3,5,7)
Important	I	(5,7,9)
Very Important	VI	(7,9,9)

Implementation of Fuzzy TOPSIS Method

All data were gathered and calculated in Microsoft Excel. The first stage is to put together a group of decision-makers in the social media selection process in the group of 20 decision makers. The second step, a combined fuzzy decision matrix to rank options was constructed as it can be calculated using **equation (2)** which is $a_{ij} = \min_k\{a^k{}_{ij}\},\ b_{ij} = \frac{1}{K}\sum_{k=1}^{K} b^k{}_{ij}\,, c_{ij} = \max_k\{a^k{}_{ij}\}$.
For $\tilde{x}_{11}$, the element 'a' is denoted as the minimum of its sub-column. Following by element 'b' which can get by dividing the summation of its sub-column with 20 by mean indicates as number of decision makers. Also for element 'c' is the maximum values of its sub-column. The following table is a description of a combined fuzzy decision matrix for ranking options ;

As an example; $\tilde{x}_{11} = (a_{ij}, b_{ij}, c_{ij}) = \begin{cases} a_{11} = \min_k\{a^1{}_{11}\} = \mathbf{1} \\ b_{11} = \frac{1}{20}\sum_{k=1}^{20} b^1{}_{11} = \mathbf{6.8} \\ c_{11} = \max_k\{a^1{}_{11}\} = \mathbf{9} \end{cases}$

Table 6: Combined decision matrix

	COMBINED DECISION MATRIX											
	C1			**C2**			**C3**			**C4**		
A1	**1**	**6.8**	**9**	1	6.2	9	1	6.3	9	1	6.9	9
A2	1	7.3	9	1	7.2	9	1	7.2	9	1	7.3	9
A3	1	6.8	9	1	6.8	9	1	6.8	9	1	6.4	9
A4	1	7.1	9	1	7	9	1	6.7	9	1	6.3	9

The third step is calculating aggregated fuzzy weight for criterion by using **equation (3)** which is $w_{j1} = \min_k\{w^k{}_{j1}\},\ w_{j2} = \frac{1}{K}\sum_{k=1}^{K} w^k{}_{j2}\,, w_{j3} = \max_k\{w^k{}_{j3}\}$. This can be done as in the second step, as shown below.

Example of aggregated fuzzy weighted for C1.

$$C_1 = \tilde{w}_1 = (w_{j1}, w_{j2}, w_{j3}) = \begin{cases} w_{11} = \min_k\{w^k{}_{j1}\} = \mathbf{1} \\ w_{12} = \dfrac{1}{20}\displaystyle\sum_{k=1}^{20} w^k{}_{j2} = \mathbf{8.1} \\ w_{13} = \max_k\{w^k{}_{j3}\} = \mathbf{9} \end{cases}$$

Table 7: Aggregated fuzzy weighted decision matrix

FUZZY WEIGHTED DECISION MATRIX												
C1			**C2**			**C3**			**C4**			
1	**8.1**	**9**	**3**	**7.7**	**9**	**1**	**7.7**	**9**	**1**	**7.3**	**9**	

Then calculate the normalized decision matrix by using **equation (4)** which is $\tilde{r}_{ij} = \left(\frac{a_{ij}}{c^*{}_j}, \frac{b_{ij}}{c^*{}_j}, \frac{c_{ij}}{c^*{}_j}\right)$ and $c^*{}_j = \max_i\{c_{ij}\}$. This is because the criteria are classified as 'beneficial' in **Table 2**. Before computing the weighted normalized decision matrix, each criteria's decision matrix must be normalized. For example, 1_{ij} can be calculated as follows which is 'a', 'b', and 'c' components need to divide by the maximum of 'c' component column since all of the criteria is a beneficial criterion. Let say component 'a' is 1, component 'b' is 6.8 and component 'c' is 9. All the components are divided by 9 and rounded of to three decimal points.

So, we can get 0.111, 0.756 and 1.000. Same goes to other values of $\tilde{r}_{ij}$. The following Table 8 shows the final normalized decision matrix ;

The example of calculation can be seen as :-

$$\tilde{r}_{11} = \left(\frac{a_{11}}{c^*_1}, \frac{b_{11}}{c^*_1}, \frac{c_{11}}{c^*_1}\right) = \left(\frac{1}{9}, \frac{6.8}{9}, \frac{9}{9}\right) = (\mathbf{0.111}, \mathbf{0.756}, \mathbf{1.000})$$

Where $c^*_1 = \max_1\{c_{11}\}$

Table 8: Normalized fuzzy decision matrix

	COMBINED DECISION MATRIX											
	C1			**C2**			**C3**			**C4**		
A1	**0.111**	**0.756**	**1.000**	0.111	0.689	1.000	0.111	0.700	1.000	0.111	0.767	1.000
A2	0.111	0.811	1.000	0.111	0.800	1.000	0.111	0.800	1.000	0.111	0.811	1.000
A3	0.111	0.756	1.000	0.111	0.756	1.000	0.111	0.756	1.000	0.111	0.711	1.000
A4	0.111	0.789	1.000	0.111	0.778	1.000	0.111	0.744	1.000	0.111	0.700	1.000

Next, we compute the weighted normalized fuzzy decision matrix according to the **equation (6)** which is $\tilde{V}_{ij} = \tilde{r}_{ij} \times w_j,\ i = 1,2,\dots,m,\ j = 1,2,\dots,n.$ The components are multiplied to each other, that is 'a' component is multiplied with 'a' weighted component, 'b' component is multiplied with 'b' weighted component, and same goes with 'c' component. For instance, 1 is multiplied with the 'a' element of each row in the first column. Similarly, 8.1 is multiplied with the 'b' element of each row of the first column and 9 is multiplied with the 'c' element of each row in the first column. Likewise, it can multiply the weightage with the other elements in each column. Hence, the following matrix is derived as in Table 9 ;

For example, $\tilde{V}_{11} = \tilde{r}_{11} \times w_1 = \begin{cases} a = 0.111 \times 1.000 = \mathbf{0.111} \\ b = 0.756 \times 8.100 = \mathbf{6.124} \\ c = 1.000 \times 9.000 = \mathbf{9.000} \end{cases}$

Table 9: Weighted normalize fuzzy decision matrix

	C1			C2			C3			C4		
WEIGHTAGE	**1.000**	**8.100**	**9.000**	**3.000**	**7.700**	**9.000**	**1.000**	**7.700**	**9.000**	**1.000**	**7.300**	**9.000**
A1	**0.111**	**6.124**	**9.000**	0.333	5.305	9.000	0.111	5.390	9.000	0.111	5.599	9.000
A2	0.111	6.569	9.000	0.333	6.160	9.000	0.111	6.160	9.000	0.111	5.920	9.000
A3	0.111	6.124	9.000	0.333	5.821	9.000	0.111	5.821	9.000	0.111	5.190	9.000
A4	0.111	6.391	9.000	0.333	5.991	9.000	0.111	5.729	9.000	0.111	5.110	9.000

Next step, we computed the Fuzzy Positive Ideal Solution (FPIS) and Fuzzy Negative Ideal Solution (FNIS). The formula used for calculating FPIS and FNIS can be referred to **equation (7)** as in $A^* = \{\tilde{v}_1^*, \tilde{v}_2^*, \dots, \tilde{v}_n^*\}$, $where\ \tilde{v}_j^* = \max_i\{v_{ij3}\}$ and **equation (8)** $A^- = \{\tilde{v}_1^-, \tilde{v}_2^-, \dots, \tilde{v}_n^-\},\ where\ \tilde{v}_j^- = \min_i\{v_{ij1}\}$ respectively. In the formula, it can be derived as follows ;

$$A^* = \{\tilde{v}_1^*, \tilde{v}_2^*, \dots, \tilde{v}_n^*\}, \quad where\ \tilde{v}_j^* = \max_i\{v_{ij3}\} = (\mathbf{0.111}, \mathbf{6.569}, \mathbf{9.000})$$
$$A^- = \{\tilde{v}_1^-, \tilde{v}_2^-, \dots, \tilde{v}_n^-\}, \quad where\ \tilde{v}_j^- = \min_i\{v_{ij1}\} = (\mathbf{0.111}, \mathbf{6.124}, \mathbf{9.000})$$

Table 10: Fuzzy Positive Ideal Solution and Fuzzy Negative Ideal Solution

	C1			C2			C3			C4		
A1	0.111	6.124	9.000	0.333	5.305	9.000	0.111	5.390	9.000	0.111	5.599	9.000
A2	0.111	6.569	9.000	0.333	6.160	9.000	0.111	6.160	9.000	0.111	5.920	9.000
A3	0.111	6.124	9.000	0.333	5.821	9.000	0.111	5.821	9.000	0.111	5.190	9.000
A4	0.111	6.391	9.000	0.333	5.991	9.000	0.111	5.729	9.000	0.111	5.110	9.000
A*	**0.111**	**6.569**	**9.000**	0.333	6.160	9.000	0.111	6.160	9.000	0.111	5.599	9.000
A-	**0.111**	**6.124**	**9.000**	0.333	5.305	9.000	0.111	5.390	9.000	0.111	5.110	9.000

Next, continue on computing the distance from each alternative to the FPIS and to the FNIS. The column for C1, C2, C3 and C4 can be derived according to the formula in **equation (9)** which is $d(A_1, A_2) = \sqrt{\frac{1}{3}[(a_1 - a_2)^2 + (b_1 - b_2)^2 + (c_1 - c_2)^2]}$ since the linguistic values is represented as triangular functions. In the equation, 'a_2', 'b_2' and 'c_2' derived from A* for FPIS in each criteria. Also derived from A- for FNIS in each criterion. Next, the distance value is simply the summation of all values in each row based on **equation (10)** as in $D_i^* = \sum_{j=1}^{n} d(\tilde{v_{ij}}, \tilde{v}_j^*)\ , i = 1, 2, \dots, m$ and **equation (11)** which is $D_i^- = \sum_{j=1}^{n} d(\tilde{v}_{ij}, \tilde{v}_j^-)\ , i = 1, 2, \dots, m$ for FPIS and FNIS respectively. In the following table, D represents the distance of each alternative between the two fuzzy numbers ;

Table 11: Distance from FPIS

	Distance from FPIS				
FPIS	**C1**	**C2**	**C3**	**C4**	**Di***
A1	**0.257**	**0.494**	**0.445**	**0.000**	**1.196**
A2	0.000	0.000	0.000	0.185	0.185
A3	0.257	0.196	0.196	0.236	0.885
A4	0.103	0.098	0.249	0.282	0.732

A1 = 0.257 + 0.494 + 0.445 + 0.000 = **1.196**

Table 12: Distance from FNIS

	Distance from FNIS				
FNIS	**C1**	**C2**	**C3**	**C4**	**Di-**
A1	**0.000**	**0.000**	**0.000**	**0.282**	**0.282**
A2	0.257	0.494	0.445	0.468	1.664
A3	0.000	0.298	0.249	0.046	0.593
A4	0.154	0.396	0.196	0.000	0.746

A1 = 0.000 + 0.000 + 0.000 + 0.282 = **0.282**

In this section, the closeness coefficient CC_i is computed for each alternative by referring to the **equation (12)** as in $CC_i = \frac{D_i^-}{D_i^* + D_i^-}$, $i = 1, 2, \dots, m$. The calculation is shown in the following table ;

$$CC_i = \frac{0.282}{1.196 + 0.282} = \mathbf{0.191}$$

Table 13: Closeness Coefficient

	Di*	**Di-**	**CC_i**
A1	**1.196**	**0.282**	**0.191**
A2	0.185	1.664	0.900
A3	0.885	0.593	0.401
A4	0.732	0.746	0.505

During the final phase of implementation, all alternatives were sorted according to their CC_i values. The most optimum answer is the value that is closest to 1 as possible. Listed in Table 13 are the relative rankings of all available alternatives.

RESULTS AND DISCUSSION

When it comes to finding a positive-ideal solution, we look for one that optimizes the benefit criterion while minimizing the cost criteria. Using the negative-ideal solution, the cost criterion is maximized while the benefit criterion is minimized. In conclusion, the positive-ideal solution is made up of all of the best values that can be obtained from the criteria, while the negative-ideal solution is made up of all of the worst values that can be obtained from the criteria. In Table 8, it shows the result for the value of FPIS and FNIS in each column.

It is determined that there is a difference between the rankings of the closeness coefficient for every alternative using the FPIS and FNIS, as well as the distance formula in this research which is shown in Table 10 and Table 11. The Euclidean distance formula was utilized in the research of the hierarchical fuzzy TOPSIS by Roshandel, Miri-Nargesi, and Hatami-Shirkouhi, and it was shown to be effective in this case (2013).

Afterwards, how close each alternative is to the optimal answer, was evaluated in terms of closeness. The outcome of the relative closeness is relied on the distance equations with two distinct FPIS and FNIS values, which are used to calculate the distance between two values. Table 12 depicts the relative proximity CC_i.

The results for all calculations are shown in the table below ;

Table 14: Ranking for each alternative

	Di*	**Di-**	**CC_i**	**RANK**	
A1	1.196	0.282	0.191	**4**	FACEBOOK
A2	0.185	1.664	0.900	**1**	**INSTAGRAM**
A3	0.885	0.593	0.401	**3**	TWITTER
A4	0.732	0.746	0.505	**2**	TIKTOK

Based on the results, we can see that the most optimum alternative of social media for business related matters among students of Universiti Teknologi MARA (UiTM) Selangor branch is Instagram which indicate as A2 followed by TikTok as A4, Twitter as A3 and lastly is Facebook as A1. Instagram is the most popular platform among teenagers in this era. As a result, the Instagram platform has risen to become the preferred social media platform among UiTM students to look for business related issues.

CONCLUSIONS AND RECOMMENDATIONS

The objective to determine the relative importance and to rank the social media platforms based on their criteria were achieved. It is found that Instagram is the most suitable and popular platform to be used for firms or companies in order to market their products. This helps the firm to highlight their products in a short amount of time since youngsters nowadays prefer to use Instagram as their platform to look for various types of products sold. Instagram is an excellent tool for increasing a company's reach and interaction with shoppers. Posts in Instagram indicates people's trust and attention because it shows the products physically. Indirectly, it facilitates the meeting of companies with prospective clients.

According to estimation, Instagram will have over 112.5 million users by 2020, making among the most successful social media networks. Instagram is always developing new tools to assist company owners in their efforts to flourish on the photo-sharing social networking site. From collecting information to selling products, Instagram is constantly evolving. It may not be too soon to change using Instagram and making a name for yourself. Businesses may use Instagram to advertise their goods and services, build their brand, and improve sales if they have a solid marketing plan in place. Aside from establishing connection with followers, Instagram live postings are one of the great methods to demonstrate that the company has a human side by showing them that the companies have been accessible and approachable.

The companies may use Instagram to keep the followers informed about deals and special promotions that are taking place. If the company want to raise knowledge about the company and increase website traffic, then it might undertake a promotional advertising campaign. Since companies are releasing a new products and services, then it can use Instagram to give a sneak peek into the most recent offers to all customers and followers.

In summary of this project, Fuzzy TOPSIS evaluates multiple alternatives against the selected criteria. Plus, it is one of the easiest structures to use compared to other MCDM method. Fuzzy TOPSIS performs better than Fuzzy Analytical Hierarchy Process (AHP) in regard to changes of alternatives and criteria, agility and number of criteria and alternatives. Other social media platforms and relevant criterions and sub-criteria for research may be added in the future by academics. It is possible for the researchers to gather information from the respondents with the help of additional participants, such as academics or businesspeople. Social media sites might be rated by multiple age groups, or researchers can choose a particular area and region for the further study.

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