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Students' Preferences for Mobile Phone Service Providers based on Fuzzy Grade Matrix and Statistical Analysis

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Abstract: Selecting the most appropriate mobile phone network service provider can be challenging due to factors such as limited network coverage, varied service offerings, and other influencing factors. This study aims to identify the factors influencing university students' preferences for mobile phone network service providers in Malaysia. To address the vagueness and imprecision inherent in human evaluation, a fuzzy grade matrix was developed to analyse the ratings of performance based on sub-criteria. The methodology comprises two main parts: fuzzy grade matrix analysis and statistical analysis. The fuzzy grade matrix process includes calculating the fuzzy weight and grades based on the importance and performance levels of each criterion, constructing the fuzzy grade matrix, determining the ranking of alternatives, and interpreting the results. In parallel, the statistical analysis uses Spearman's rank correlation to measure the strength and direction of relationships between the influencing factors and students' choices. This analysis identified price, service quality, and coverage as the most significant factors influencing students' decisions. Based on the fuzzy grade matrix, Unifi was identified as the most preferred mobile network service provider by students, while U Mobile was the least preferred. However, the analysis also revealed that students rated all service providers relatively low overall, despite Unifi's top ranking. This study highlights the need for mobile network service providers to consider additional important criteria that influence students' decision-making processes to better cater to their preferences.

Keywords: Mobile phone network service providers, Fuzzy Grade Matrix, performance levels for each sub-criterion, ranking of alternatives, statistical analysis

Introduction

Nowadays, numerous mobile plan providers are on the market, each offering various services at affordable prices. They introduce a range of popular and suited plans for consumers. However, consumers must compare and choose the provider that best matches and satisfies their needs. This selection process is complex and involves making judgments based on various criteria such as contract features, company reputation, customer satisfaction, and communication quality (Alshurideh, 2016). These criteria significantly affect human judgment in selecting mobile phone network service providers. Additionally, evaluating these criteria and the performance of different providers relies heavily on prior experience and human judgment, which are often imprecise and uncertain.

Several studies have used statistical analysis to evaluate and rank mobile phone service providers. For instance, Verma and Mehlawat (2017) used the Analytical Hierarchy Process (AHP) to rank providers based on network quality, customer service, and plan pricing. Their findings highlighted network coverage and service reliability as the top determinants for consumers. Similarly, Kubasu (2018) used multiple regression models to identify the factors influencing customer satisfaction among mobile service users. Their research found that service quality, pricing, and customer support were significant predictors of customer satisfaction. Specifically, they discovered that high-quality service and responsive customer support significantly enhance customer satisfaction, while competitive pricing makes the services more attractive to consumers.

Moreover, Uzun et al., (2021) applied the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) to rank providers by service quality and user satisfaction. Their research emphasized that consistent network performance and responsive customer service are crucial in achieving high user satisfaction. The TOPSIS method revealed that providers who excel in maintaining stable network quality and promptly addressing customer issues were ranked higher in user satisfaction.

Khonglumtan and Srisattayakul (2022) used Structural Equation Modeling (SEM) to explore the relationships between service quality dimensions, customer satisfaction, and loyalty. They identified reliability and assurance as key factors driving customer loyalty. Their study found that when customers perceive bus air conditioner services to be reliable and the service providers to be trustworthy and dependable, their overall satisfaction increases, which in turn fosters loyalty towards the service provider.

While statistical analysis provides a robust framework for evaluating and ranking mobile service providers, fuzzy set theory offers a complementary approach that can handle the inherent imprecision and uncertainty in human judgment. Fuzzy analysis enhances the ability to model, analyze, and make decisions in complex and uncertain environments. In the selection of mobile phone network service providers, fuzzy analysis can assist consumers in making the right decision by providing suitable guidelines, as human evaluation is subjective in nature. The fuzzy grade matrix proposed by Wang and Chen (2008) is one evaluation method in fuzzy environment that considers detailed ratings. Ramli et al. (2010) further improved this method by incorporating fuzzy linguistic variables throughout the evaluation process.

In this paper, the researchers apply the fuzzy grade matrix to analyse the selection of mobile phone network service providers among students at a higher education institution in Klang Valley, Malaysia. This approach allows us to address the subjective and imprecise nature of human judgment in evaluating service providers, complementing the statistical analyses with a method that can better capture the nuances of consumer preferences and experiences.

Literature Review

Fuzzy set theory, in particular, had been widely applied, particularly for decision-making. As is well known, fuzzy analysis is a technique for resolving problems involving ambiguity, imprecision, and vagueness. By providing consumers with some appropriate criteria, fuzzy analysis can assist them in making the optimal provider selection decision. Numerous researchers have recently emphasised several elements that influence customers' selection and purchase of mobile network service providers in a certain country. Nurysh et al. (2019) conducted a study using Spearman’s correlation coefficient and regression analysis to determine the relationship between potential elements affecting customer happiness in the Malaysian mobile telecommunications business. The study revealed a positive relationship between perceived value and service quality with customer satisfaction. In other study, Saha et al. (2016) conducted an investigation into the critical factors affecting the degree of satisfaction of Bangladeshi mobile phone customers based on linear regression and hypothesis testing method. The findings indicate a significant and positive correlation between all criteria and the overall level of customer satisfaction. Moreover, Rajeswari and Sadasivan (2019) highlighted the reasons

driving users to choose prepaid mobile services in India by descriptive research method. The analysis confirms that mobile operators should implement critical tactics to enhance client loyalty.

In another study, Krell et al. (2021) explored the acceptance and usage of mobile phone services (m-services) among small-scale farmers in central Kenya. The study revealed that 25% of the participants use mobile services to access agriculture and livestock information, while 23% use them to engage in purchasing and selling activities. Additionally, 18% of the respondents receive notifications pertaining to agriculture. Oughton et al. (2021) considered the competitive and collaborative functions of two major wireless technologies: 5G and Wi-Fi 6. The study concluded that 5G is better suited for providing broad coverage over large areas and supporting high mobility. Still, Wi-Fi 6 performs very well in indoor settings due to its cheaper deployment costs. According to the report, rather than totally replacing one another, 5G and Wi-Fi 6 are more likely to work well together in a variety of settings. Kar (2021) examined the factors that impact the satisfaction of mobile payment customers in India. The study develops and verifies a model known as the digital service usage satisfaction model by incorporating ideas from the literature on technology adoption and service science. According to the study, affordability, usefulness, trust, social influence, credibility, information privacy, and responsiveness are essential factors that have an impact on usage satisfaction.

Several researchers frequently recommend multi-criteria decision making (MCDM) in their studies since it is widely regarded as an effective method for resolving decision-making challenges. MCDM enables decision-makers to choose the best appropriate alternative among several criteria-based choices. Specifically, Ho (2008) added that MCDM is a generic name for approaches that exist to assist people in making decisions based on their preferences when several conflicting criteria are present. Numerous studies have used fuzzy ideas such as fuzzy VIKOR, fuzzy AHP and fuzzy TOPSIS in decision-making, which take uncertainty into account during the performance measuring process.

In recent years, fuzzy set theory has been extensively used to solve difficulties relating to the choosing of mobile network providers. Recent studies on MCDM applications have been proposed by several researchers, including Suh et al. (2019), Trrad et al. (2019), and others. Suh et al. (2019) employed the fuzzy VIKOR technique to assess the quality of mobile services, and the decision-making trial and assessment laboratory (DEMATEL) to weight the evaluation criteria subjectively, and the Shannon entropy to weight evaluation criteria objectively. It has also been shown that fuzzy logic was utilised to cognitive wireless communications, as demonstrated in a study by Trrad et al. (2019). The primary outcomes of the study are wireless data networks are advancing in the construction of cognitive data networks that facilitate the extensive utilisation of artificial intelligence components throughout the entire architecture.

Chang et al. (2019) proposed an MCDM hybrid method based on AHP, TOPSIS and graph theory and matrix approach (GTMA) in determining the most ideal smartphone and its provider, as well as to choose the most appropriate tariff plan option. The study showed that the R script programming concept in GTMA significantly contribute in determining the ideal solution.

Liu et al. (2019) validated the consumer's acceptability of mobile health care by integrating DEMETEL, DANP, and VIKOR techniques to develop a DDANPMV model. The purpose of this study is to develop an assessment index system for user acceptance of mobile health care, to analyse the primary elements influencing consumer acceptance of medical health care, and to validate the model's effectiveness for specific mobile health care products. Sabzian et al. (2020) developed an agent-based model (ABM) to study the spread of MTTs in Iran over time. The goal of the study is to examine the dissemination structure of three competing MTTs in Iran and to draw conclusions from diffusion of innovation and social network theories. In 2016, Belbag et al. (2016) conducted a study on the evaluation of smartphone brand choice using the Fuzzy ELECTRE I technique. The goal of this study is to ascertain how people choose their smartphone.

Fuzzy grade matrix was proposed by Wang and Chen (2008) as an evaluation method which considered more details on the ratings part. The method can provide ratings of alternative with respect to the sub-criteria. Ramli et al. (2010) enhanced the method by implementing the fuzzy linguistic variables throughout the assessment process. The fuzzy grade matrix was further extended by

numerous researchers such as Shohaimay et al. (2012), Ozdemir and Tekin (2016), Darwish and Poleschuk (2017), and Berkachy (2021).

Methodology

The online survey of dual language (English and Malay) questionnaire was distributed to 97 students from various semesters of the Bachelor of Science (Hons.) Mathematics program at one higher institution in the Klang Valley Malaysia. The students' preferences for mobile phone service providers were analysed using fuzzy grade matrix and statistical analyses. In the statistical analysis, the preferences were measured through the proportion of actual service providers currently used by students and using the Spearman correlation coefficient towards all main criteria using R programming. The mean scores for each criterion and sub-criterion were compared across service providers to determine users' actual preferences for each respective provider.

In this paper, students' preferences for mobile phone network service providers in Malaysia, which included Celcom, Maxis, Digi, U Mobile, Yes, and Unifi is evaluated. The hierarchical structure is shown in Fig. 1, with the main criteria as contract features (X_1), company factors (X_2), customer satisfaction (X_3), and communication dimension (X_4) and the sub-criteria as presented in Table 1.

Table 1. The main and sub-criteria for factors affecting mobile phone network service providers

Main Criteria	Sub criteria
Contract features (X_1)	(X_{11})Contract price per month
	(X_{12}) Plan offer (Internet package size offer, free call per min, free message per min)
	(X_{13}) Contract length or prepaid cards
	(X_{14}) Promotion (Handset insurance offer)
Company factors (X_2)	(X_{21})Signal strength
	(X_{22}) Sales outlet availability
	(X_{23}) Switching cost
	(X_{24}) Information access
Customer satisfaction (X_3)	(X_{31})Loyalty
	(X_{32}) Product features
	(X_{33}) Service features
Communication dimension (X_4)	(X_{41})Network quality (internet speed)
	(X_{42}) Geographical coverage area
	(X_{43}) Security privacy

The fuzzy grade matrix was used to analyse students' preferences for mobile phone network service providers. The linguistic terms of importance and performance levels are presented in Table 2 and 3 respectively.

Table 2. Linguistic terms for importance levels for each criterion

Linguistic Terms	Fuzzy numbers
Very low	(0.0,0.0,0.1)
Low	(0.0,0.1,0.3)
Medium low	(0.1,0.3,0.5)
Medium	(0.3,0.5,0.7)
Medium high	(0.5,0.7,0.9)
High	(0.7,0.9,1.0)
Very high	(0.9,1.0,1.0)

Table 3. Linguistic terms for performance levels for each sub-criterion

Linguistic Terms	Fuzzy numbers
Very poor	(0,0,1)
Poor	(0,1,3)
Medium poor	(1,3,5)
Fair	(3,5,7)
Medium good	(5,7,9)
Good	(7,9,10)
Very good	(9,10,10)

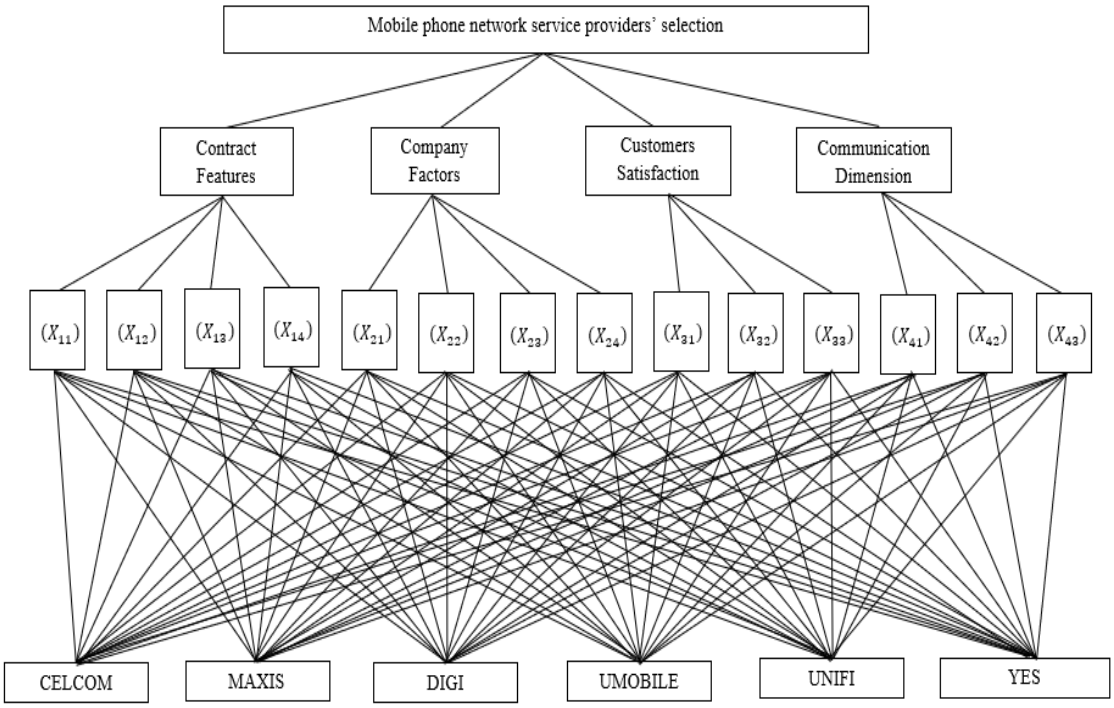

Fig. 1 Hierarchical Figure of Factors Affecting Mobile Phone Network Service Provider

Fuzzy Grade Matrix

The fuzzy grade matrix procedure from Ramli et al. (2010) can be expressed in six steps as follows:

Step 1

The fuzzy weight $\widetilde{w}_i$ of each criterion is calculated using aggregated fuzzy assessment which is defined as

$$\widetilde{w_i} = \frac{\sum_{k=1}^{N} \widetilde{w_i^k}}{N} \quad (1)$$

where $\widetilde{w}_i$ is the importance weight of the *k*-th decision-maker and *N* is the number of decision-makers. The fuzzy weighted vector criteria can be represented as $\widetilde{W} = [\widetilde{w}_1 \;\; \widetilde{w}_2 \;\; \widetilde{w}_3\,]^T$.

Step 2

The fuzzy grade $\tilde{g}_{ij}$ of each sub-criterion of each alternative is calculated using the aggregated fuzzy assessment, which is defined as

$$\widetilde{g_{ij}} = \frac{\sum_{k=1}^{N} \widetilde{x_{ij}^{k}}}{N} \tag{2}$$

where $\tilde{x}_{ij}^{k}$ are the ratings of the *k*-th decision-maker.

Step 3

The fuzzy grade matrix $\tilde{G}$ is defined as

$$\tilde{G} = \begin{pmatrix} \tilde{g}_{11} & \tilde{g}_{12} & \cdots & \tilde{g}_{1k} \\ \tilde{g}_{21} & \tilde{g}_{22} & \cdots & \tilde{g}_{2k} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{g}_{n1} & \tilde{g}_{n2} & \cdots & \tilde{g}_{nk} \end{pmatrix}, \tag{3}$$

where $\tilde{g}_{ij}$ denotes the fuzzy grade of the *i*-th provider A_i concerning the *j*-th criterion X_j, *n* denotes the numbers of alternatives, and *k* denotes the number of criteria.

Step 4

The total fuzzy grade vector $\tilde{R}$ is calculated as

$$\tilde{R} = \tilde{G} \otimes \widetilde{W} = \begin{pmatrix} \tilde{g}_{11} & \tilde{g}_{12} & \cdots & \tilde{g}_{1k} \\ \tilde{g}_{21} & \tilde{g}_{22} & \cdots & \tilde{g}_{2k} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{g}_{n1} & \tilde{g}_{n2} & \cdots & \tilde{g}_{nk} \end{pmatrix} \otimes \begin{pmatrix} \widetilde{w}_1 \\ \widetilde{w}_2 \\ \vdots \\ \widetilde{w}_k \end{pmatrix} = \begin{pmatrix} \tilde{R}_1 \\ \tilde{R}_2 \\ \vdots \\ \tilde{R}_k \end{pmatrix}, \tag{4}$$

where $\tilde{R}_i$ denotes the total fuzzy grade of the *i*-th provider A_i and $1 \leq i \leq n$.

Step 5

The ranking order of $\tilde{R}_i = (a, b, c)$ is calculated based on the methods of centroid point by Wang et al. (2006) and distance of fuzzy numbers by (Cheng, 1998) that can be defined as follows:

$$S(\widetilde{R_i}) = \sqrt{(\tilde{x}_0)^2 + (\tilde{y}_0)^2} \tag{5}$$

$$\bar{x}_{\mathbf{0}}(\tilde{R}_i) = \tfrac{1}{3}[a + b + c]\ ,\ \bar{y}_{\mathbf{0}}(\tilde{R}_i) = \tfrac{1}{3} \tag{6}$$

Step 6

The ranking of fuzzy numbers $\tilde{R}_i$ and $\tilde{R}_j$ is given as follows:
(1) If $S(\tilde{R}_i) < S(\tilde{R}_j)$, then $\tilde{R}_i \prec \tilde{R}_j$,
(2) If $S(\tilde{R}_i) > S(\tilde{R}_j)$, then $\tilde{R}_i \succ \tilde{R}_j$ and
(3) If $S(\tilde{R}_i) = S(\tilde{R}_j)$, then $\tilde{R}_i \approx \tilde{R}_j$.

The higher the value of $S(\tilde{R}_i)$, the higher the ranking of $\tilde{R}_i$.

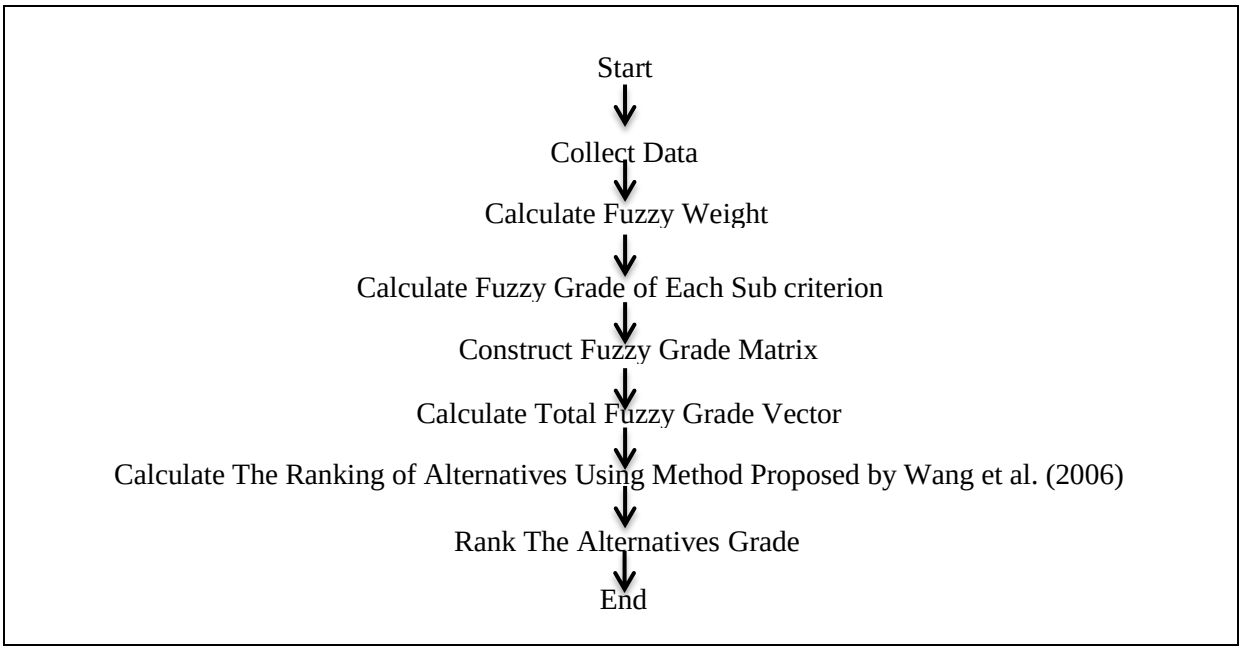

Fig.2 Flow-charts of fuzzy grade matrix procedure

Findings and Discussion

The results comprise two parts based on the fuzzy grade matrix and statistical analysis.

Fuzzy Grade Matrix

The students' preferences for mobile phone network service providers in Malaysia, which included Celcom (A_1), Maxis (A_2), Digi (A_3), U Mobile (A_4), Unifi (A_5), and Yes (A_6) towards criteria contract features (X_1), company factors (X_2), customer satisfaction (X_3), and communication dimension (X_4) were analysed.

Table 4. The ranking order for criteria

Main Criteria X_i	Fuzzy weight $\widetilde{w}_i$	$\bar{x}_0(\widetilde{w}_i)$	$\bar{y}_0(\widetilde{w}_i)$	$S(\widetilde{w}_i)$	Ranking
X_1	(0.597,0.766,0.884)	0.750	$\frac{1}{3}$	0.821	2
X_2	(0.623,0.778,0.878)	0.760	$\frac{1}{3}$	0.830	1
X_3	(0.585,0.751,0.868)	0.735	$\frac{1}{3}$	0.807	4
X_4	(0.587,0.761,0.885)	0.740	$\frac{1}{3}$	0.815	3

The ranking of criteria is obtained from Eqs. 5 and 6. The values of $\bar{x}_0$ and $\bar{y}_0$ obtained from Eq. 6 are substituted in Eq. 5 and obtained the distance as $S(\widetilde{w}_i)$. Thus, from the value of $S(\widetilde{w}_i)$ in Table 4, the ranking result of the criteria is given as $X_3 \prec X_4 \prec X_1 \prec X_2$. Based on the result obtained, the students pointed X_2 (Company factors) as the leading factor affecting the selection of mobile network service providers, followed by X_1 (Contract features), X_4 (Communication dimension). Besides, X_3 (Customer satisfaction) was identified as the least important factor affecting the selection of the mobile network service provider.

Table 5. The ranking order for mobile network service provider

Criteria	Ranking Order
X_1	$A_4 \succ A_5 \succ A_2 \succ A_3 \succ A_6 \succ A_1$
X_2	$A_5 \succ A_2 \succ A_1 \succ A_3 \succ A_6 \succ A_4$
X_3	$A_5 \succ A_2 \succ A_3 \succ A_1 \succ A_6 \succ A_4$.
X_4	$A_5 \succ A_2 \succ A_1 \succ A_3 \succ A_6 \succ A_4$
Final ranking order	$A_5 \succ A_2 \succ A_1 \succ A_3 \succ A_6 \succ A_4$

Based on the result, the ranking order for criteria X_1 (Contract features) is $A_4 \succ A_5 \succ A_2 \succ A_3 \succ A_6 \succ A_1$. For criteria X_2 (Company factors) and X_4 (Communication dimension), the ranking is $A_5 \succ A_2 \succ A_1 \succ A_3 \succ A_6 \succ A_4$ while for criterion X_3(Customer satisfaction), the ranking is $A_5 \succ A_2 \succ A_3 \succ A_1 \succ A_6 \succ A_4$. This shows that for criteria X_2 (Company factors), X_3(Customer satisfaction) and X_4 (Communication dimension), alternative A_5 is ranked as the best while alternative A_4 is ranked as the worst. However, criteria X_1 (Contract features) shows that alternative A_4 is ranked as the best while alternative A_1 is the worst. Based on the result obtained in Table 7, the final ranking result is $A_5 \succ A_2 \succ A_1 \succ A_3 \succ A_6 \succ A_4$. This is because both criteria X_2 (Company factors) and X_4 (Communication dimension) have the ranking result that dominates the final ranking results. Alternative A_5 is ranked as the best, followed by alternatives A_2, A_1, A_3, A_6 and A_4. Thus, it is identified that Unifi is the best provider compared to others since it is ranked highest. Maxis is the second preferred followed by Celcom, Digi and Yes. U Mobile is ranked last based on the Fuzzy Grade Matrix approach.

Statistical Analysis

The students' preference towards mobile phone service providers was checked using the correlation matrix as in Fig. 3. The correlation matrix is between the type of mobile phone service provider (SP) used by the respondents with their opinion on the main criteria as contract features (X_1), company factors (X_2), customer satisfaction (X_3), and communication dimension (X_4). This is to study whether there is any relationship between the main criteria in influencing the students' preference in choosing the mobile phone service provider.

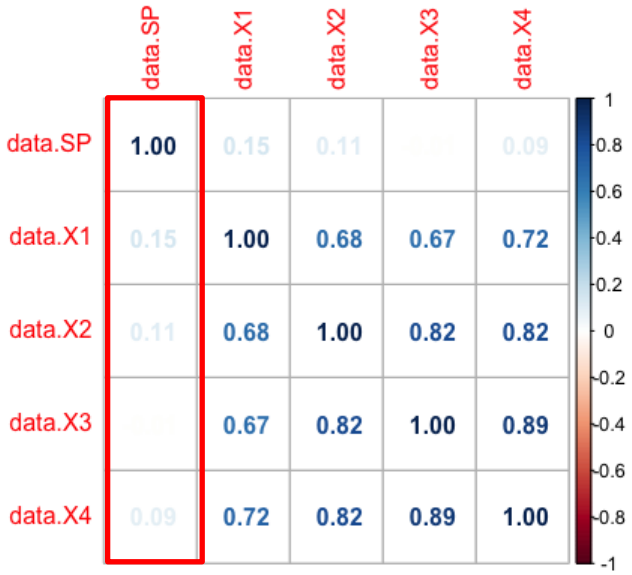

Fig. 3 Correlation plot of service provider used and main criteria

For X_1, the question is generally about the appropriateness of importance level for each criterion related to contract features such as plans offered and monthly price. For X_2, the question is generally about the appropriate importance level for each of the criterion related to company factors such as signal strength and providers' outlet availability. Meanwhile for X_3, it is about the appropriate importance level for each of the criterion related to customer satisfaction. The last criteria are the appropriate importance level for each of the criterion related to communication dimension. Based on the results in Figure 3, the Spearman Rank correlation values show that there is no statistically significant correlation between the service provider used (SP) and the main criteria assessed. This indicates that the listed criteria such as price, network coverage, and data plans do not significantly influence students' choices of mobile phone service providers. Instead, students might be influenced by other factors not covered in the study, like personal recommendations, brand loyalty, or special promotions. Research supports this view, showing that consumer decisions are often affected by a complex mix of rational, emotional, and social factors (Kotler & Keller, 2016). This complexity makes it difficult to identify a single decisive factor in choosing a service provider, as multiple influences can impact decision-making (Schiffman & Kanuk, 2010).

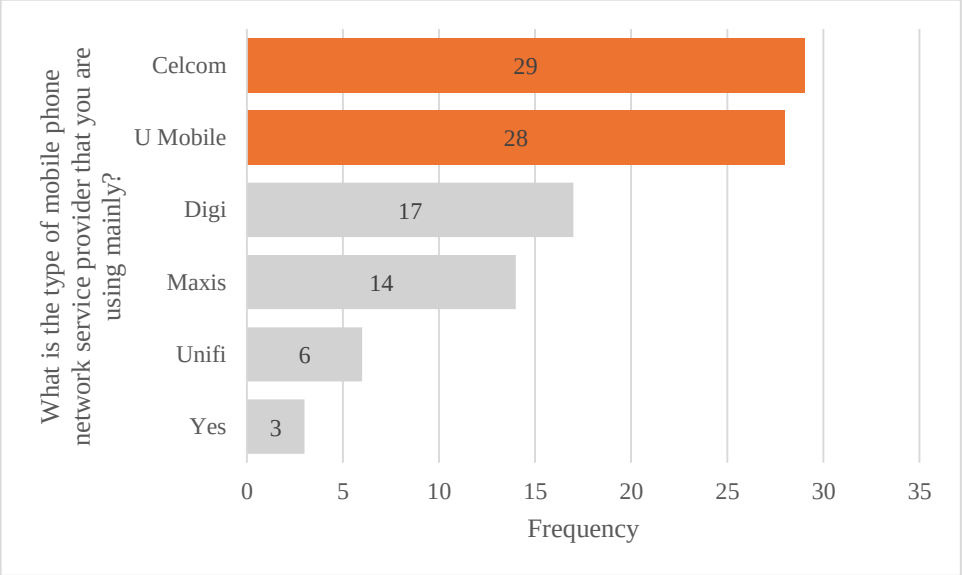

Fig. 4 Number of users for each service provider

Students' existing service providers can be utilised to check their preferences for mobile phone service providers. Based on the frequency in Fig. 4, it showed that Celcom and U Mobile are the most noticeable preferred mobile phone service providers of the students with 29 users and 28 users respectively. Only 17 users and 14 users for Digi and Maxis respectively. While the remaining 3 users used Yes which makes it the least preferred by students among the service providers followed by Unifi (6 users). For further comprehension on the users rating towards service providers, Fig. 5 encompasses six bar charts for mean scores of users rating obtained by all service providers. The mean scores is the average of all factors discussed which are contract features (X_1), company factors (X_2), customer satisfaction (X_3), and communication dimension (X_4). Only users of the respective service provider is counted for this mean scores.

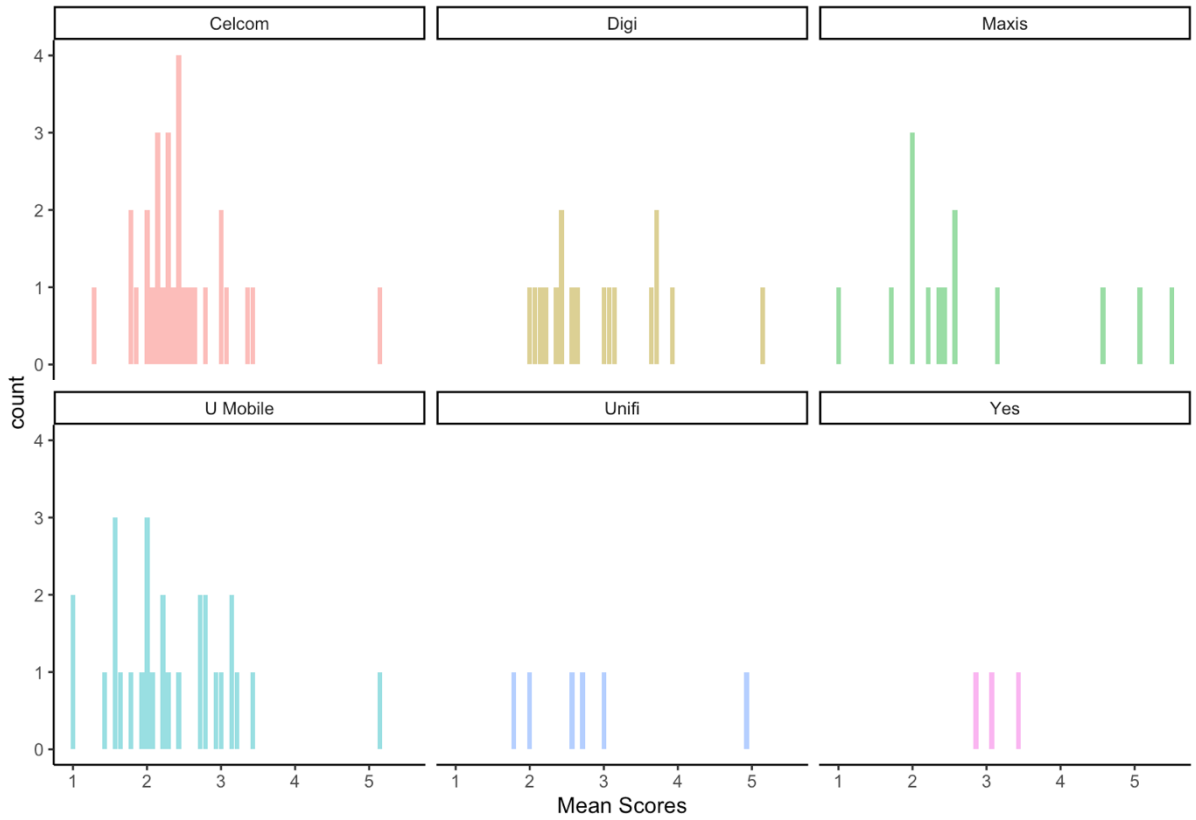

Fig. 5 Users rating on the overall services provider they use

Table 6. Descriptive analysis of mean scores of users rating

Service Provider	Min	Median	Mean	Max
Celcom	1	2.429	2.611	5.5
Digi	1	2.357	2.585	6
Maxis	1	2.357	2.655	5.463
U Mobile	1	**2.714**	**2.901**	**7**
Unifi	1	2.5	2.644	6
Yes	1	2.214	2.588	6.071

In Fig. 5, bar chart A represents overall rating given to Celcom from 29 clients. Based on the linguistics term used for the performance, when the rate is equal to 2 it is poor and 3 is medium poor. From bar chart A, the distribution of the rating ranges from 1 to 3.5 with one user rated at 5.5 which can be said as an outlier. Albeit Celcom has the highest users in this sample of study, the average rate given by the users is only 2.611 as reported in Table 6. Whereas, when compared across different service provider, U Mobile with 28 users received the highest rating with mean 2.901 and median 2.714. Besides that, Maxis and Digi both received values lower than Celcom and Digi rating. The lowest rating was given to Digi with the average value of 2.585. Bar chart E and F represent Unifi and Yes respectively, since the users involved in this study only six and three users. The graph cannot be used to explain the rating for the service providers in general.

To compare both the Fuzzy Grade Matrix and the statistical analysis, even though Unifi is ranked the highest in the Fuzzy Grade Matrix, students actually gave low scores for each service provider. There is no significant relationship between the criteria and the service provider used by the respondents. This suggests that there might be much more important criteria not included in this study that influence decision-making, such as the cost or coverage of the service provider.

Conclusion

This paper presents a fuzzy approach to human judgement measurement based on ratings of alternatives from the sub-criteria. From the finding, it can be seen that Unifi is the best provider, Maxis is the second preferred followed by Celcom, Digi and Yes. U Mobile is ranked last based on the Fuzzy Grade Matrix approach. Based on the result, company factor is the most important element influencing the choice of mobile network service providers, followed by contract features and communication dimension. This result slightly differs from Alshurideh (2016), which ranked contract features as the most important factor and company factors second. This slight difference may reflect changes in consumer priorities or variations in study contexts. Furthermore, customer satisfaction is recognized as the least essential factor influencing mobile network service provider decision. When it comes to multi-criteria decision making (MCDM), Fuzzy Grade Matrix is one of the strategies that can be used to handle ambiguity. Both the importance of each criterion and the performance level of each sub-criterion are taken into consideration by the proposed method. The contradiction between the Fuzzy Grade Matrix ranking and the statistical analysis of student scores highlights the need for a more thorough evaluation approach. By including a wider range of criteria and employing mixed methods, the study can achieve a more accurate representation of students' preferences and satisfaction with service providers.

Suggestion for Future Research

Future research could explore diverse regions to understand local consumer preferences and the impact of new technologies like 5G. Examining psychological factors and tracking changes in preferences over time would also be valuable. Using ordinal logistic regression could provide a more detailed analysis on how different factors influence preferences. Additionally, studying detailed customer experience metrics, service quality aspects, and cultural influences will offer actionable insights for improving mobile network services. Further repetitions of the study can be conducted to assess any changes when the representation of each service provider is equal.

Co-Author Contribution

Writing – Original draft preparation, Ramli, N., Osman, R., Ujang, S; Literature Review, Ramli, N., R., Osman, R., Ujang, S; Methodology, Ramli, R., Osman, R., Ujang, S; Writing – Review and editing, Ramli, N., Osman, R., Ujang. S.

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