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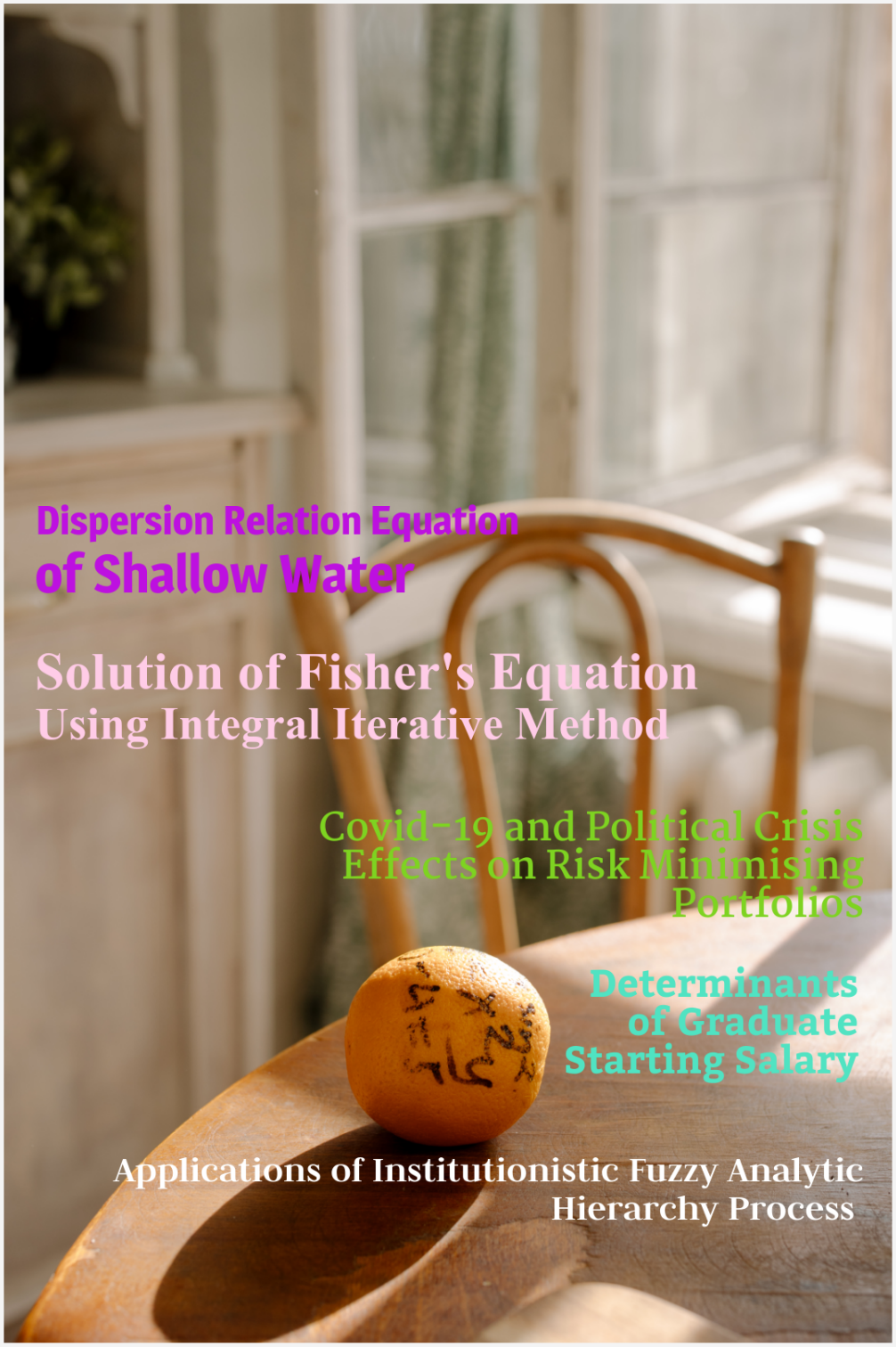

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EDISI NOVEMBER 2022

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Al-Hamdulillah bersyukur kita ke hadrat Allah swt, dengan penerbitan edisi ketiga makalah Mathematics in Applied Research terbitan Kolej Pengajian Pengkomputeran, Informatik, dan Media UiTM kampus Seremban. Penerbitan ini merupakan satu usaha untuk menonjolkan hasil penyelidikan pelajar bersama pensyarah dalam Projek Tahun Akhir program ijazah sarjana muda di KPPIM Seremban.

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Disamping itu, pihak KPPIM Seremban mengharapkan makalah ini akan menjadi rujukan dan pemangkin kepada usaha menghasilkan penyelidikan Projek Tahun Akhir yang lebih bermutu tinggi. Makalah ini juga adalah batu asas kepada perkongsian penyelidikan terkini daripada pelajar dan pensyarah KPPIM Seremban.

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- Profesor Madya Dr. Nur Azlina Abd Aziz
- Dr. Nor Azni Shahari

semoga kecemerlangan perkhidmatan yang ditunjukkan oleh kedua editor-editor ini akan menjadi pendorong kepada editorial board yang seterusnya.

Sekian. Terima kasih.

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for all the dedications and

Happy Retirement

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Contents

AN INTUITIONISTIC FUZZY ANALYTIC HIERARCHICAL PROCESS (IFAHP) APPROACH IN SOLVING THE MARKETING PLATFORM SELECTION PROBLEM

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Keywords: marketing platform selection problem; IFAHP; AHP

1. Introduction

Nowadays, digital marketing is becoming a more popular marketing strategy since it can reach a wider audience, be cost-effective, and engage customers with the brand efficiently. Technology advancement may be the factor that contributes to businesses choosing to shift their marketing strategies from traditional to digital marketing. There are many social media platforms available to market a brand online. Each of these platforms has its advantages and functionality that will affect the business's growth. The process of selecting these platforms to satisfy the decision-makers (DMs) preferences can be challenging since multiple conflicting criteria may involve in the evaluation process.

The Multi-Criteria Decision Making (MDCM) method is recommended to solve the problem. One of the most popular MCDM methods is Analytic Hierarchical Process (AHP) method. However, this method is often criticised for failing to appropriately address the inherent uncertainty and vagueness of human judgments despite its popularity and simplicity (Xu and Liao, 2013). The Fuzzy Analytic Hierarchical Process (FAHP) method is then proposed to overcome the weaknesses of the AHP method. The Fuzzy set (FS) theory introduced by Zadeh (1965) is integrated into the AHP method to develop the FAHP method. The Intuitionistic fuzzy set is then introduced by Atanassov (1986) as the extension to the FS theory. The IFS theory is characterised by a membership function, a non-membership function, and a hesitation function. The IFS theory is integrated into the AHP method to develop the Intuitionistic Fuzzy Analytic Hierarchical Process (IFAHP) method. This method not only improved the objectivity of expert judgment but also reflected the hesitant information of DMs when they make judgments on the evaluation objects (Xu et al., 2020) moreover when the DMs cannot express their preference for an alternative easily. The IFAHP method may effectively solve the subjectivity of expert decision-making in the evaluation process since the hesitancy degree can explain experts' hesitation (Li, 2021).

Therefore, this study applied the Intuitionistic Fuzzy Analytic Hierarchical Process (IFAHP) method to choose the most suitable social media platform as the marketing tool for businesses.

2. Methodology

Below show the steps in implementing the IFAHP method (Abdullah and Najib, 2016).

Step 1: Perform the data scaling based on the scale of the Intuitionistic fuzzy (IF) judgment shown in Table 1 and then form the pairwise comparison matrix based on the data.

Step 2: Identify the weights of DMs. The importance of the DMs is considered as linguistic variables and these linguistic variables are adapted from Boran et al. (2009). Table 2 shows the defined Triangular Intuitionistic Fuzzy Numbers (TIFNs) for the linguistic variables. Next, consider an Intuitionistic fuzzy number to rate the kth decision-maker, $\lambda_k = (\mu_k, v_k, \pi_k)$ where

Table 1: Linguistic variables for pairwise comparison

AHP Linguistic Variables	AHP Preference Number	TIFNs	Reciprocal TIFNs
Equally important (E)	1	(0.02, 0.18, 0.80)	(0.18, 0.02, 0.80)
Moderately more important (WMI)	3	(0.13, 0.27, 0.60)	(0.27, 0.13, 0.60)
Strongly more important (SMI)	5	(0.33, 0.27, 0.40)	(0.27, 0.33, 0.40)
Very strong more important (VSMI)	7	(0.62, 0.18, 0.20)	(0.18, 0.62, 0.20)
Extreme/absolute more important (AMI)	9	(1.0, 0, 0)	(0, 1.0, 0)

Table 2: Linguistic variables for the importance of decision makers

Linguistic Variables	TIFNs
Very important	(0.90, 0.05, 0.05)
Important	(0.75, 0.20, 0.05)
Medium	(0.50, 0.40, 0.10)
Unimportance	(0.25, 0.60, 0.15)
Very unimportance	(0.10, 0.80, 0.10)

$w_\lambda \in [0,1]$ and $\sum_{\lambda=1}^{n} w_\lambda = 1$. The weights of the *k*th decision-maker is obtained by using:

$$\lambda_k = \frac{\left(\mu_k + \pi_k\left(\frac{\mu_k}{\mu_k + v_k}\right)\right)}{\sum_{k=1}^{t}\left(\mu_k + \pi_k\left(\frac{\mu_k}{\mu_k + v_k}\right)\right)} \tag{1}$$

Step 3: Form the aggregated IF judgment matrix based on the DMs. Let $R^{(k)} = (R_{ij}^{(k)})_{m\times n}$ be the IF decision matrix of *k*th decision maker, $\lambda = \{\lambda_1, \lambda_2, ..., \lambda_n\}$ be the weights of all the DMs and $\sum_{k=1}^{t} \lambda = 1 \in [0,1]$. The aggregated fuzzy judgment matrix is obtained by using the Intuitionistic Fuzzy Weighted Averaging (*IFWA*) operator proposed by Xu (2007) as shown below:

$$\begin{aligned} r_{ij} &= \mathit{IFWA}_\lambda\left(r_{ij}^{(1)}, r_{ij}^{(2)}, ..., r_{ij}^{(t)}\right) = \lambda_1 r_{ij}^{(1)} \oplus \lambda_2 r_{ij}^{(2)} \oplus ... \oplus \lambda_t r_{ij}^{(t)} \\ &= \left(1 - \prod_{k=1}^{t}\left(1-\mu_{ij}^{(k)}\right)^{\lambda_k}, \prod_{k=1}^{t}\left(v_{ij}^{(k)}\right)^{\lambda_k}, \prod_{k=1}^{t}\left(1-\mu_{ij}^{(k)}\right)^{\lambda_k} - \prod_{k=1}^{t}\left(v_{ij}^{(k)}\right)^{\lambda_k}\right) \end{aligned} \tag{2}$$

where $r_{ij} = (\mu_{ij}, v_{ij}, \pi_{ij}), \mu_{ij} = 1 - \prod_{k=1}^{t}\left(1-\mu_{ij}^{(k)}\right)^{\lambda_k}, v_{ij} = \prod_{k=1}^{t}\left(v_{ij}^{(k)}\right)^{\lambda_k}$,

$\pi_{ij} = \prod_{k=1}^{t}\left(1-\mu_{ij}^{(k)}\right)^{\lambda_k} - \prod_{k=1}^{t}\left(v_{ij}^{(k)}\right)^{\lambda_k}\ i \in M, j \in N.$

Step 4: Compute the Consistency Ratio (*CR*) of the aggregated IF judgment matrix by using:

$$\mathit{CR} = \frac{\mathit{CI}}{\mathit{RI}} < 0.1 \tag{3}$$

social media analytics tools can be used to collect data from social media platforms in order to assist in the development of marketing strategies (Kumar and Nanda, 2019). The DMs also prioritised advertisement since this criterion has an impact on the advancement of the company's operations and growth. Meanwhile, Table 4 shows that the ranking order for the alternatives is given by $A_3 = A_4 > A_1 > A_2$. Instagram (A_3) and Facebook (A_4) are equally selected as the most preferred social media platforms by the DMs in accordance with the listed criteria.

Table 4: Final ranking for each alternative

A_i	Final entropy weights	Ranking	
A_1	Tiktok	0.2452	3
A_2	Twitter	0.2247	4
A_3	Instagram	0.2650	1
A_4	Facebook	0.2650	1

4. Conclusion

The findings revealed that the two social media marketing platforms which are Instagram, and Facebook are equally chosen as the best alternatives. Hence, the business should take full advantage of these platforms. If these platforms are used efficiently, the business may reach a larger audience, build brand recognition, and market its products and services. In this study, the IFAHP method was successfully used to solve the social media marketing platform selection problem. The IFAHP method proved to be a versatile instrument that enabled an optimal selection of the suitable platform for the promotion of the company. The IFAHP method is not only simple in calculations but also convenient in implementations in practice (Wang et al., 2021). Thus, it is recommended to extend the application of the IFAHP method in other areas for future research.

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