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Sustainable Metaverse Marketing Decisions Using an Intuitionistic Fuzzy Approach

Abstract. *This study examines the Metaverse's potential in marketing, focusing on how it can contribute to sustainable business practices. Using a survey-based approach, this study uses intuitionistic fuzzy numbers and the FUCOM (Full Consistency Method) decision-making model to rank and weight criteria, quantify ambiguity and uncertainty in respondents' opinions, and the newness of the Metaverse and related knowledge gaps that lead to this method. This framework allows organizations to align initiatives with business strategies systematically. Also, by presenting these opportunities and measuring management teams' satisfaction with using them in their marketing strategies, it shows that despite different opinions, the criteria for marketing opportunities in the Metaverse have similar weights, which shows the convergence of opinions about the potential of technology. Respondents from a home appliance company expressed approximately 39% satisfaction with Metaverse's marketing strategy. It highlights opportunities by considering the dimensions of sustainability to increase competitive capacity, improve its position in the market, and increase customer satisfaction. Metaverse is positioned as a transformative marketing tool that provides immersive experiences and data-visualization capabilities.*

Keywords: *Metaverse, intuitionistic fuzzy, FUCOM, marketing, sustainability, decision-making.*

JEL Classification: C44, L21, M00, M16, M31.

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1. Introduction

Metaverse represents the contemporary evolution of the Internet, recognized by researchers and venture investors as a paradigm shift that shapes individuals' utilization and engagement with digital technologies in immersive virtual

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environments (Buchholz et al., 2022). In recent years, the concept of the Metaverse has garnered considerable attention, propelled by advancements in technology and the increasing realism and accessibility of virtual experiences. Metaverse constitutes a digital realm wherein individuals or their avatars engage in interactive experiences with each other and digital entities within a shared virtual space (Barrera & Shah, 2023). According to Rimol (2022), by 2026, approximately 25% of the population will allocate a minimum of one hour daily within the Metaverse, engaging in activities such as work, shopping, learning, socializing, and entertainment.

Two advanced analytical methods were used to study metaverse opportunities in marketing strategies: the complete compatibility method (FUCOM) and the intuitionistic fuzzy number method. These were chosen to overcome the challenges of evaluating Metaverse's multifaceted marketing opportunities. The FUCOM method is central to determining the significance of different criteria without complete pairwise comparisons. This approach is beneficial for prioritizing the complex aspects of a metaverse's marketing potential. This enabled structured prioritization, which is crucial for guiding companies to focus on adopting metaverse technologies.

An Intuitionistic fuzzy number method was included to address the uncertainties and different levels of understanding associated with metamorphism among stakeholders. ultimately, the interplay between sustainability, intuitionistic fuzzy decision-making, and consumer behaviour highlights a critical frontier for marketers. The adoption of new predictive models for understanding consumers' evolving preferences, as illustrated by studies employing advanced fuzzy logic techniques, can reveal nuanced insights (Sadri & Rostamy-Malkhalifeh, 2020).

This study is organized into several key sections. The first part reviews literature on sustainability performance indicators and existing theories on sustainability measurement across industries, providing foundational understanding. The second part focuses on the Metaverse, exploring its concepts, key indicators, and marketing opportunities, along with its relevance to marketing strategies. Section 3 presents the research methodology, combining the FUCOM (Full Consistency Method) decision model and intuitionistic fuzzy numbers for data analysis. Followed by the case study in section 4. The final section summarizes the key findings, suggests directions for future research, discusses limitations, and outlines the study's contributions.

2. Literature review

Sustainability encompasses three dimensions: economic, social, and environmental (Kuhlman & Farrington, 2010) as visualized in Figure 1. Emerging research suggests that the Metaverse will significantly influence all three (Vlăduțescu & Stănescu, 2023). Sustainable marketing in the context of the metaverse harnesses the power of digital transformation and green marketing to promote eco-friendly practices. Digital platforms can significantly enhance the visibility of sustainability efforts, fostering consumer trust and engagement through

transparent communication about sustainable practices and products (Aryasa et al., 2025). The integration of digital technologies in marketing strategies not only helps display a business's commitment to sustainability but also aligns with emerging consumer expectations for corporate social responsibility (Cao et al., 2024).

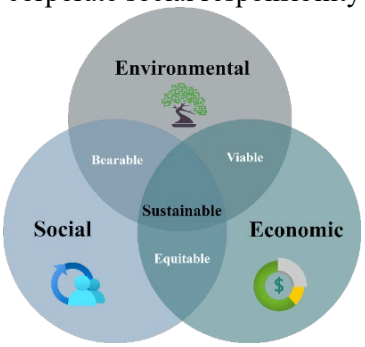

Figure 1. Dimensions of Sustainability
Source: (Purvis et al., 2019).

By integrating strategic vision, technological advancements, and operational efficiency, businesses can leverage the Metaverse as a transformative marketing tool. The classification of marketing opportunities into these three dimensions ensures that companies can effectively prioritize investments, maximize engagement, and align digital initiatives with long-term sustainability goals. This comprehensive approach reinforces the role of the Metaverse not only as a digital extension of traditional marketing but as an evolution that redefines consumer engagement and business growth in the digital age.

Table 1. Metaverse Marketing Opportunities

	Dimension	Opportunities	References
Strategic Level	**Long-Term Customer Engagement**	**Op1:** Engage customers in long-term relationships using virtual communication. **Op2:** Prioritize interaction centrality with the customer in marketing strategies. **Op3:** Create unique virtual experiences to differentiate from competitors in both the virtual and physical realms. **Op4:** Establish new networks of potential colleagues and communities with fewer restrictions than in the physical world.	(Darbinyan, 2022)
	Innovative Advertising in the Metaverse	**Op5:** Create innovative advertising strategies. **Op6:** Utilize the Metaverse for advertising, promotion, sponsorship, endorsement, and brand-building. **Op7:** Foster organic growth and community building by enabling users to create content in the Metaverse.	(Lu & Mintz, 2023)

	Dimension	Opportunities	References
	New Distribution Channels and Communities	**Op8:** Replace or supplement current distribution channels. **Op9:** Establish communities with fewer spatial limitations than in the physical world. **Op10:** Reach unreachable or hard-to-reach customers. **Op11:** Access a diverse range of customers. **Op12:** Explore personalized advertising in the Metaverse through advanced location-based strategies.	(Peyton, 2022)
	Metaverse Gifts and Brand Awareness	**Op13:** Leverage Metaverse gifts as a strategic means to augment brand visibility and foster meaningful engagement with the intended audience. **Op14:** Facilitate virtual product placement in the Metaverse. **Op15:** Increased optimization of marketing campaigns, with tracking and monitoring capabilities inherent in Metaverse marketing tools.	(Bousba & Arya, 2022)
	Cooperation and Global Brand Presence	**Op16:** Facilitate cooperation between brands, offer unique deals, and attract diverse user bases to create a sense of a wide common world. **Op17:** Leverage the Metaverse for new advertising possibilities, including highly contextualized and personalized ads, interactive billboards, and in-world sponsorships. **Op18:** Provide an unprecedented interactive experience bridging the physical and virtual worlds. **Op19:** Build trust and communication with customers through gamified production processes and virtual tours of production sites.	(Koohang et al., 2023)
Technical Level	**Product Development**	**Op20:** Produce products aligned with consumer preferences in interconnected fields. **Op21:** Develop products catering to customers' needs in the non-physical world. **Op22:** Design prototypes, digital wearables for user avatars, and virtual goods in virtual stores associated with real-world physical items **Op23:** Explore the consumption of virtual goods and the relationships between virtual assets and consumers (e.g., ownership, attachment, disposal, and scarcity).	(Zhang et al., 2022)
	Improved Communication and Brand Showcase	**Op24:** Enhance communication for increased brand awareness. **Op25:** Showcase brands more effectively. **Op26:** Providing previously unattainable experiences to customers. **Op27:** Reach unreachable or hard-to-reach customers and provide unprecedented experiences.	(Dwivedi et al., 2023)

	Dimension	Opportunities	References
		Op28: Extend customer interaction beyond the physical world. **Op29:** Create original and authentic content. **Op30:** Utilize non-human virtual influencers for cost-effectiveness and greater control. **Op31:** Gain valuable customer insights in a non-intrusive manner. **Op32:** Use customer data to infer demand for physical world products.	
	Cross-Platform Integration and Realistic Experiences	**Op33:** Facilitate cross-platform integration with other technologies. **Op34:** Capitalize on a proliferated network of users and a diversity of connected devices. **Op35:** Capture real-time data and test new data types from virtual entities and interface devices. **Op36:** Present realistic and high-fidelity 3D representations of objects and spaces.	(Wang et al., 2022)
	Immersive Experiences and Direct-to-Consumer Engagement	**Op37:** Offer realistic and immersive experiences. **Op38:** Enhance interface devices with multisensorial input and output. **Op39:** Allow alternate levels of immersiveness, environmental fidelity, and sociability. **Op40:** Foster relationships between consumers and avatars, supporting direct-to-avatar business models. **Op41:** Respect user privacy and mitigate algorithmic biases. **Op42:** Enable direct purchase and an integrated, interactive consumer shopping journey using social platforms. **Op43:** Create non-fungible tokens (NFTs) for the brand using the blockchain.	(Rathore, 2018)
Operational Level	**Innovative Pricing and Payment Strategies**	**Op44:** Implementing new and innovative strategies in payments and pricing, including NFTs, digital currencies, and blockchain technologies. **Op45:** Create new income streams independently and through collaborations with other companies. **Op46:** Explore the use of non-human virtual influencers for cost-effective marketing. **Op47:** Issue and trade NFTs and other tokenized digital assets. **Op48:** Launch a brand's token economy.	(Lu & Mintz, 2023)
	Gamified and Interactive Experiences	**Op49:** Provide gamified and interactive virtual experiences for customers to view and test products and services.	(Zhang et al., 2022)

	Dimension	Opportunities	References
		Op50: Utilize the Metaverse for customer service and community activities.	
	Metaverse Utilization for Customer Interaction	**Op51:** Enhance customer interaction with brands using the Metaverse. **Op52:** Enhancing the personalized nature of marketing communications through the systematic collection of customer data. **Op53:** Leveraging virtual consumer services, storytelling for your brand, and community communications.	(de Brito Silva et al., 2022)
	Virtual Focus Groups and Market Research	**Op54:** Forming global virtual groups of people and customers **Op55:** Facilitate market and customer research in the Metaverse. **Op56:** Support in-app surveys and collect user feedback.	(Lee & Gu, 2022)
	Testing Virtual Products and Personalized Ads	**Op57:** Simulate the way and scenario of consumption of products in the real world in Metaverse. **Op58:** Personalize messages and marketing strategies using user data. **Op59:** Enable users to create avatars, display them in digital space, and communicate with the brand. **Op60:** Create personalized ads using social communication and real-time interactions. **Op61:** Provide 24/7/365 access for communication between customers and brands.	(Rosário et al., 2023)
	Real-Time Updates and Interactive Marketing	**Op62:** Update digital content in real-time. **Op63:** Ensure high responsiveness to consumer reactions. **Op64:** Provide a suitable environment for need identification, idea generation, and market launch. **Op65:** Involve users in a participatory manner for enhanced engagement.	(Barrera & Shah, 2023)

Source: Table compiled by authors.

3. Materials and methods

3.1 FUCOM decision-making model

Pamučar et al. (2018) developed the Full Consistency Method (FUCOM) as a novel approach for criteria weighting, and the practical implementation of FUCOM was investigated by Nunić (2018). The following section outlines the process of acquiring the weight coefficients of criteria using the FUCOM.

Step 1. The first phase involves the ranking of the assessment criteria, which are selected from a preset set $C = (C_1, C_2, \dots, C_n)$. The ranking is determined based on

the relative importance of the criteria, with the criterion predicted to have the largest weight coefficient given the highest priority and the criterion of least relevance given the lowest priority. Therefore, the criteria are prioritized based on the anticipated values of the weight coefficients.

$$C_{j(1)} > C_{j(2)} > \cdots > C_{J(K)} \quad (1)$$

Here, κ is the position or level of the observed criteria. If two or more criteria are deemed equally significant, the sign of equality is used instead of the $'' >''$ Symbol in expression (1).

Step 2. In the second phase, a comparison of the ranking criteria is carried out, and the comparative priority ($\varphi_{K/(k+1)}$), $k = 1, 2, \dots, n$, where k denotes the rank of the criteria) of the assessment criteria is calculated. The comparative priority of the assessment criteria ($\varphi_{k/(k+1)}$) is an advantage of the criterion of the $C_{j(k)}$ rank compared to the criterion of the $C_{j(k+1)}$ Rank. Thus, the vectors of the comparative priority of the assessment criteria are determined, as in the statement (Eq. 2):

$$\Phi = (\varphi_{1/3}, \varphi_{2/3}, \dots, \varphi_{k/(k+1)}) \quad (2)$$

where ($\varphi_{k/(k+1)}$) reflects the relevance (priority) that the criteria of the $C_{j(k)}$ rank has been compared to the criterion of the $C_{j(k+1)}$ rank.

The FUCOM model permits the pairwise comparison of the criteria by employing integer, decimal values, or the values from the preset scale for the pairwise comparison of the criteria.

Step 3. In the third step, the final values of the weight coefficients of the assessment criteria $(w_1, w_2, \dots w_n)^T$ are determined.

Based on the parameters provided, the final model for calculating the final values of the weight coefficients of the assessment criteria may be defined:

$$\begin{aligned} &\min \chi \quad (3)\\ &s.t.\\ &\left| \frac{\omega_{j(k)}}{\omega_{j(k+1)}} - \varphi_{k/(k+1)} \right| \le x, \forall j\\ &\left| \frac{\omega_{j(k)}}{\omega_{j(k+2)}} - \varphi_{k/(k+1)} \otimes \varphi_{(k+1)/(K+2)} \right| \le x, \forall j\\ &\sum_{j=1}^{n} = 1, \forall j\\ &\omega_j \ge 0, \forall j \end{aligned}$$

By solving the model ($Eq.3$), the final values of the evaluation criteria $(w_1, w_2, \dots w_n)^T$ and the degree of a deviation from full consistency DFC (χ) is created.

3.2 Intuitionistic Fuzzy number

In 1986, (Atanassov & Stoeva) proposed the notion of intuitionistic fuzzy set (IFS) to expand upon fuzzy set theory to address imprecision. In 1994, (Atanassov) demonstrated the relevance and necessity of dealing with ambiguity. The uncertainty in the respondent's thinking may be eliminated by eliciting a response in an intuitionistic fuzzy sense. They defined membership degree, nonmember ship degree, and the degree of hesitation for each element in a set. Also, in Figure 2, the steps of this method are briefly shown in order. So, by an IFS, we mean the triplet $(x, \mu_{\tilde{A}}, \nu_{\tilde{A}})$ and the connection between the components of x, and their images under $\mu_{\tilde{A}}$ and $\nu_{\tilde{A}}$ This may be stated as:

$$\tilde{A} = \{\langle x, \mu_{\tilde{A}}(x), \nu_{\tilde{A}}(x)\rangle : x \in X, \mu_{\tilde{A}}(x) \in [0,1]\} \quad (4)$$

The notion of non-membership function is not comparable to the normal concept of probability of occurrence P and nonoccurrence $(1 - P)$ of a specific event in classical probability theory. That is, in IFS, , $\mu_{\tilde{A}}(x) + \nu_{\tilde{A}}(x) \leq 1$. This suggests that there must be some degree of uncertainty in offering answer to a certain incident.

Atanassov (Atanassov, 1989, 1994) defined the algebraic operations on IFS as follows:

$$\tilde{A} + \tilde{B} = \{\langle x, \mu_{\tilde{A}}(x) + \mu_{\tilde{B}}(x) - \mu_{\tilde{A}}(x) * \mu_{\tilde{B}}, \nu_{\tilde{A}}(x)\nu_{\tilde{B}}(x)\rangle : x \in X\} \quad (5)$$

$$n\tilde{A} = \{\langle x, 1 - [1 - \mu_{\tilde{A}}(x)]^n, [\nu_{\tilde{A}}(x)]^n\rangle : x \in X\} \quad (6)$$

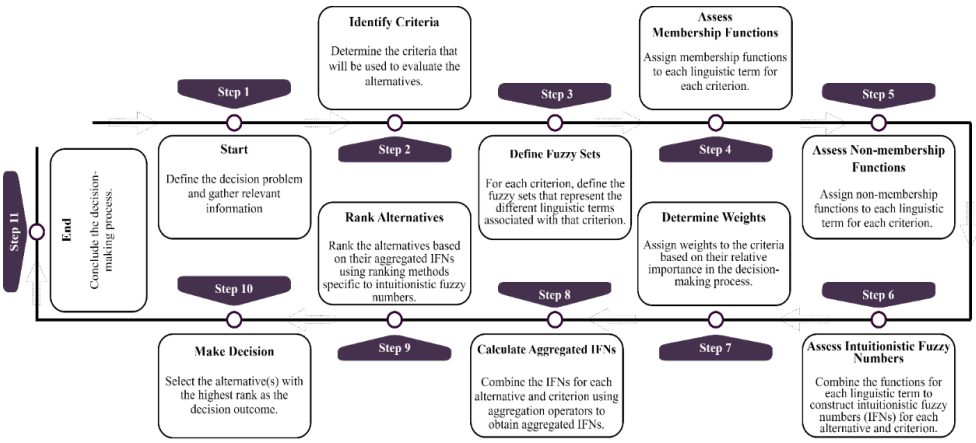

Figure 2. Intuitionistic Fuzzy number model flowchart
Source: Figure created by authors.

4. Data Analysis

Our decision-making method is made of several steps, which need the decision maker's participation in many of the steps, so we decided to gather data in a meeting instead of the person-to-person interview or questionnaire used to ask their opinions and scores. In the first step, we asked the team of the managerial board and executive managers of the home appliances company, which was selected to be the case of this study, to score three sustainability dimensions using the seven-point Likert scale. Our respondents have 17 members; their answers are reported in Table 2.

Table 2. Scores given to sustainability dimensions

Dimension	Social	Environmental	Economic
Respondent	**C1**	**C2**	**C3**
1	7	3	2
2	7	4	2
3	7	6	2
4	7	5	2
5	3	6	3
6	7	6	3
7	2	6	2
8	1	4	6
9	3	7	6
10	3	5	7
11	5	4	5
12	1	5	6
13	3	6	5
14	1	4	7
15	6	3	2
16	1	5	6
17	2	7	4
Average	3.88	5.05	4.11

Source: Table computations and data written by authors.

Considering the results from Table 2, we now start the FUCOM algorithm to find the weight of our three decision criteria: sustainability dimensions.

From Table , we have $C_2 > C_3 > C_1$. Comparative importance of the criteria is calculated as:

$$\varphi_{\left(\frac{c_2}{c_3}\right)} = \frac{5.05}{4.11} = 1.23, \qquad \varphi_{\left(\frac{c_3}{c_1}\right)} = \frac{4.11}{3.88} = 1.06$$

Optimization constraints are determined as:

Constraint 1:

$$\frac{w_2}{w_3} = 1.23, \qquad \frac{w_3}{w_1} = 1.06$$

Constraint 2:

$$\frac{w_2}{w_1} = \frac{w_2}{w_3} * \frac{w_3}{w_1} = 1.23 * 1.06 = 1.3$$

The final optimization model to find criteria weights can be written as follows:

Min X

Sub to:

$$\left|\frac{w_2}{w_3} - 1.23\right| \leq X$$
$$\left|\frac{w_3}{w_1} - 1.06\right| \leq X$$
$$\left|\frac{w_2}{w_1} - 1.30\right| \leq X$$
$$w_j \geq 0 \qquad \forall j$$
$$\sum_{j=1}^{3} w_j = 1$$

Solving this model by LINGO18 software, the weight of criteria is calculated; $w_1 = 0.29, w_2 = 0.38, w_3 = 0.31$ and the objective function $x = 0.1155428\text{E} - 02$.

In the next step, we ask respondents to evaluate metaverse marketing opportunities. According to the nature of Metaverse and its new outcomes, many companies and managers do not have a clear idea of it, so they cannot have a clear idea or decision about its concept and usage. We realized that common questionnaires cannot gather trustworthy data. It led us to use intuitionistic fuzzy numbers, which better show the hesitant nature of the situation.

Every respondent assigns weight to each dimension (W_j) and opportunities (W_{ij}) listed in Table 1 according to relative importance. As explained above, we use intuitionistic triangular fuzzy numbers, and the range of grades is [0,1], as shown in Table (Rasheed et al., 2021).

Table 3. Intuitionistic fuzzy grades

Grade	Intuitionistic fuzzy numbers
0	([0,0,1], [2,3,4])
1	([0,1,2], [3,4,5])
2	([1,2,3], [4,5,6])
3	([2,3,4], [5,6,7])
4	([3,4,5], [6,7,8])
5	([4,5,6], [7,8,9])
6	([5,6,7], [8,9,10])
7	([6,7,8], [0,2,4])
8	([7,8,9], [1,3,5])
9	([8,9,10], [4,5,6])
10	([9,10,10], [7,8,9])

Source: Table computations and data written by authors.

The average weight assigned by n respondents for each dimension can be calculated using:

$$W_j = \frac{1}{n}(W_1 + W_2 + \cdots + W_n)$$

Which is also an intuitionistic triangular fuzzy number. Then the average should be defuzzified by:

$$Defuzzified(W_j) = \frac{(a_1 + 4a_2 + a_3) + (\acute{a}_1 + 4\acute{a}_2 + \acute{a}_3)}{12}$$

And normalized by:

$W_j = \frac{Defuzzified(\mathrm{W}_j)}{\sum_{j=1}^{m} Defuzzified(\mathrm{W}_j)}$, m is the number of dimensions.

The results of these calculations are reported in Table 4.

Table 4. Intuitionistic fuzzy average weight calculations for Metaverse Dimensions

Level	No	Dimension	Average weight	Defuzzified	Normalized
Strategic Level	1	Long-Term Customer Engagement	([5.64,6.64,7.58],[4.41,5.52,6.64])	6.083	0.073
	2	Innovative Advertising in the Metaverse	([5.05,6.05,6.94],[4.64,5.82,7])	5.931	0.071
	3	New Distribution Channels and Communities	([4.47,5.47,6.41],[4.35,5.52,6.70])	5.495	0.066
	4	Metaverse Gifts and Brand Awareness	([5.05,6.05,7],[3.88,5.17,6.47])	5.612	0.067
	5	Cooperation and Global Brand Presence	([4.76,5.64,6.64],[3.47,4.70,5.94])	5.186	0.062
Technical Level	6	Product Development	([3.11,3.88,4.82],[4,5.17,6.35])	4.544	0.054
	7	Improved Communication and Brand Showcase	([4.70,5.70,6.41],[4.64,5.82,7])	5.740	0.069
	8	Cross-Platform Integration and Realistic Experiences	([3.94,4.88,5.64],[5.29,6.29,7.29])	5.573	0.067
	9	Immersive Experiences and Direct-to-Consumer Engagement	([5.58,6.58,7.47],[3.35,4.82,6.29])	5.696	0.068
Operational Level	10	Innovative Pricing and Payment Strategies	([3,3.94,4.94],[4.58,5.64,6.70])	4.799	0.057

Level	No	Dimension	Average weight	Defuzzified	Normalized
	11	Gamified and Interactive Experiences	([3.94,4.82,5.64],[3.94,5.11,6.29])	4.965	0.059
	12	Metaverse Utilization for Customer Interaction	([5.41,6.41,7.05],[6.11,7.17,8.23])	6.764	0.081
	13	Virtual Focus Groups and Market Research	([5.05,5.94,6.64],[5.52,6.58,7.64])	6.249	0.075
	14	Testing Virtual Products and Personalized Ads	([4,4.94,5.82],[5.29,6.41,7.5])	5.671	0.068
	15	Real-Time Updates and Interactive Marketing	([3.23,4.11,5.05],[3.94,5.05,6.17])	4.593	0.055

Source: Table computations and data written by authors.

Now we need to know how our respondents assess the importance of metaverse marketing opportunities in regard to each sustainability dimension, so we use seven-point Likert scale intuitionistic triangular fuzzy numbers as defined in it is shown in Figure 3 and Table 5 (Rasheed et al., 2021).

Table 5. Seven-point Likert scale intuitionistic triangular fuzzy number

Code	Linguistic term	Equivalent term
A_1	Extra low	([0,0,1/6],[2/6,3/6,4/6])
A_2	Very low	([0,1/6,2/6],[3/6,4/6,5/6])
A_3	Low	([1/6,2/6,3/6],[4/6,5/6,6/6])
A_4	Medium	([2/6,3/6,4/6],[5/6,6/6,6/6])
A_5	High	([3/6,4/6,5/6],[0,1/6,2/6])
A_6	Very high	([4/6,5/6,6/6],[1/6,2/6,3/6])
A_7	Extra high	([5/6,6/6,6/6],[2/6,3/6,4/6])

Source: Table computations and data written by authors.

Figure 3 illustrates the Seven-point Likert scale with intuitionistic triangular fuzzy numbers. The larger triangles (A1 to A7) represent intuitively defined fuzzy numbers, each corresponding to a specific point on the Likert scale. The smaller triangles within these larger ones denote ambiguous spaces for each Likert number, highlighting areas of uncertainty or overlap. The rhombuses embedded within the triangles pinpoint specific parts that are exclusive to each Likert number and do not overlap with adjacent numbers.

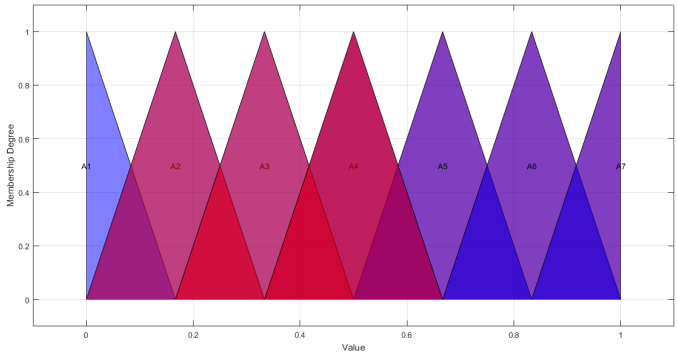

Figure 3. Seven-point Likert scale intuitionistic triangular fuzzy number
Source: Figure created by authors.

Applying these calculations to our data, for the first sustainability dimension, which is "Social", the main intuitionistic fuzzy membership and nonmembership rate for all linguistic terms defined in Table 5, respectively, are:

$$G_1 = \begin{bmatrix} \langle 0.031,0.026\rangle, \langle 0.035,0.021\rangle, \langle 0.031,0.027\rangle, \langle 0.032,0.026\rangle, \langle 0.035,0.023\rangle, \\ \langle 0.030,0.026\rangle, \langle 0.035,0.022\rangle \end{bmatrix}$$

For the second sustainability dimension, which is "Environmental", we have:

$$G_2 = \begin{bmatrix} \langle 0.030,0.028\rangle, \langle 0.034,0.022\rangle, \langle 0.030,0.027\rangle, \langle 0.031,0.027\rangle, \langle 0.033,0.025\rangle, \\ \langle 0.037,0.022\rangle, \langle 0.032,0.026\rangle \end{bmatrix}$$

And for the third sustainability dimension, which is "Economic", we have:

$$G_3 = \begin{bmatrix} \langle 0.029,0.027\rangle, \langle 0.036,0.023\rangle, \langle 0.032,0.024\rangle, \langle 0.035,0.023\rangle, \langle 0.034,0.022\rangle, \\ \langle 0.036,0.023\rangle, \langle 0.034,0.022\rangle \end{bmatrix}$$

Defuzzifying the above numbers and multiplying the result of each by the calculated weights by FUCOM, we will have the Metaverse marketing benefit rate of 0.391, which means the board members of this company 39% agree with the Metaverse marketing deployment considering sustainability goals.

5. Conclusions

This study highlights the significant role of the Metaverse in fostering sustainable development in marketing by providing companies with opportunities to enhance their market position, improve customer interaction, and align with economic, environmental, and social sustainability objectives. The findings suggest that adopting Metaverse technologies enables businesses to create immersive brand experiences, increase consumer engagement, and strengthen their competitive advantage. Furthermore, organizations that effectively leverage Metaverse-driven marketing strategies can reduce their environmental footprint, enhance their corporate social responsibility, and drive economic growth.

The research emphasizes that for companies to successfully integrate the Metaverse into marketing, they must consider its impact on consumer behavior, assess available opportunities, and develop strategies to maximize engagement and business performance. Companies seeking to incorporate the Metaverse into their marketing strategies should invest in comprehensive research, establish clear strategic objectives, collaborate with industry experts, and personalize the customer experience to enhance brand interactions. Moreover, continuous evaluation and adaptation of Metaverse strategies will enable businesses to optimize return on investment and remain competitive in an evolving digital landscape (Ball, 2021; Rosário et al., 2023).

Despite the growing interest in Metaverse-based marketing, various challenges persist, including high implementation costs, informational barriers, and managerial resistance. Organizations may be reluctant to adopt Metaverse technologies due to uncertainty regarding infrastructure investments and the perceived risks associated with digital transformation. Addressing these challenges requires a structured framework that enables businesses to systematically evaluate Metaverse opportunities at strategic, technical, and operational levels(Barrera & Shah, 2023; Zhang et al., 2022). This classification ensures that organizations can prioritize resource allocation, technology adoption, and operational enhancements, ultimately improving market agility and sustainability outcomes.

Given the early-stage development of the Metaverse, further research is required to explore its long-term implications for marketing and organizational communication. Future research directions should focus on assessing strategies to reduce implementation costs, identifying informational barriers that hinder adoption, and examining management resistance to Metaverse integration. Such studies will provide insights into whether Metaverse-driven marketing strategies remain sustainable over time and how businesses can refine their approaches to maintain consumer engagement in digital spaces (Hazan et al., 2022).

In conclusion, the Metaverse represents a transformative shift in marketing, redefining how companies interact with consumers and communicate their brand messages. However, successful integration requires a strategic, research-driven approach that aligns Metaverse initiatives with business objectives, market conditions, and sustainability principles. By adopting a structured and adaptable framework, organizations can leverage the full potential of the Metaverse, ensuring long-term market relevance, customer engagement, and sustainable business growth in the digital age.

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