AIMS Mathematics

AIMS Mathematics, 8(3): 6288–6308.
DOI: 10.3934/math.2023318
Received: 16 September 2022
Revised: 05 December 2022
Accepted: 21 December 2022
Published: 03 January 2023

http://www.aimspress.com/journal/Math

Research article

A hybrid multiple-criteria decision-making model for podcaster selection from the perspective of Taiwanese mattress brands

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Abstract: The year 2020 has been called the first year of the podcast in Taiwan. In recent years, Taiwan's podcast industry has witnessed gradual growth in the number of listeners, as well as in programme variety. Podcast subscribers can choose their favourite content, receive new content, and can choose what they want to listen to and download it through different hosting platforms. Additionally, a growing number of companies are attempting to use podcasts to market their brands, achieve targeted brand effects, and build their customer base, especially among the lead generation. This study developed a hybrid multiple-criteria decision-making (MCDM) model to assist Taiwanese mattress brand executives in selecting podcasters to market their brands. This is a major issue that has not yet been explored in the literature. First, 12 sub-criteria (SC) were selected using the fuzzy Delphi method (FDM) and categorised to establish the hierarchical structure. Then, a combination of decision making trial and evaluation laboratory (DEMATEL), analytic network process (ANP), and technique for order preference by similarity to ideal solution (TOPSIS) was adopted to assist the case company's executives in selecting the best podcaster. The integrated operations performed in this study are logically coherent, practical, and functional. This hybrid MCDM model allows companies and decision-makers to make objective, efficient, and accurate decisions.

Keywords: ANP; DEMATEL; FDM; podcaster; TOPSIS
Mathematics Subject Classification: 03E72, 90B50, 90B60

1. Introduction

As the relationship between social media and consumers becomes increasingly tight, consumers receive and disseminate corporate messages, business ideas, and the latest information through social media. This has become a part of the daily lives of consumers, and deeply affects their psyche and influences their shopping decisions. Consequently, social media has become the principal medium through which companies market their products and services to consumers. With the development of the Internet and popularity of smartphones, the relevance of social media is growing at an alarming rate, and its importance cannot be underestimated. By using social media to instantaneously interact and share information with consumers, companies can not only meet consumer needs but also retain a competitive advantage [1]. Moreover, the ease and speed with which social media can disseminate information has made it one of the most popular marketing tools. In addition to reducing marketing costs, social media can be utilised to increase the exposure of new products or services and build customer loyalty. If social media can be used as a medium to search for information about goods or services, or to seek advice from friends and relatives, individuals can efficiently perceive the benefits of the target goods or services, enabling them to make favourable purchasing decisions [2].

Web 2.0 was originally a business revolution in the information industry, and with the impact of globalisation, industries are now moving forward by capturing its spirit of 'interaction', 'sharing', and 'collective intelligence'. Web 2.0 has created many crucial, exciting, and popular web applications, such as blogs and podcasts. The latter is an emerging audio-visual medium that has created another ripple after blogs became the world's leading personal media on the web in 1999. After blogs changed how people read, podcasts emerged and revolutionised listening. Podcasts represent brand-new audio-visual technology that reflects the trend of customisable, on-demand, and portable content, the advent of which is bound to change listeners' habits and modes of receiving audio-visual information [3]. Many studies have also shown that podcast episodes are vital for marketing. For example, McGowan [4] claimed that podcasts have the potential to become a popular and profitable resource for advertisers. Makrinova et al. [5] pointed out that during the pandemic, many businesses reduced their advertising budget. However, at present, social media offers a great opportunity to update the format of communication and create new advertising channels to help businesses reach their target audience. Podcasts are among these advertising platforms, and companies are using them extensively. McCarthy et al. [6] indicated that podcasts are becoming a highly popular form of entertainment, and as the number of podcasts and listeners grow, marketers are presented with an excellent opportunity to interact with their target audience.

Podcasts have become an indispensable part of our daily entertainment, and many people listen to them while commuting to work or doing housework. Rapid advances in Internet technology have led to the evolution of information dissemination media. The number of podcast listeners has been increasing annually, and with the emergence of many new programmes on a variety of topics on both domestic and international platforms, the market's growth is outpacing that of other audio-visual streaming platforms [7]. In August 2020, the podcast listening rate in Taiwan was 6.6%; by the end of 2020 it surpassed 10%. In May 2021, the podcast listening rate officially reached 20%, indicating that one out of every five people in Taiwan listened to podcasts. Additionally, over 30% of non-listeners have reported their willingness to listen to a podcast in the future, which indicates considerable growth potential for the podcast market and listening rate [8]. Moreover, nearly 30% of business operators had already tried podcasts, and over 40% said they would consider it. Among the companies that used podcasts, the most popular format was interviews (66%), followed by advertisements (36%). Podcasts have been popular since 2020, but companies are still experimenting with podcast marketing [9].

Overall, podcast episodes are critical for corporate marketing. However, podcasters are a factor that listeners consider when deciding whether it is worth their time and investment in the subscription cost [10]. Podcasters influence audience engagement [11]. Therefore, it is crucial for businesses to select the right podcaster to appeal to their target audiences. However, in an increasingly complex decision-making environment, important problems often require multiple experts to carefully evaluate several criteria and apply multi-criteria group decision-making (MCGDM) methods to aid deciding authorities in identifying the most appropriate solution. The results of group decision-making, which entails integrating various decision-makers' views, are more objective than those of a single decision-maker [12]. Additionally, it has recently become common to combine different methods in MCDM analysis to address methodological deficiencies [13]. Accordingly, this study applied a hybrid MCDM model to assist Taiwanese mattress brand executives in selecting the optimal podcaster through group decision-making, a major issue not explored in previous literature.

Decision-making is a process by which an alternative or action is selected or classified based on the decision-maker's choices. Many problems are resolved based on multiple criteria. There are many approaches for identifying solutions to MCDM problems in many subjects [14]. Recently, many studies have applied or combined different MCDM approaches for personnel selection in the field of media or marketing, such as a combination of FDM, DEMATEL, ANP, and TOPSIS [15–19], a combination of the modified Delphi method and the analytic hierarchy process (AHP) [20]; a combination of the importance-performance analysis (IPA), AHP, and TOPSIS [21]; a combination of IPA, DEMATEL, ANP, and TOPSIS [22]; a combination of FDM, AHP, and TOPSIS [23]; and AHP [24]. However, each MCDM approach has advantages and disadvantages, and determining the best MCDM method can be a challenging process [25]. For example, insensitivity to priority weights on the final rankings is a drawback of TOPSIS [26]. Additionally, in the decision-making process, experts face vagueness and ambiguities. Moreover, expert evaluations of decisions are always fuzzy [27], which the modified Delphi method and IPA ignore. Moreover, AHP assumes that the elements are independent in the hierarchical structure. This may not be in line with reality. Finally, ANP requires many pairwise comparison matrices, which can make it difficult for decision-makers to provide answers.

Decision-making is a vital process in theoretical studies and applications in numerous fields. MCGDM is a method for dealing with different situations in which the criteria driving the decisions are considered by various experts. However, increased uncertainty in the evaluation may add barriers to an appropriate decision [28]. Roughly speaking, the decision-making strategy considers imprecision in the data without identifying the ambiguity and inconsistency it displays [29]. However, FDM is an effective factor-filtering method that has four advantages over the traditional Delphi method. It reduces the number of surveys, allows for a more complete representation of expert opinions, makes expert knowledge more rational and relevant through fuzzy theory, and is more cost-effective in terms of time and money [30]. DEMATEL, which can confirm the mutual effects between elements, has been applied in many research fields to resolve complex system problems [31]. Saaty [32] created ANP because real-life problems often involve dependence or feedback relationships. ANP is a new approach to decision-making that builds on AHP and extends it to accommodate non-independent 'hierarchical structures'. As such, ANP is an extension of AHP. The former has a feedback mechanism and uses a supermatrix to calculate the degree of influence of interdependencies. The basic concept of TOPSIS is to find the best solution based on the analytical logic of 'closest to the ideal solution and furthest from the negative ideal solution'. TOPSIS is a simple and easy-to-use procedure [13]. Overall, TOPSIS is a well-known MCDM model that is often used to solve decision-making problems [33].

As mentioned above, this study first interviewed Taiwanese mattress brand executives, reviewed the relevant literature, and then compiled the selection SC. The next step was to investigate the importance of each selection sub-criterion using FDM and identify the selection SC. The interaction between the criteria and SC was determined using DEMATEL software. ANP can deal with decision-making problems where there are interactions between the criteria and SC; however, it requires a large number of pairwise comparison matrices, which can make it difficult for decision-makers to provide the necessary answers. Therefore, ANP was used to determine the weights of the criteria and SC based on the interactions between them. To decrease the number of pairwise comparison matrices and the operational difficulties encountered by decision-makers, TOPSIS was applied to incorporate the integrated weight of each sub-criterion as determined through ANP and select the optimal podcaster.

The objectives of the present study are:

(1) To interview Taiwanese mattress brand executives, review the relevant literature, compile the selection SC for podcasters, and filter the selection SC according to FDM, and then categorise the SC with reference to the literature to establish a hierarchy that Taiwanese mattress brand executives can use to select the optimal podcaster.

(2) To apply the hierarchy to a single mattress brand and assist the case company's executives by selecting the best podcaster using a combination of DEMATEL, ANP, and TOPSIS.

The remainder of this paper is organised as follows. Section 2 presents research gaps. Section 3 describes the research methodology. Section 4 details the case study, the purpose of which was to assist the case company's executives in selecting the best podcaster using the constructed hybrid MCDM model. Section 5 presents conclusions, research contributions, research limitations, and suggestions for future research.

2. Research gap

Many recent studies have examined the issue of personnel selection in the field of media or marketing, including celebrity endorsers [15], professional esports gamers [16], bloggers [17,21], variety show hosts [18], YouTubers [19,20], esports casters [22], live streamers [23], and salespersons [24]. However, no studies have addressed the important issue of selecting podcasters.

As for the methods, studies have applied or combined different MCDM approaches, as shown in Table 1. However, each MCDM approach has advantages and disadvantages, and deciding on the best MCDM method can be a very challenging process [25]. For example, in the procedure of decision-making, experts have faced vagueness and ambiguity. Moreover, expert evaluations of decisions are always fuzzy [27]. The modified Delphi method and IPA were not used in this study. Moreover, AHP assumes that elements are independent in the hierarchical structure. This may not be in line with reality. Finally, ANP requires many pairwise comparison matrices, which can make it difficult for decision-makers to provide the answers. As a result, to improve the quality of decision-making and accelerate the decision-making process, a hybrid MCDM model (FDM, DEMATEL, ANP, and TOPSIS) was utilised in this study to assist Taiwanese mattress brand executives in selecting podcasters to market their brands.

Table 1. Methods for personnel selection in the field of media or marketing.

Methods	Contributors
FDM, DEMATEL, ANP, and TOPSIS	[15–19]
The modified Delphi method and AHP	[20]
IPA, AHP, and TOPSIS	[21]
IPA, DEMATEL, ANP, and TOPSIS	[22]
FDM, AHP, and TOPSIS	[23]
AHP	[24]

3. Materials and methods

This section introduces the proposed hybrid MCDM model. First, FDM was used to filter the selection SC for podcasters. DEMATEL was then used to establish the interaction between the criteria and SC. Next, ANP was employed to determine the weighting of each criterion and sub-criterion. Finally, TOPSIS was used to identify the best podcaster.

3.1. The fuzzy Delphi method

The expert assessment method, also known as the expert survey method, is a mode in which experts apply their knowledge and experience in their field of expertise to focus on and simplify complex criteria through rational mathematical summarisation, so that the resultant criteria are more representative. The Delphi method is the most frequently used expert assessment method. Since the 1990s, it has become an indispensable forecasting tool for major long-term planning and decision-making in the public and private sectors, as it uses group communication to reach an expert consensus. However, the Delphi method requires repeated surveys to reach expert consensus, which increases the cost and time of implementation, resulting in less feedback. Moreover, confusion occurs in different experts' presentations of their opinions [34]. In addition, the Delphi method has several methodological shortcomings, although it has been widely used in different fields. For example, questionnaire items can be ambiguous, resulting in different experts having different perceptions of a particular question, which may lead to misrepresentation owing to the inability to communicate with each other. This entails more iterations to encourage agreement among experts, which is associated with increased costs, higher time investment, and lower response rates. Furthermore, by aggregating expert opinions, the surveyor may have a preconceived notion that leads to filtering out what the correct expert opinion may actually be, resulting in different ideas and results. Moreover, by taking the median and middle 50% of the data as the range of expert opinions, the other half of the experts' opinions are ignored [30]. Finally, another study suggests that the Delphi method is a means of reducing the number of criteria that may influence decision-making by integrating the results of expert questionnaires to identify important criteria, but it fails to address inconsistencies amongst opinions in the group decision-making process [35].

The mathematical descriptions of real-life phenomena can be divided into three categories: Deterministic, random, and fuzzy. The mathematical tools used to study deterministic phenomena are traditional mathematics, such as algebra and geometry, which are familiar to most people, whereas those for random phenomena are probability theory and statistics. Common phenomena in real life are mostly fuzzy. It is often impossible to quantify subjective perceptions of abstract things, and even when quantification is used, it often distorts a respondent's real perception. To address this, Zadeh [36] proposed the concept of fuzzy theory in 1965. Under fuzzy theory, fuzzy sets make it possible to add the notion of the degree between belonging and not belonging to a set as an alternative to the dichotomy of simply belonging or not belonging [37].

The traditional Delphi method can effectively summarise the views of a group of experts and produce a prediction that is more in line with decision-makers. However, there are problems with the traditional Delphi method. Specifically, iterative surveys are required to obtain better convergence, thus creating a costly analysis process and decreasing the response rate. Hence, an improved approach combining fuzzy theory and the traditional Delphi method has been adopted [30]. FDM can consider all expert opinions and the potential ambiguity of human judgement, thereby simplifying the iterative process required to apply the Delphi method [38]. FDM used in this study was based on a 9-point Likert-type semantic scale to demonstrate the importance of experts ascribing to each sub-criterion. The steps in FDM process are as follows:

(1) Collect the views of the decision-making community.

Use the collected data to design a 9-point Likert-scale questionnaire to ascertain each expert's importance score for each sub-criterion.

(2) Compute the importance scores for each sub-criterion.

Based on Hwang et al. [39], the respondents' ratings for each sub-criterion were computed and converted into triangular fuzzy numbers. Finally, the centre of gravity approach was applied to defuzzify the triangular fuzzy numbers of each sub-criterion [40].

(3) Filter the SC.

Finally, setting thresholds allows the selection of the appropriate SC from a wide range. A value with a threshold greater than 7.0000 was considered important.

3.2. The decision making trial and evaluation laboratory

Using DEMATEL, we can easily quantify the relationships among the many elements included in a complex problem group and identify the priorities among the elements in a structured model of the complex problem group to improve the overall problem structure [30]. DEMATEL analysis follows five steps [22,41]:

(1) Define the elements and determine their relationships.

List and define the elements. The number of elements can be ascertained through discussions, literature reviews, and brainstorming. A 5-point scale is used to represent the degrees of influence from 0 to 4.

(2) Establish a direct relationship matrix (X).

X can be created once the magnitude of influence has been defined. If there are n elements, pairwise comparisons based on their influence and magnitude can produce a direct relationship matrix of size $n \times n$. It is represented as $X = [x_{ij}]$ ($i = 1,2,3,\ldots,n$; $j = 1,2,3,\ldots,n$), where $[x_{ij}]$ represents the extent to which element i affects element j, and the diagonal elements are set to 0.

(3) Establish a normalised direct relationship matrix (D).

The X obtained in Step 2 is normalised by multiplying the elements of the entire matrix X by S to establish D.

$$S = \frac{1}{\underset{1 \le i \le n}{MAX} \sum_{j=1}^{n} x_{ij}} . \tag{1}$$

(4) Establish the total influence relationship matrix (T).

T can be calculated using the formula below.

$$T = \frac{D}{I - D}, \text{ where } I \text{ is the identity matrix.} \quad (2)$$

(5) Establish the threshold value.

The threshold value is set based on the experts' decisions.

DEMATEL is widely used to build interactions among factors for personnel selection issues [15–19,22]. The primary objective of this study was to build the interaction between the criteria and SC using DEMATEL.

3.3. The analytic network process

In our daily lives, we often need to make various decisions, but the criteria that affect decision-making may be difficult to structure because of variability of experience and ability. Further, the quantitative and qualitative characteristics of the criteria may vary, so that the decision-makers often fail to obtain sufficient information and may make wrong and high-risk decisions. AHP, developed by Saaty [42], is one of the most suitable methods for addressing problems that require the consideration of many complex criteria. In simple terms, AHP is a hierarchical structure of complex MCDM problems, in which each layer comprises different elements. AHP can systematically address many qualitative factors and provide decision-makers with quantified results as objective reference data. However, several recent social science studies have revealed that many issues related to decision-making are not expressed exclusively in hierarchical terms regarding their complex internal correlations, as there is interplay between the upper and lower layers and interdependence between elements in the lower layer and those in the higher layer [32]. Thus, a mutual feedback relationship has been discovered between the alternatives and criteria in an organisation. Accordingly, ANP has been proposed to address these issues [30]. Saaty [32] proposed ANP, which is derived from AHP. AHP assumes that elements are independent and do not affect each other. However, in practice, this assumption seems too strong, as there is likely to be an interaction between elements. ANP can address non-linear and complicated hierarchical relationships, and it is more reflective of real-life phenomena than AHP; therefore, it has become more widely applied in recent years [37].

In ANP, the decision-making process is as follows [32,43].

(1) Define the decision-making problem.

Based on the nature of the decision-making problem and the system in which it is situated, all the elements that may affect the decision problem are included. At this stage, a planning team is formed to gather relevant information and define the scope of the decision-making problem.

(2) Form a decision-making group.

Experts from relevant fields are recruited to form a decision-making group depending on the field and complexity of the decision problem.

(3) Devise the problem structure.

The planning team collates and summarises information about the decision-making problem as reference for decision group members and then uses brainstorming to identify the systemic elements that influence the decision-making problem, including objectives, criteria, SC, and alternatives. In the problem structure, hierarchical layers are linked by circular arcs and two- and one-way arrows to indicate subordination and the existence of feedback relationships.

(4) Design the questionnaire and survey.

Based on this hierarchy, the experts in the decision-making group determine the relative importance of the elements. This is achieved by designing a questionnaire that clearly describes each of the pairwise comparison issues to assist the experts' judgement.

(5) Integrate the experts' preferences.

As each expert has a different perception of the problem when a decision-making group conducts an evaluation, and as the resulting pairwise comparison judgement values are different, it is necessary to integrate the experts' preferences.

(6) Build a pairwise comparison matrix and calculate the weight of each element.

Based on the integrated expert preferences, a number of pairwise comparison matrices can be obtained. The relative importance of the elements can be judged on a scale of 1–9. ANP scale is divided into five basic grades, which are given scale values of 1, 3, 5, 7, and 9. Further scale values of 2, 4, 6, and 8 between the five basic grades are assigned, indicating a level of importance that lies between the aforementioned designations. When the measure is the inverse of the scale value, the latter element is more important. The decision-maker or expert's preferences must be transferable and therefore go through the consistency ratio (CR). Once pairwise comparisons have been integrated, the eigenvalues and eigenvectors of the pairwise comparison matrix can be obtained to derive the weights of the elements.

(7) Operationalise the supermatrix.

To address the dependencies between elements in the problem structure, ANP uses a supermatrix to compute the relative weights of the elements. The supermatrix consists of a number of submatrices, which are the pairwise comparison matrices obtained in the previous step. If there is no correlation between the elements, the pairwise comparison value of the submatrices is 0. The unweighted supermatrix (the column values do not sum to 1) must be transformed using a specific procedure. The weighted supermatrix is obtained by giving the unweighted supermatrix its relative importance weight. Eventually, the dependencies gradually converge through a limiting process and the relative weights of the elements are obtained.

(8) Derive the relative weights of the alternatives.

Under each element, the relative importance of each alternative is compared, a matrix of pairwise comparisons is created, and preferences are integrated, allowing the relative weight of each alternative to be measured.

ANP is commonly utilised to obtain the weights of factors for personnel selection issues [15–19,22]. ANP can be used to address decision-making problems in which interactions exist between elements. Therefore, this study used ANP to determine the weights of the selection criteria and SC, based on the interactions between them.

3.4. The technique for order preference by similarity to ideal solution

The aim of TOPSIS is to rank different solutions to derive their priority sequences. The basic concept is to first identify the ideal solution and the negative ideal solution, where the former is the solution with the largest benefit criterion and the smallest cost criterion. Conversely, the negative ideal solution is the solution with the smallest benefit criterion and the largest cost criterion. When selecting an ultimate solution, the option closest to the ideal solution and furthest from the negative ideal solution is regarded as the best [30]. As proposed by Hwang and Yoon [44], TOPSIS has become a major MCDM method that selects the best solution to a real-world problem from among many options [45]. Unlike most decision-making methods that only consider the positive ideal solution, TOPSIS also weighs the distance between the ideal solution and the negative ideal solution, allowing decision-makers to find the most suitable solution by choosing the appropriate relative position. This avoids a situation in which the two solutions are closest to the positive ideal solution and cannot be compared [12].

According to TOPSIS connotation and solution process, the solution steps can be summarised as follows [17,46]:

(1) Define the decision-making problem and the decision-makers (decision-making group).

(2) Develop feasible solutions.

(3) Develop elements to evaluate the decision-making problem.

(4) The decision-makers or decision-making group decide on the weighting of each evaluation element.

(5) Measure the performance values of the solutions to obtain an evaluation matrix.

(6) Normalise the data in the evaluation matrix to obtain a normalised evaluation matrix.

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \tag{3}$$

where i is the solution, j is the evaluation element, and x_{ij} is the i solution under the jth element to be estimated using a 9-point Likert-scale.

(7) Create a weighted normalised evaluation matrix (multiplying the element weights by the normalised performance values).

The priorities of the evaluation elements, $w=(w_1, w_2, \cdots, w_n)$, multiplied by the normalised evaluation matrix can be presented by the following equation:

$$v = \begin{bmatrix} v_{11} & v_{12} & \dots & v_{1n} \\ v_{21} & v_{22} & \dots & v_{2n} \\ \vdots & \vdots & \dots & \vdots \\ v_{m1} & v_{m2} & \dots & v_{mn} \end{bmatrix} = \begin{bmatrix} w_1 r_{11} & w_2 r_{12} & \dots & w_n r_{1n} \\ w_1 r_{21} & w_2 r_{22} & \dots & w_n r_{2n} \\ \vdots & \vdots & \dots & \vdots \\ w_1 r_{m1} & w_2 r_{m2} & \dots & w_n r_{mn} \end{bmatrix}. \tag{4}$$

(8) Identify the ideal and negative ideal solutions.

$$A^* = \left\{v_1^*, v_2^*, \dots, v_j^*, \dots, v_n^*\right\} = \left\{\left(\max_i \ v_{ij} \middle| \ j \in J\right) \middle| \ i = 1, \dots, m\right\},$$

$$A^- = \left\{v_1^-, v_2^-, \dots, v_j^-, \dots, v_n^-\right\} = \left\{\left(\min_i \ v_{ij} \middle| \ j \in J\right) \middle| \ i = 1, \dots, m\right\}. \tag{5}$$

(9) Obtain the degree of separation.

$$S_i^* = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_i^*\right)^2}, i = 1, \dots, m$$

$$S_i^- = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_i^-\right)^2}, i = 1, \dots, m. \tag{6}$$

(10) Determine the relative proximity to the ideal solution.

$$C_i^* = \frac{S_i^-}{S_i^* + S_i^-}. \tag{7}$$

(11) Rank the solutions by superiority.

(12) Make a final decision.

TOPSIS is frequently used to rank the alternatives for personnel selection issues [15–19,21–23]. However, Olson [47] pointed out that the key to accurate TOPSIS results is obtaining the correct weights. Additionally, in MCDM, to give criteria weights is quite important [48]. Thus, TOPSIS was used in the case study to help select the best podcaster by incorporating the weight of each criterion derived from ANP.

4. An empirical analysis for podcaster selection

MCDM problems may create conflicting dilemmas between the criteria, which simply indicates that 'you cannot have your cake and eat it'. This makes the decision-making problem complex. Relying on the subjective judgement of a single decision-maker cannot lead to the effective integration of all decision-making information to make a decision that is correct and consistent with the actual decision-making situation. Therefore, a decision-making team comprising several experienced members or experts from relevant backgrounds should be formed to make decisions by consensus through expert discussions [12].

In this study, a survey method was adopted to collect relevant data. However, executives' assessments of different SC varied, and their agreement on semantic variables also differed. To integrate executives' opinions and facilitate the subsequent use of MCDM, this study applied FDM. Through interviews with Taiwanese mattress brand executives and a review of the relevant literature [10,20], the SC for selecting podcasters were compiled, and a questionnaire scored on a 9-point Likert scale was designed and distributed to Taiwanese mattress brand executives as per FDM. Those respondents rated the importance of the SC according to their professional and practical work experience, with higher scores indicating a higher level of importance ascribed to a given sub-criterion. The triangular fuzzy numbers of each sub-criterion were computed based on Hwang et al. [39]. Then, the centre of gravity approach was applied to defuzzify the triangular fuzzy numbers of each sub-criterion [40]. FDM was used to filter the podcaster selection SC, and a sub-selection criterion with an importance rating greater than 7.0000 was considered significant. The selection SC for podcasters were set accordingly. Once the SC were established, a literature review and interviews with Taiwanese mattress brand executives were conducted to categorise the SC into criteria.

Based on the opinions of 22 Taiwanese mattress brand executives with more than five years of experience, 12 SC were selected via FDM (shown in Table 2) and categorised based on the findings of a literature review [20] and interviews with the executives, thus establishing the following hierarchical structure for the selection of podcasters:

(1) The Content criterion comprises three SC: The lifestyle content, the easy-to-understand content, and the objective introduction of products.

(2) The Person criterion comprises three SC: The communication ability, the sense of trust, and the placement cost.

(3) The Production criterion comprises three SC: The effective production time management, the content quality, and the script creativity.

(4) The Channel criterion comprises three SC: The channel exposure, the channel image, and the non-repeated audience size.

Table 2. The results of FDM.

SC	Triangular fuzzy numbers			Defuzzification
	Minimum	Geometric mean	Maximum	
The lifestyle content	7.0000	7.7331	9.0000	7.9110
The easy-to-understand content	7.0000	8.0284	9.0000	8.0095
The objective introduction of products	7.0000	8.5004	9.0000	8.1668
The content is combined with individual characteristics	5.0000	6.1005	8.0000	6.3668
Enduring the pressure of public opinions	5.0000	5.9345	9.0000	6.6448
The communication ability	7.0000	8.0889	9.0000	8.0296
Interaction well with audiences	5.0000	5.6934	9.0000	6.5645
The crisis management ability	5.0000	6.3661	8.0000	6.4554
Understanding of audience needs	5.0000	6.5370	9.0000	6.8457
The sense of trust	7.0000	8.0831	9.0000	8.0277
The market insight ability	5.0000	6.5384	9.0000	6.8461
The script creativity	7.0000	7.1720	8.0000	7.3907
The effective production time management	7.0000	8.0889	9.0000	8.0296
Production of new content regularly	5.0000	6.6206	9.0000	6.8735
The content quality	7.0000	8.1877	9.0000	8.0626
Cooperation with celebrities	6.0000	6.8544	7.0000	6.6181
The continuous learning ability	5.0000	6.5021	9.0000	6.8340
The persuasiveness ability	6.0000	6.3459	7.0000	6.4486
Title setting ability	5.0000	6.1538	9.0000	6.7179
The non-repeated audience size	7.0000	8.0457	9.0000	8.0152
The placement cost	7.0000	8.0284	9.0000	8.0095
The channel exposure	7.0000	8.0773	9.0000	8.0258
The channel image	7.0000	8.1701	9.0000	8.0567

The hierarchy was applied to a Taiwanese mattress brand to help its executives select the best podcaster. The case company has been in the mattress business since 1985. The company further established its brand in 2009 through direct sales channels. Currently, the company has seven shops in Taipei City, New Taipei City, Taoyuan City, Hsinchu City, Hsinchu County, and Taichung City. The questionnaire was designed using a hierarchy based on three methods. Three executives from the case company completed the questionnaire and analysed three podcasters.

First, DEMATEL was utilised to build the interaction between the criteria and SC. Tables 3 and 4 present the X and T of DEMATEL. The threshold value that served to establish the relationships between the criteria was set to 4.4000 (based on experts' decisions). Hence, the interdependent hierarchy for selecting the optimal podcaster for a Taiwanese mattress brand was established, as shown in Figure 1.

Table 3. The *X* of DEMATEL.

Criteria	Content	Person	Production	Channel	Total
Content	0.0000	4.0000	4.0000	4.0000	12.0000
Person	3.6667	0.0000	4.0000	4.0000	11.6667
Production	4.0000	3.3333	0.0000	3.3333	10.6667
Channel	4.0000	3.3333	4.0000	0.0000	11.3333
Total	11.6667	10.6667	12.0000	11.3333	

Table 4. The *T* of DEMATEL.

Criteria	Content	Person	Production	Channel
Content	4.9162	4.8372	5.2670	5.0475
Person	5.0429	4.4864	5.1572	4.9423
Production	4.7496	4.4166	4.5916	4.6086
Channel	4.9561	4.6086	5.0521	4.5916
The threshold value is 4.4000				

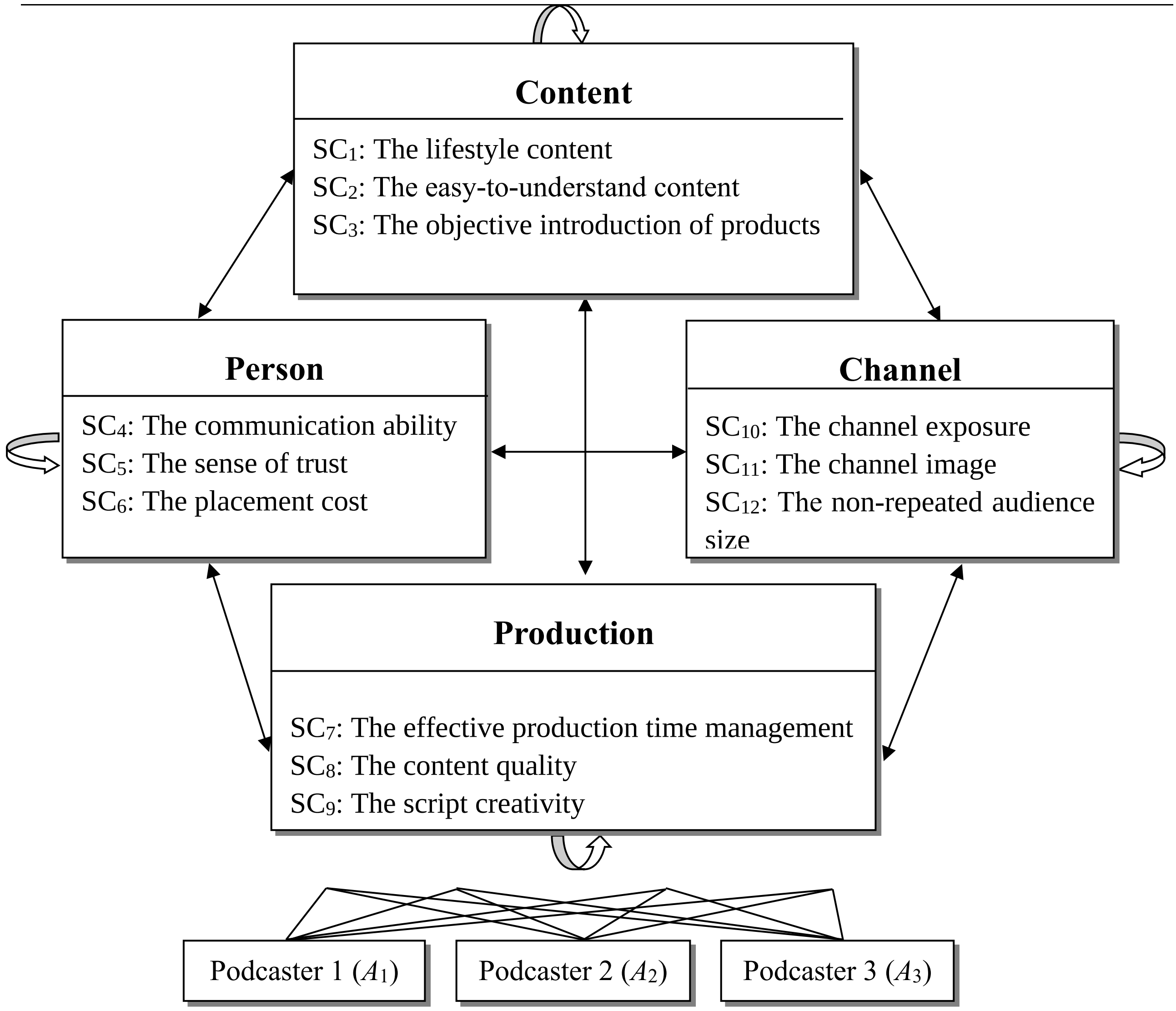

Figure 1. The interdependent hierarchy to select the optimal podcaster for a Taiwanese mattress brand.

ANP was then used to compute a geometric mean that was converted into a composite score for the group decisions, with CR values less than 0.1 for all completed ANP matrices in the questionnaires. This indicates that the decision-making model has high reliability. The pairwise comparison matrix and weights for the criteria based on the interactions established according to DEMATEL are shown in Tables 5–8.

An unweighted supermatrix was built based on the weight of each sub-criterion in the criteria. For instance, under the influence of 'the lifestyle content', the pairwise comparison matrix and weight of each sub-criterion in the Channel criteria are presented in Table 9. The unweighted supermatrix, weighted supermatrix, and supermatrix (after convergence) are also listed in Tables 10–12.

Table 5. The pairwise comparison matrix of the criteria under the influence of content.

Criteria	Content	Person	Production	Channel	Weights
Content	1.0000	1.1006	1.8420	0.7368	0.2662
Person	0.9086	1.0000	2.1544	0.9283	0.2795
Production	0.5429	0.4642	1.0000	0.5503	0.1469
Channel	1.3572	1.0772	1.8171	1.0000	0.3074
CR=0.0070					

Table 6. The pairwise comparison matrix of the criteria under the influence of person.

Criteria	Content	Person	Production	Channel	Weights
Content	1.0000	1.7100	2.4662	1.0000	0.3414
Person	0.5848	1.0000	1.3572	0.7368	0.2083
Production	0.4055	0.7368	1.0000	0.5503	0.1517
Channel	1.0000	1.3572	1.8171	1.0000	0.2986
CR=0.0032					

Table 7. The pairwise comparison matrix of the criteria under the influence of production.

Criteria	Content	Person	Production	Channel	Weights
Content	1.0000	1.1006	3.6840	0.7368	0.3039
Person	0.9086	1.0000	2.9240	0.7368	0.2735
Production	0.2714	0.3420	1.0000	0.5503	0.1099
Channel	1.3572	1.3572	1.8171	1.0000	0.3127
CR=0.0359					

Table 8. The pairwise comparison matrix of the criteria under the influence of channel.

Criteria	Content	Person	Production	Channel	Weights
Content	1.0000	3.4200	2.0000	1.7100	0.4243
Person	0.2924	1.0000	0.9086	0.6300	0.1468
Production	0.5000	1.1006	1.0000	0.6300	0.1761
Channel	0.5848	1.5874	1.5874	1.0000	0.2528
CR=0.0074					

Table 9. The pairwise comparison matrix of the Channel criteria under the influence of 'the lifestyle content'.

SC	SC_{10}	SC_{11}	SC_{12}	Weights
SC_{10}	1.0000	2.0000	0.8736	0.3799
SC_{11}	0.5000	1.0000	0.4642	0.1939
SC_{12}	1.1447	2.1544	1.0000	0.4262
CR=0.0003				

Table 10. The unweighted supermatrix.

	SC_1	SC_2	SC_3	SC_4	SC_5	SC_6	SC_7	SC_8	SC_9	SC_{10}	SC_{11}	SC_{12}
SC_1	0.6904	0.4915	0.3309	0.3509	0.4221	0.6091	0.1679	0.1787	0.0866	0.2533	0.2934	0.3523
SC_2	0.2065	0.4052	0.4842	0.3924	0.2385	0.1442	0.5485	0.3228	0.5446	0.3733	0.5626	0.3773
SC_3	0.1032	0.1033	0.1849	0.2566	0.3394	0.2468	0.2836	0.4985	0.3688	0.3733	0.1440	0.2704
SC_4	0.4454	0.5739	0.6180	0.7437	0.5425	0.2711	0.2024	0.6055	0.2383	0.1871	0.1129	0.2325
SC_5	0.1320	0.2779	0.1837	0.1646	0.2943	0.2487	0.3412	0.1138	0.3773	0.4982	0.3190	0.4058
SC_6	0.4226	0.1481	0.1984	0.0918	0.1631	0.4802	0.4564	0.2808	0.3845	0.3147	0.5681	0.3617
SC_7	0.6303	0.5612	0.5670	0.3516	0.1822	0.3652	0.3463	0.5882	0.3766	0.2010	0.3631	0.4608
SC_8	0.1991	0.3208	0.1868	0.1560	0.4673	0.3025	0.2993	0.2265	0.4689	0.4701	0.3723	0.1782
SC_9	0.1706	0.1180	0.2462	0.4924	0.3505	0.3324	0.3544	0.1853	0.1545	0.3289	0.2646	0.3610
SC_{10}	0.3799	0.6021	0.5083	0.6571	0.2694	0.4883	0.3880	0.4189	0.1921	0.1802	0.5457	0.3446
SC_{11}	0.1939	0.1966	0.1541	0.1101	0.1339	0.2069	0.1323	0.2846	0.4315	0.6240	0.1251	0.5161
SC_{12}	0.4262	0.2013	0.3376	0.2329	0.5966	0.3048	0.4797	0.2964	0.3765	0.1958	0.3292	0.1393

Table 11. The weighted supermatrix.

	SC_1	SC_2	SC_3	SC_4	SC_5	SC_6	SC_7	SC_8	SC_9	SC_{10}	SC_{11}	SC_{12}
SC_1	0.1838	0.1308	0.0881	0.1198	0.1441	0.2079	0.0510	0.0543	0.0263	0.1075	0.1245	0.1495
SC_2	0.0550	0.1078	0.1289	0.1340	0.0814	0.0492	0.1667	0.0981	0.1655	0.1584	0.2387	0.1601
SC_3	0.0275	0.0275	0.0492	0.0876	0.1159	0.0842	0.0862	0.1515	0.1121	0.1584	0.0611	0.1148
SC_4	0.1245	0.1604	0.1727	0.1549	0.1130	0.0565	0.0554	0.1656	0.0652	0.0275	0.0166	0.0341
SC_5	0.0369	0.0777	0.0513	0.0343	0.0613	0.0518	0.0933	0.0311	0.1032	0.0731	0.0468	0.0596
SC_6	0.1181	0.0414	0.0554	0.0191	0.0340	0.1000	0.1248	0.0768	0.1051	0.0462	0.0834	0.0531
SC_7	0.0926	0.0825	0.0833	0.0533	0.0276	0.0554	0.0381	0.0646	0.0414	0.0354	0.0639	0.0811
SC_8	0.0292	0.0471	0.0274	0.0237	0.0709	0.0459	0.0329	0.0249	0.0515	0.0828	0.0655	0.0314
SC_9	0.0251	0.0173	0.0362	0.0747	0.0532	0.0504	0.0389	0.0204	0.0170	0.0579	0.0466	0.0636
SC_{10}	0.1168	0.1851	0.1562	0.1962	0.0804	0.1458	0.1213	0.1310	0.0601	0.0456	0.1380	0.0871
SC_{11}	0.0596	0.0604	0.0474	0.0329	0.0400	0.0618	0.0414	0.0890	0.1349	0.1578	0.0316	0.1305
SC_{12}	0.1310	0.0619	0.1038	0.0695	0.1781	0.0910	0.1500	0.0927	0.1177	0.0495	0.0832	0.0352

Table 12. The supermatrix (after convergence).

	SC_1	SC_2	SC_3	SC_4	SC_5	SC_6	SC_7	SC_8	SC_9	SC_{10}	SC_{11}	SC_{12}
SC_1	0.1241	0.1241	0.1241	0.1241	0.1241	0.1241	0.1241	0.1241	0.1241	0.1241	0.1241	0.1241
SC_2	0.1267	0.1267	0.1267	0.1267	0.1267	0.1267	0.1267	0.1267	0.1267	0.1267	0.1267	0.1267
SC_3	0.0839	0.0839	0.0839	0.0839	0.0839	0.0839	0.0839	0.0839	0.0839	0.0839	0.0839	0.0839
SC_4	0.0973	0.0973	0.0973	0.0973	0.0973	0.0973	0.0973	0.0973	0.0973	0.0973	0.0973	0.0973
SC_5	0.0589	0.0589	0.0589	0.0589	0.0589	0.0589	0.0589	0.0589	0.0589	0.0589	0.0589	0.0589
SC_6	0.0679	0.0679	0.0679	0.0679	0.0679	0.0679	0.0679	0.0679	0.0679	0.0679	0.0679	0.0679
SC_7	0.0631	0.0631	0.0631	0.0631	0.0631	0.0631	0.0631	0.0631	0.0631	0.0631	0.0631	0.0631
SC_8	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450
SC_9	0.0427	0.0427	0.0427	0.0427	0.0427	0.0427	0.0427	0.0427	0.0427	0.0427	0.0427	0.0427
SC_{10}	0.1248	0.1248	0.1248	0.1248	0.1248	0.1248	0.1248	0.1248	0.1248	0.1248	0.1248	0.1248
SC_{11}	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750
SC_{12}	0.0905	0.0905	0.0905	0.0905	0.0905	0.0905	0.0905	0.0905	0.0905	0.0905	0.0905	0.0905

In TOPSIS portion, the decision-makers assigned a score of 1–9 to each sub-criterion, and the geometric mean was used to integrate the three opinion matrices to create a normalised TOPSIS evaluation matrix, as presented in Table 13. The integrated SC weights obtained via ANP were multiplied by the normalised TOPSIS evaluation matrix to obtain the weighted normalised TOPSIS evaluation matrix (Table 14), which was then used to find the ideal solution and negative ideal solution.

Table 13. The normalised TOPSIS evaluation matrix.

	SC_1	SC_2	SC_3	SC_4	SC_5	SC_6	SC_7	SC_8	SC_9	SC_{10}	SC_{11}	SC_{12}
A_1	0.4500	0.5623	0.3879	0.5768	0.5522	0.5704	0.5717	0.4816	0.5776	0.6542	0.5898	0.5359
A_2	0.3760	0.5716	0.8168	0.6072	0.6398	0.6529	0.5468	0.6036	0.5334	0.5228	0.4862	0.6689
A_3	0.8100	0.5976	0.4270	0.5465	0.5346	0.4983	0.6117	0.6354	0.6180	0.5466	0.6448	0.5152

Table 14. The weighted normalised TOPSIS evaluation matrix.

	SC_1	SC_2	SC_3	SC_4	SC_5	SC_6	SC_7	SC_8	SC_9	SC_{10}	SC_{11}	SC_{12}
A_1	0.0558	0.0712	0.0325	0.0561	0.0325	0.0387	0.0361	0.0217	0.0247	0.0816	0.0443	0.0485
A_2	0.0467	0.0724	0.0685	0.0591	0.0377	0.0443	0.0345	0.0272	0.0228	0.0652	0.0365	0.0605
A_3	0.1005	0.0757	0.0358	0.0532	0.0315	0.0338	0.0386	0.0286	0.0264	0.0682	0.0484	0.0466

The ideal solution is (0.1005, 0.0757, 0.0685, 0.0591, 0.0377, 0.0338, 0.0386, 0.0286, 0.0264, 0.0816, 0.0484, 0.0605), while the negative ideal solution is (0.0467, 0.0712, 0.0325, 0.0532, 0.0315, 0.0443, 0.0345, 0.0217, 0.0228, 0.0652, 0.0365, 0.0466). According to the Euclidean distance formula, each alternative's evaluation matrix value was calculated using the values of the ideal and negative ideal solutions to obtain each alternative's degree of separation from the ideal and negative ideal solutions, respectively. The priority order was then determined according to each alternative's relative proximity to the ideal solution. Podcaster 3 showed the best results (Table 15), and the case company selected podcaster 3 accordingly. Table 16 also shows a comparative analysis with AHP and ANP. These methods also yielded podcaster 3 as the best. The results of this study and those of ANP were the same. Thus, the effectiveness of this study was confirmed. Moreover, the main limitation of AHP is it supposed that criteria and SC are independent of each other. The interactions among criteria and SC are not considered. When determining weights of criteria and SC, interactions among them are considered, which is more consistent with real-life decision-making environments [48]. However, ANP requires a large number of pairwise comparison matrices, which can make it difficult for decision-makers to provide the necessary answers. To decrease the number of pairwise comparison matrices and the operational difficulties encountered by decision-makers, TOPSIS was applied to incorporate the integrated weight of each sub-criterion as determined through ANP and select the optimal podcaster. The efficiency of decision-making is increased.

Table 15. The priority order of podcasters.

	Separation from the ideal solution	Separation from the negative ideal solution	The relative proximity to the ideal solution	priority order
A_1	0.0599	0.0215	0.2645	3
A_2	0.0589	0.0399	0.4040	2
A_3	0.0389	0.0572	0.5949	1

Table 16. The rankings under different methods.

Methods	Ranking
ANP	$A_3(0.3979) > A_2(0.3093) > A_1(0.2927)$
AHP	$A_3(1.4141) > A_1(1.1642) > A_2(1.0541)$

5. Conclusions

With recent technological advancements and the popularity of the internet, various social media and audio-visual platforms have captured much of our visual attention, and emerging platforms have shifted their attention from the eyeball economy to the ear economy, resulting in the rise of the podcast industry. Moreover, the outbreak of the novel coronavirus (COVID-19) in 2019 triggered changes in social and recreational activities among the public. While the pandemic has changed the mode of physical entertainment, various types of home entertainment have also been affected, with significant growth due to the increased time people spend at home. Among the various forms of home entertainment, audio-based podcasts are rapidly gaining popularity. Taiwan has recently witnessed a podcast boom that has transformed the original broadcast format of fixed time slots into on-demand listening based on listeners' schedules. Given the rapid growth of podcast channels and listeners, podcast marketing has become a principal marketing channel for companies. However, the choice of podcasters affects listeners' decisions as to whether it is worth their time. The subscription cost investment also affects audience engagement. Therefore, this study utilised a hybrid MCDM model to help Taiwanese mattress brand executives select an optimal podcaster.

Based on the opinions of 22 Taiwanese mattress brand executives with more than five years of experience, 12 SC were selected via FDM and categorised based on the findings of a literature review and interviews with executives, thus establishing the following hierarchical structure for the selection of podcaster. The questionnaire was designed using a hierarchy based on DEMATEL, ANP, and TOPSIS methods, and three executives from the case company completed the questionnaire and analysed three podcasters. Based on DEMATEL and ANP, 12 important SC were ranked according to their degree of importance: the easy-to-understand content > the channel exposure > the lifestyle content > the communication ability > the non-repeated audience size > the objective introduction of products > the channel image > the placement cost > the effective production time management > the sense of trust > the content quality > the script creativity. According to TOPSIS, the priority order of the three podcasters is $A_3 > A_2 > A_1$. A comparative analysis with AHP and ANP was also conducted to confirm the effectiveness of this study.

The four methods integrated into the hybrid MCDM model proposed in this study all have respective strengths. The overall contributions of this study are as follows.

(1) Regarding the study's research questions, it was found that podcaster selection is important to companies. However, a review of past research showed that no literature has addressed this issue. To improve decision-making quality and enhance the decision-making process, this study proposes a

hybrid MCDM model to help Taiwanese mattress brand executives select the best podcaster, which is a practical contribution.

(2) By filtering podcaster selection SC using FDM, an effective hierarchy was established.

(3) Through DEMATEL, the interplay between the criteria and SC was established. Based on this interplay, ANP was adopted to determine the weight of each criterion and sub-criterion. Given that it is the decision-makers who provide the weights of the criteria and SC, their assessment may lead to biased results. This study used ANP with objective weights to tackle the issue of subjective weighting and to increase objectivity and accuracy by reducing human interference.

(4) To reduce the number of pairwise comparison matrices and the difficulty decision-makers experienced in providing answers, TOPSIS incorporated the weight of each criterion and SC obtained via ANP to help select the best podcaster and increase decision-making efficiency.

(5) This exercise illustrated the practicality and effectiveness of the hybrid MCDM model, and the final results enabled the company's decision-makers to make an objective and accurate decision.

Overall, the integrated operations performed in this study were logically coherent, practical, and functional. In addition to establishing a systematic and objective general model of selection in the context of this study and reflecting the characteristics of the conditions to meet practical needs, it can also serve as a reference for future studies in similar fields.

Moreover, this combination is a scientific contribution of this work, which not only presents the usefulness of the proposed hybrid MCDM model but also points out how such integrated methods (FDM, DEMATEL, ANP, and TOPSIS) can help solve the podcaster selection issue. Practically, this study suggests that Taiwanese mattress brand executives can collect data on podcasters suitable for co-operation. As there are marketing opportunities, Taiwanese mattress brand executives can use the decision-making model of this research to select suitable podcasters to reduce the risk of ineffective marketing.

Regarding research limitations, the conclusions of this study can only be used as a reference for and or applied to Taiwanese mattress brands' selection of podcasters. The results are not applicable to other countries. Some possibilities of future research are discussed hereon. First, in FDM section, this study administered an online questionnaire survey. Compared with a paper questionnaire, online questionnaire collection and completion may be less accurate. Therefore, it is suggested that future studies distribute paper questionnaires, increase the sample size, and include the opinions of more industry executives in the decision-making process to improve the research in terms of completeness and error reduction. Next, some SC were qualitative in nature and difficult to express in terms of precise data. Moreover, in DEMATEL, ANP, and TOPSIS methods, executives scored criteria, SC, and alternatives using their subjective judgement. Therefore, fuzzy theory should be incorporated in the future, such as an extended fuzzy-DEMATEL [49]. Finally, future research could use different MCDM methods besides AHP and ANP to explore the same issues and further verify the validity of the present study's results through comparison. For example, the novel ANP-VlseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR) method [50].

Conflict of interest

All authors declare no conflicts of interest regarding this study.

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