Exploring the influence of content marketing strategies on the expansion of the fashion second-hand market: a theoretical prediction study

Received 11 September 2023
Revised 20 November 2023
Accepted 26 November 2023

Lingwen wei and Yan Hong
College of Textile and Clothing Engineering, Soochow University, Suzhou, China, and
Xianyi Zeng
GEMTEX Laboratory, ENSAIT, Roubaix, France

Abstract

Purpose – The purpose of this research is to conduct a theoretical prediction study exploring the effectiveness of different content marketing strategies in expanding the second-hand market for fashion brands, comparing the costs and risks involved in these strategies in practice.

Design/methodology/approach – First, the expert interview method is employed to extract the content marketing strategies of the fashion second-hand market. Then, a descriptive space that is able to identify various fashion brand images is established. Then, experts' perceptions of the relationships between content marketing strategies and fashion brand image dimensions are obtained through a subjective evaluation procedure. Data of semantic evaluation were quantified and analyzed using the fuzzy logic method.

Findings – When fashion brands expand to the second-hand market, they not only need to focus on improving the individual differentiation of products but also give priority to the quality of products and services and the overall customer experience. Exploring the "social impact strategy" will become an important direction for the development of fashion brands in the future.

Originality/value – The research methodology employed herein exhibits a noteworthy degree of novelty. This study introduces a pioneering theoretical prediction approach utilizing fuzzy logic, marking the inaugural exploration of this emerging and captivating dimension within the context of the study. Simultaneously, the study provides comparative results among content marketing strategies for expanding the fashion second-hand market, offering guidance for market expansion.

Keywords Content marketing, Fashion brands, The second-hand market, Development strategy, Fuzzy logic

Paper type Research paper

1. Introduction

Fashion brands have a solid unifying effect on the entire marketing value chain (Showrav *et al.*, 2020; Youn and Cho, 2021). The mainstream marketing model of fashion brands is fast fashion (Velasco-Molpeceres *et al.*, 2022). The styles of fast fashion are trendy, but the craftsmanship and quality are low, which can easily lead to rapid obsolescence and loss of value (Alexander, 2022; Cairns *et al.*, 2022). This continuous backlog leads to long-term waste of resources such as raw materials, having an impact on unsustainable fashion brand image (Mohammad *et al.*, 2020).

This research was funded by the National Natural Science Foundation of China (Grant Number: 61906129), the China Association for Science and Technology Youth Support Talent Project (Grant Number: 2021-298), and the Hong Kong Polytechnic University GBA Startup Postdoc Programme 2022 (Grant Number: SP-22-13).

Competing interests: There are no financial or nonfinancial interests among authors.

Journal of Fashion Marketing and Management: An International Journal
© Emerald Publishing Limited
1361-2026
DOI 10.1108/JFMM-09-2023-0232

Therefore, based on their own social responsibilities, the major garment companies are more focused on promoting environmentally responsible fashion strategies in order to establish a good sustainable brand image (Mizrachi and Tal, 2022).

Among these strategies, the expansion of the second-hand market emerges as a pivotal approach. This strategy holds the objective of extending the utilization period and overall life span of products, aiming at minimizing environmental impacts through ethical consumption (Moriuchi and Takahashi, 2022). Therefore, to achieve this goal, major fashion brands have begun to focus more on expanding the second-hand market (Guo *et al.*, 2021). However, the current theoretical research foundation of second-hand fashion brand market development strategy is weak and lacks mature practical experience.

In the context of the post-flow era, fashion brands are required to grasp consumers' intentions and make accurate decisions (Li *et al.*, 2012; Choi *et al.*, 2014). Content marketing is a customer-centric marketing approach that focuses on creating and delivering valuable, relevant and consistent content to attract and retain a targeted audience and ultimately drive action from users who are likely to contribute to profits (Alexander, 2022; Frick *et al.*, 2020). Rancati *et al.,* (2016) employed content marketing as a communication strategy for luxury companies, aiming to provide valuable and relevant information to a well-defined target audience, with the objective of enhancing sales Rancati *et al.,* (2016). Diachuk *et al.,* 2019 developed and presented a content marketing model, which is particularly beneficial for companies that achieve their business goals and improve their leadership position (Diachuk *et al.,* 2019). It can be concluded that content marketing emerges as a marketing approach that requires careful attention and consideration from brands or companies (Akbiyik *et al.*, 2016; Bazi *et al.*, 2023).

Henceforth, content marketing has emerged as a proficient approach for market expansion and the augmentation of brand loyalty (Bazi *et al.*, 2023). This is particularly evident in the fashion industry, where content marketing has become the primary means for fashion brands to increase their market presence and stimulate growth in the second-hand fashion brand market (Muniesa and Giménez, 2020). However, there is still a lack of comprehensive research on the effectiveness of various content marketing strategies in facilitating the expansion of the second-hand market in the fashion industry. To address this challenge, the present study aims to provide a theoretical and predictive analysis that examines the influence of content marketing strategies on the expansion of the second-hand fashion market.

The construction and maintenance of brand image is a prerequisite of brand management (Balmer *et al.*, 2020). Therefore, brand image plays a pivotal role in facilitating consumers' subjective evaluations and influencing their purchase decisions (Chen *et al.*, 2021). First, based on the idea of ontology, this paper summarizes the content marketing strategy system. Combined with the characteristics of fashion brands and the second-hand market, the content marketing strategy ontology of the fashion brand second-hand market is constructed. Second, a descriptive space that is able to identify various fashion brand images is established. And the relative importance of each element is determined. Then, the experts' perceptions of the relationships between content marketing strategies and fashion brand image dimensions are obtained through a subjective evaluation procedure. Subsequently, the comprehensive impact of each strategy on the brand image is used as the evaluation criterion for predicting the success of a fashion brand's second-hand market content marketing strategy. Since the evaluation data are semantic and cannot be quantified directly, the fuzzy logic can convert subjective semantic vocabulary into quantifiable data and perform data analysis. Finally, based on the conclusions of the experimental data, content marketing strategies for fashion brands to expand into the second-hand market are selected and recommended.

The contributions of this article are several fold. First, this paper provides an ontology map of content marketing strategies in the context of secondary market of fashion brands. Second, this research advances the theoretical landscape of fashion brand marketing by

adopting the effectiveness of a fashion brand's second-hand market expansion strategy in shaping its brand image as a criterion for evaluating and predicting the strategy's success. Third, by adopting a content marketing perspective, this article offers valuable guidance and references for fashion brands in their selection of strategies to expand into the second-hand market. It presents the garment industry with promising opportunities for exploring new domains characterized by low-risk investment requirements. Moreover, the examination of theoretical predictions delineated in this manuscript constitutes an emerging and intriguing facet of scholarly investigation. The distinctive research methodology employed herein is remarkably novel, particularly in the domain of content marketing strategies and their application to fashion brands.

2. Related work

Fashion brands are currently confronted with escalating levels of competitiveness as they endeavor to expand their market presence. Concurrently, the rapid ascent of the second-hand market has ushered in novel avenues for business growth and diversification, while content marketing strategies have emerged as indispensable tools for fashion brands in their efforts to both allure and sustain consumer engagement (Tangri and Yu, 2023).

2.1 Expansion of fashion brands

In the light of the global market's expansion and the increasing pursuit of personalization by consumers, fashion brands find themselves compelled to broaden their horizons beyond traditional markets. This entails reaching a wider consumer base through e-commerce and social media platforms and penetrating international markets. Furthermore, brand differentiation emerges as a pivotal strategy within brand development, aimed at capturing consumer attention through the deployment of innovative technologies, brand narratives and immersive brand experiences (Joy *et al.*, 2022). For instance, leading global luxury brands, such as Burberry, Ralph Lauren and Louis Vuitton, have strategically embraced transformative digital technologies, including blockchain and artificial intelligence, to redefine their brand identities and enhance the consumer experience (Joy *et al.*, 2022). Notably, Bulgari pioneered the use of Non-Fungible Token (NFT) technology and blockchain in its "Serpentine Metamorphosis" installation in 2021, resulting in an unparalleled digital artwork (Joy *et al.*, 2022). Brand storytelling, as effectively employed by Christian Dior, emerges as a potent tool for global luxury brands, ultimately contributing to the creation of an enduring and successful luxury brand image (Donzé and Wubs, 2019). Sensory marketing and brand experience play instrumental roles in elevating the consumer experience, with the former significantly interacting with store image to intensify emotional bonds between consumers and luxury brands (Shahid *et al.*, 2022).

2.2 Expansion of the second-hand market

The second-hand fashion market has has presented fashion brands with unprecedented opportunities for recycling, reutilization and consumer engagement (Tangri and Yu, 2023). As a result, many fashion companies have embarked on a dialogue with consumers regarding environmental issues through the development of sustainability guidelines, the implementation of supply chain and environmental management systems, and participation in voluntary second-hand fashion markets (Hvass, 2022).

For instance, companies such as H&M, WEEKDAY, Name It, and PUMA have instituted in-store product recycling programs, permitting consumers to exchange old clothing for discount coupons, thereby promoting business models that align with sustainable development (Hvass, 2022). Fashion brands have explored diverse strategies to engage with the secondary market,

integrating second-hand services through third-party facilitators, thus fostering added value and relevance while strengthening consumer connections (Turunen and Henninger, 2022). Numerous fashion brands have also entered the second-hand market through activities such as recycling and refurbishing products and the creation of dedicated second-hand clothing lines, exemplified by initiatives like Eileen Fisher's Green Eileen (Hvass, 2022). Abedsoltan *et al.*, 2022 proposed a model for co-branding luxury brands to produce remanufactured products, facilitating market expansion and reinforcing environmental sustainability. The inclusion of the second-hand market within brand expansion strategies lends brands a more multifaceted and socially responsible image.

2.3 Content marketing strategy

Content marketing strategy represents a pivotal instrument in brand development. Terho *et al.* emphasize three critical activities for content marketing: gathering intelligence about the customer journey, creating valuable content portfolios and disseminating content to engage consumers (Terho *et al.*, 2022).

Fashion brands have increasingly turned to content marketing, by generating captivating content encompassing narratives, visual elements and social media engagement to capture and retain consumers' attention while expanding their brand's influence. Khan's research underscores the influential role of social media marketing activities in enhancing brand experience, improving the customer experience and augmenting brand value (Khan, 2022). Yoo's study explores the influence of visual content marketing strategies on the success of luxury and fast fashion brand imagery on Instagram. This entails the use of brand names, logos, text and hashtags to communicate brand identity and enhance consumer engagement (Yoo, 2023). The emergence of the secondary market has provided fresh topics and opportunities for content marketing. Fashion brands can engage consumers by creating content related to the second-hand market, thereby amplifying brand exposure and recognition (Turunen *et al.*, 2020). Wang's research accentuates that the second-hand market imbues young consumer demographics with the excitement of treasure hunting. By crafting engaging content centered on this aspect, fashion brands attract young consumers to second-hand clothing, bolstering the image of eco-conscious brands (Wang *et al.*, 2022). Content marketing strategies also offer platforms and channels for promoting second-hand market expansion (Ahmad *et al.*, 2016).

The aforementioned sections elucidate the roles and methodologies of each strategy in fashion brand expansion. Currently, no comprehensive comparative analysis exists that establishes the priority relationships among these strategies or delineates the scenarios wherein each strategy is most effective. This knowledge gap poses inherent decision-making risks and uncertainties for marketing managers, potentially influencing strategic decisions that shape the overall trajectory of brand expansion. Consequently, this study identifies representative content marketing strategies, and explores their impact on fashion brand imagery, utilizing the second-hand market as an applied context. Furthermore, it introduces a novel approach incorporating the analytic hierarchy process (AHP), expert knowledge evaluation and fuzzy logic, ensuring the professionalism and scientific rigor of the research findings.

3. Methodology

3.1 Research methodology

The primary objective of this research is to examine fashion brand second-hand market expansion strategies from the perspective of content marketing. Specifically, the study aims to predict and evaluate the effectiveness of these strategies in achieving success.

The study initially develops an ontology of fashion brand second-hand market expansion strategies based on content marketing. Additionally, the connotation space of fashion brand image is constructed through expert interviews, providing a comprehensive framework for analysis. Furthermore, the relative importance of each element within the fashion brand image is quantified through a questionnaire survey and the application of the AHP. Subsequently, questionnaires and subjective evaluation techniques are employed to gather subjective evaluation data regarding the influence of fashion brand second-hand market content marketing strategies on fashion brand image. As the collected data from the subjective evaluations consist of semantic information that cannot be directly quantified and analyzed, the utilization of fuzzy logic becomes necessary (Wagner *et al.*, 2019; Ling *et al.*, 2022). As Figure 1 reveals, this is a research process to explore the influence of content marketing strategies on the expansion of the fashion second-hand market.

3.2 Related concepts, methods and tools

3.2.1 Expert interview method. The expert interview method, as a subjective evaluation technique, facilitates the identification of the relationship between human factors and product elements (Hong *et al.*, 2018a; Ling *et al.*, 2020; Ling *et al.*, 2022). Its application is primarily concentrated in research fields such as fashion design evaluation, fashion brand marketing strategy evaluation, etc. (Nagamachi, 2002; Hong *et al.*, 2017b).

In this study, considering the scope and function of this method, the indices of the content marketing system within the second-hand market of fashion brands are systematically summarized. Furthermore, the existing theoretical models of brand image,

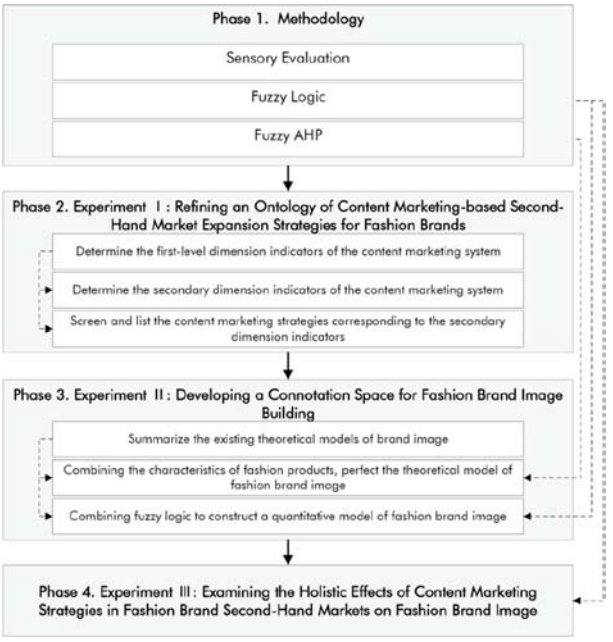

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Figure 1.
Research methodology for investigating the impact of content marketing strategies on the expansion of the second-hand fashion market

incorporating the distinctive characteristics of fashion products, are integrated through the expert interview method, establishing the connotation space of the fashion brand image.

3.2.2 Fuzzy logic and related tools. Fuzzy logic is a scientific discipline that employs the principles of fuzzy sets to investigate the nature of imprecise reasoning, linguistic expressions and their underlying principles (Hong *et al.*, 2018a; Belman *et al.*, 1966). Fuzzy set theory was developed to effectively model and analyze intricate and indistinct problems (Tseng *et al.*, 2008; Hong *et al.*, 2019). By employing fuzzy sets, the linguistic terms of interest can be quantified, enabling further data processing (Wagner *et al.*, 2019; Ling *et al.*, 2022). This is accomplished through the characterization of human judgments with linguistic terms such as "equal," "moderately," "strongly," "very strongly," "extremely," thereby defining the "degree of importance" associated with indicators (Zeng *et al.*, 2013; Piltan *et al.*, 2012).

A triangular fuzzy number (TFN) represents one of the extensively utilized fuzzy sets, as depicted in Figure 2 (Ling *et al.*, 2020; Chen, 2000). Specifically, a TFN, M, can be expressed using n-tuples formalism as $M = (l,\ m,\ u)$ or alternatively as $M = (l \mid m,\ m \mid u)$. Within this notation, the parameters l, m and u are employed to characterize the fuzzy event, signifying the smallest possible value, the most promising value and the largest possible value, respectively. Notably, each TFN exhibits linear representations on both its left and right side, thereby enabling the definition of its membership function as follows (Ling *et al.*, 2022; Zeng *et al.*, 2013):

$$\mu_m(\mathrm{x}) = \begin{cases} 0,\ x \in [-\infty,\ l] \\ \dfrac{\mathrm{x} - l}{m - l},\ x \in [l,\ \mathrm{m}] \\ \dfrac{\mathrm{x} - u}{m - u},\ x \in [m,\ u] \\ 0,\ x \in [u,\ +\infty] \end{cases} \tag{1}$$

If $M_1 = (l_1, m_1, u_1)$ and $M_2 = (l_2, m_2, u_2)$ are two TFNs, the operation laws between them can be defined as follows (Ling *et al.*, 2022; Hong *et al.*, 2019):

$$M_1 \oplus M_2 = (l_1 + l_2, m_1 + m_2, u_1 + u_2) \tag{2}$$

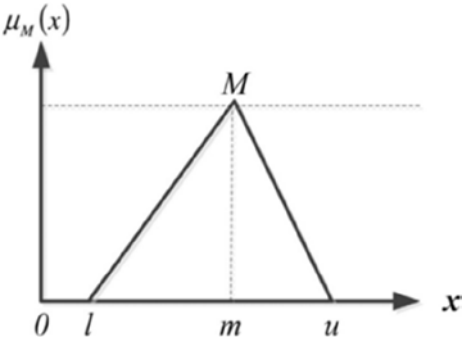

Figure 2.
The triangular fuzzy number

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$$M_1 \odot M_2 = (l_1 l_2, m_1 m_2, u_1) \tag{3}$$

$$\lambda \odot M_1 = (\lambda l_1, \lambda m_1, \lambda u_1) \tag{4}$$

$$(l_1, m_1, u_1)^{-1} = \left(\frac{1}{u_1}, \frac{1}{m_1}, \frac{1}{l_1}\right) \tag{5}$$

In this study, the method of the TFN is employed for data processing. Specifically, it is utilized to ascertain the weights assigned to individual components comprising the fashion brand image. Moreover, this facilitates the determination of the extent of influence exerted by each strategy on the fashion brand image.

3.2.3 Fuzzy AHP. The AHP is a systematic structured technique used for organizing and analyzing intricate decision-making processes, particularly in the context of group decision-making (Chamodrakas *et al.*, 2010). By employing AHP, decision-makers can identify the optimal solution aligned with their objectives and gain a deeper understanding of the problem at hand (Hong *et al.*, 2017a). AHP provides a comprehensive and rational framework for structuring a decision problem, representing and quantifying their constituent elements, establishing relationships with overarching goals and evaluating alternative solutions (Hong *et al.*, 2018b; Bruniaux *et al.*, 2017).

(1) Establishment of a hierarchical structure.

A hierarchical structure is derived, considering the interrelationships among indicators. Within this study, the fashion brand image is conceptually partitioned into multiple dimensions, with each dimension encompassing a set of corresponding elements.

(2) Creation of fuzzy numbers between the levels.

To evaluate the relative importance of different elements, decision-makers are assumed to use linguistic terms from a linguistic rating scale. The fuzzy linguistic rating scale is presented in Figure 3. These linguistic terms can be quantified using TFNs, as illustrated in Table I. Decision-makers are then asked to provide

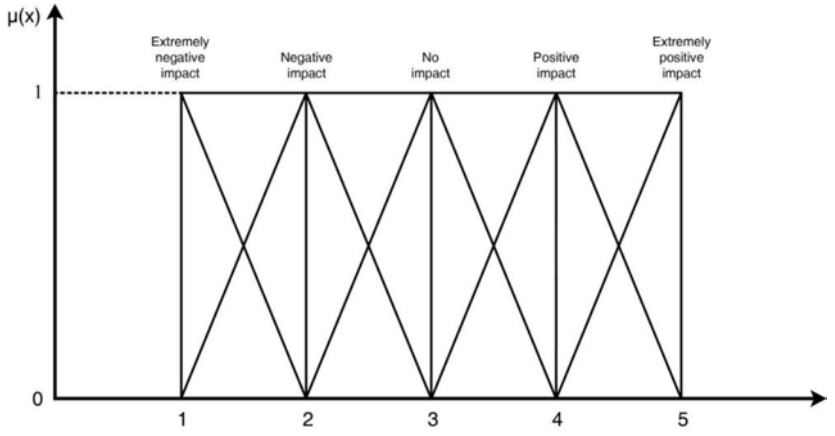

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Figure 3.
The fuzzy linguistic rating scale

comparisons for all elements at each level concerning the final goal. The relative importance degree comparison results are denoted as a_{ij}. For example, If one expert considers that the impact of "design innovation strategy" on "quality image" is "extremely positive impact," the relationship between "design innovation strategy" on "quality image" can be expressed as follows: (4,5,5).

(3) Creation of fuzzy comparisons matrices.

The evaluations performed using linguistic terms are converted into fuzzy numbers, which are then utilized to construct pairwise comparison matrices. If the TFN evaluation results are denoted as a_{ij}, the fuzzy comparison matrices of relative independence can be represented as $\tilde{A}$.

$$\tilde{A} = \begin{matrix} V_1 \\ V_2 \\ V_3 \\ V_4 \\ V_5 \end{matrix} \begin{pmatrix} V_1 & V_2 & V_3 & V_4 & V_5 \\ 1 & a_{12} & a_{13} & a_{14} & a_{15} \\ a_{21} & 1 & a_{23} & a_{24} & a_{25} \\ a_{31} & a_{32} & 1 & a_{34} & a_{35} \\ a_{41} & a_{42} & a_{43} & 1 & a_{45} \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{pmatrix} \text{where } a_{ij} = \frac{1}{a_{ji}}$$

(4) Calculating the weighting vector by extent analysis:

Using the rules given by Equations 2, 3 and 4, the evaluation scores given by each evaluator e_h are denoted as $\{a_{ijh}/i = 1,\ldots, 5, j = 1, \ldots, 5, h = 1, \ldots, m\}$, where a_{ijh} represents the number of the evaluators who choose one certain degree. Therefore,

$$a_{ij} = \left(\frac{1}{m} \sum_{j=1}^{l} a_{ijh} t_1,\ \frac{1}{m} \sum_{j=1}^{l} a_{ijh} t_2, \frac{1}{m} \sum_{j=1}^{l} a_{ijh} t_3 \right) \tag{6}$$

where t_1, t_2 and t_3 correspond to the values of the TFNs, defined according to the scale in Figure 4. The values using extent analysis are denoted as follows:

Table I.
Linguistic rating scale of the degree of influence and corresponding fuzzy numbers

Linguistic values	TFNs
Extremely negative impact	(1,1,2)
Negative impact	(1,2,3)
Average	(2,3,4)
Positive impact	(3,4,5)
Extremely positive impact	(4,5,5)

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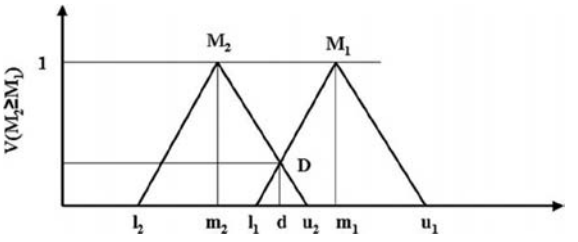

Figure 4.
The intersection between M_1 and M_2

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$$M_{E_i}^1, M_{E_i}^2, \ldots M_{E_i}^m, \ldots i = 1, 2, \ldots, n$$

For example, for exploring the relation between S_1 design innovation strategy and I_{11} quality image, we have mobilized 31 experts for the evaluation. If 11 experts consider that S_1 has a very large positive impact on I_{11}, 12 experts consider that it is a positive impact, 6 experts determine that it is an average level between positive and negative impacts, and 2 experts conside that it is a negative impact. The relation of S_1 and I_{11} can be expressed as follows:

$$a_{S1I11} = \frac{11*(4,\ 5,\ 5) + 10*(3,\ 4,\ 5) + 6*(2,\ 3,\ 4) + 2*(1,\ 2,\ 3)}{31} = (3.03,\ 4.03,\ 4.68)$$

It means that the aggregated result is also a TFN, whose most possible value is 4.03, with 3.03 and 4.68 as the smallest possible and largest possible values, respectively (Hong *et al.*, 2018c). Similarly, the other associations between S_i and I_j can also be quantified.

(5) Calculation of the weighting vector using extent analysis.

where $M_{E_i}^1$ ($i = 1, 2, \ldots, n$) are all TFNs. The value of fuzzy synthetic extent with respect to the ith object is defined as (Hong *et al.*, 2017a) follows:

$$S_i = \sum_{j=1}^{m} M_{E_i}^j \odot \left[\sum_{i=1}^{n}\sum_{j=1}^{m} M_{E_i}^j\right]^{-1} \tag{7}$$

Let $A = (a_{ij})_{n\times m}$ be a fuzzy analytical matrix, where $a_{ij} = (l_{ij}, m_{ij}, u_{ij})$ are defined by the calculated values:

$$l_{ij} = \frac{1}{u_{ij}};\ m_{ij} = \frac{1}{m_{ij}};\ u_{ij} = \frac{1}{l_{ij}}$$

(6) Calculation of initial weights for each measure.

If $M_1 = (l_1, m_1, u_1)$ and $M_2 = (l_2, m_2, u_2)$ are two TFNs, the degree of possibility of $M_2 = (l_2, m_2, u_2) \geq M_1 = (l_1, m_1, u_1)$ is defined-by

$$V(M_2 \geq M_1) = SUP_{y\geq x}[\min(\mu_{M_1}(x), \mu_{M_2}(y))] \tag{8}$$

and can be expressed as follows:

$$V(M_2 \geq M_1) = hgt\,(M_1 \cap M_2) = \mu_{M_2}(d) \begin{cases} 1, & \text{if } m_2 \geq m_1 \\ 0, & \text{if } l_1 \geq u_2 \\ \dfrac{l_1 - u_2}{(m_2 - u_2) - (m_1 - l_1)}, & \text{otherwise} \end{cases} \tag{9}$$

Figure 4 illustrates Equations (2–9), where "d" is the ordinate of the highest intersection point between μ_{M_1} and μ_{M_2}. To compare M_1 and M_2, we need both the values of $V(M_2 \geq M_1)$ and $V(M_1 \geq M_2)$. The degree possibility for a convex fuzzy number to be greater than the k convex fuzzy M_i ($i = 1, 2, \ldots, k$) numbers can be defined as follows:

$$V(M \geq M_1, M_2, \ldots, M_k) = V[(M \geq M_1 \text{ and } M \geq M_2 \text{ and } \ldots M \geq M_k) = \min V(M \geq M_i), i = 1, 2, 3, \ldots, k \tag{10}$$

Assuming that $d(A_i) = \min V(S_i \geq S_k)$ for $k = 1, 2, \ldots, n;\ k \neq i$. Then, weight vector will be given by

$$W' = (d'(A_1), d'(A_2), \ldots d'((A_n))^T \tag{11}$$

where A_i and $i = 1, 2, \ldots, n$ denote in ith element and n number of elements, respectively.

(7) Defuzzification and calculation of final weights:

A fuzzy number is a convex, normalized fuzzy set $\widetilde{A} \subseteq \mathcal{R}$ whose membership function is at least segmentally continuous and has the functional value $\mu\widetilde{A}(x) = 1$ at precisely on the element. Using the classical normalization operation, the normalized weight vectors are given as follows.

$$W = (d(A_1), d(A_2), \ldots d(A_n))^T \tag{12}$$

where W is a non-fuzzy number.

4. Experiments and result discussion

The research designs three distinct experiments, as depicted in Figure 5. *Experiment I* is designed to develop a content marketing-based second-hand market expansion strategy ontology for fashion brands. *Experiment II* aims to establish a comprehensive understanding of the fashion brand image by exploring its connotation space. *Experiment III* investigates the holistic impact of fashion brand second-hand market content marketing strategies on the fashion brand image, utilizing a sensory evaluation procedure.

4.1 Experiment I: refining an ontology of content marketing-based second-hand market expansion strategies for fashion brands

4.1.1 Experimental design. In order to develop an ontology for the content marketing strategy in the second-hand market of fashion brands, a group of 20 industry experts were invited to participate in interviews in Experiment I. The specific steps of the experiment are outlined as follows:

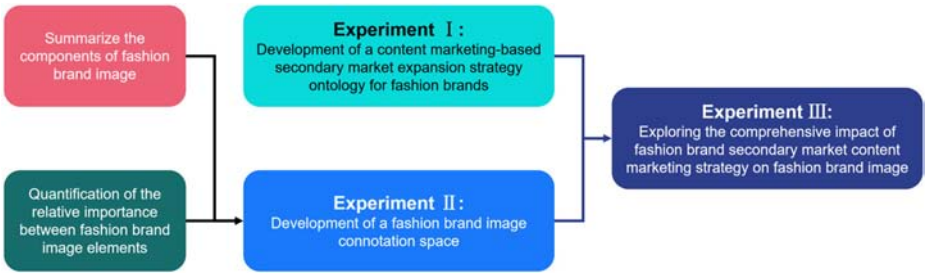


Figure 5.
The flow of the experiments and the relationship between the experiments

Source: Figure created by authors

(1) Initially, a training session was conducted to inform the evaluation team (comprising the 20 experts) about the purpose of the experiment.

(2) Relevant literature was reviewed to initially identify and categorize 8 dimensions and 24 indicators that could encapsulate the content marketing index system for the second-hand market of fashion brands.

(3) Through "a roundtable discussion," we screened the above 8 dimensional terms and 24 index terms and finally identified 4 dimensional terms (product D_1, service D_2, advertising D_3, brand culture D_4) and the corresponding 16 index terms (design D_{11}, quality D_{12}, …, social impact D_{44}) to build a fashion brand second-hand market content marketing index system.

(4) Subsequently, through another "roundtable discussion," the fashion brand second-hand market content marketing strategy ontology was established.

4.1.2 Construction of the ontology for content marketing-based expansion strategies in the second-hand market of fashion brands. Following the aforementioned experimental procedures, the content marketing index system for the second-hand market of fashion brands has been finalized, comprising 16 distinct indexes: design, quality, functionality, pricing, offline store shopping assistance, online customer service, post-purchase service, consumer engagement (Bazi *et al.*, 2023), brand name and logo, store ambiance, brand ambassador (Bazi *et al.*, 2023), public praise marketing, corporate culture, lifestyle orientation, differentiation in personality and social influence. Each element will list a specific representative strategy. The ontology for the expansion strategy in the second-hand market of fashion brands, based on content marketing, is presented in Table II.

4.2 Experiment II: developing a connotation space for fashion brand image building

4.2.1 Experiment design. Experiment II entailed the involvement of 20 representative industry experts to conduct interviews to construct the connotation space of fashion brand image. The specific steps of the experiment are outlined as follows:

Dimension	Index	Strategy
Product Content (D_1)	D_{11} Design	S_1 Design Innovation Strategy
	D_{12} Quality	S_2 Product Quality Strategy
	D_{13} Function	S_3 Versatile Design Strategy
	D_{14} Price	S_4 Price Strategy
Service Content (D_2)	D_{21} Offline Store Shopping Guide Service	S_5 Offline Store Shopping Guide Service Strategy
	D_{22} Online Customer Service	S_6 Online Customer Service Strategy
	D_{23} After-sales Service	S_7 After-sales Service Strategy
	D_{24} Consumer Engagement	S_8 Consumer Engagement Strategies
Advertising Content (D_3)	D_{31} Brand Name and Logo	S_9 Brand Name and Logo Strategy
	D_{32} Store Image	S_{10} Store Image Strategy
	D_{33} Spokesperson	S_{11} Image Spokesperson Strategy
	D_{34} Public Praise	S_{12} Public Praise Strategy
Brand Culture (D_4)	D_{41} Company Culture	S_{13} Corporate Culture Strategy
	D_{42} Attitude Toward Life	S_{14} Life Attitude Strategy
	D_{43} Personality Differentiation	S_{15} Personality Differentiation Strategy
	D_{44} Social Influence	S_{16} Social Impact Strategy

Source: Table created by authors

Table II. Ontology of content marketing based second-hand market expansion strategy for fashion brands

(1) Initially, a training session was conducted to communicate the purpose of the experiment to the evaluation team comprising the 20 experts.

(2) The elements belonging to the secondary dimensions under the fashion brand image were enumerated (I).

(3) Through a process of summarization, merging, voting and filtering, the elements of the secondary dimensional elements (I_1; I_2; I_3; I_4) were determined.

(4) The elements constituting the third-level dimensions under the second-level dimension element (I_1) were listed.

(5) Through further summarization, merging, voting and filtering, the elements of the three dimensions under the second-level dimension I_1 (I_{11}, I_{12}, …, I_{1n}) were identified.

(6) The above steps were repeated to construct the connotation space for the fashion brand image, establishing its hierarchical structure and constituent elements.

Furthermore, this experiment aimed to investigate the relative importance of each element. The experimental steps involved were as follows:

(7) A questionnaire was designed to compare the importance of elements within the same dimension of the fashion brand image. Each participant was assigned a score ranging from 1 to 5 to indicate the perceived significance of each set of elements, based on their sensory experience. The score range of 1–5 represented "significantly minor," "minor," "equally important," "important" and "obviously important," respectively.

(8) The questionnaires were distributed, and the data were compiled.

(9) The weights of each constituent element were calculated using the fuzzy AHP (TFN-FAHP) to construct a comprehensive and refined connotation space for the fashion brand image.

4.2.2 Construct the connotation space of the fashion brand image. Based on the three-dimensional model of brand image and the Icke brand identity model, this experiment takes the company image, product image and the spiritual and cultural image as the elements of the second dimension of fashion brand image. Due to the special nature of fashion products, consumers are keen to purchase in brick-and-mortar stores, so the channel image is a secondary dimension of the fashion brand image.

After the above comprehensive analysis, it is determined that the connotation space of the fashion brand image contains four secondary dimensional elements. Each secondary dimensional element contains several tertiary dimensional elements. The relationship between the content of each level and the level can be expressed as follows:

Primary dimensional elements: $X_1 = I$ = {Fashion brand image};

Secondary dimensional elements: X_2 = {I_1, I_2, I_3, I_4} = {product image, channel image, company image, spiritual and cultural image};

Three dimensional elements: X_3 = {I_{11}, I_{12}, I_{13}, I_{14}, I_{21}, I_{22}, I_{23}, I_{31}, I_{32}, I_{33}, I_{34}, I_{35}, I_{41}, I_{42}, I_{43}} = {quality image, style image, brand symbol image, price image, store image, service image, promotion image, market leadership, popularity, reputation, innovation social responsibility, user image, designer image, spokesperson image}.

The hierarchical relationship of X_1, X_2 and X_3 reflects the dimensional structure of the fashion brand image. According to such affiliation, a complete connotation space of fashion brand image is constructed, as shown in Figure 6.

4.2.3 Quantification of the relative importance between fashion brand image elements.
4.2.3.1 Survey design. The questionnaire employed in this research is divided into two

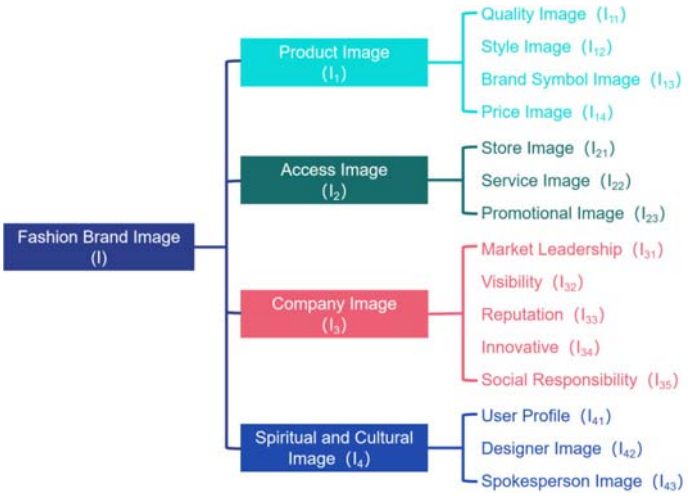


Figure 6.
Connotation space of fashion brand image

Source: Figure created by authors

sections. The first section entails a two-by-two comparison to assess the importance of elements within the second dimension of the connotation space of fashion brand image. In the second section, the importance of the various elements within the third-level dimension is evaluated.

4.2.3.2 Questionnaire. Participants in this study were asked to provide their opinions on each statement using a Likert scale. The scale ranged from 1 to 5, where "1" represented "significantly minor," "2" denoted "minor," "3" indicated "equally important," "4" represented "important" and "5" reflected "obviously important."

To ensure the data's reliability, we selected experts or students in the field of clothing as research subjects, and were required to have a strong interest in fashion products.

4.2.3.3 Data processing. Within this research, the subjective semantic data obtained from the questionnaire underwent a transformation process into fuzzy numbers. This transformation was carried out utilizing the Figure 3 fuzzy language rating diagram and the Table I TFN semantic scale. Please refer to Appendix 1 for the specific calculation process.

By using Equation (12), the normalized Key Performance Indicator (KPI) index can be obtained:

$W_{I1} = 0.312$; $W_{I2} = 0.236$; $W_{I3} = 0.236$; $W_{I4} = 0.216$

$W_{I11} = 0.083$; $W_{I12} = 0.083$; $W_{I13} = 0.068$; $W_{I14} = 0.078$

$W_{I21} = 0.082$; $W_{I22} = 0.084$; $W_{I23} = 0.07$

$W_{I31} = 0.045$; $W_{I32} = 0.048$; $W_{I33} = 0.049$; $W_{I34} = 0.046$; $W_{I35} = 0.048$

$W_{I41} = 0.081$; $W_{I42} = 0.067$; $W_{I43} = 0.068$

4.2.4 Experimental conclusions. In summary, the weights of each element of the connotation space of fashion brand image are shown in Table III:

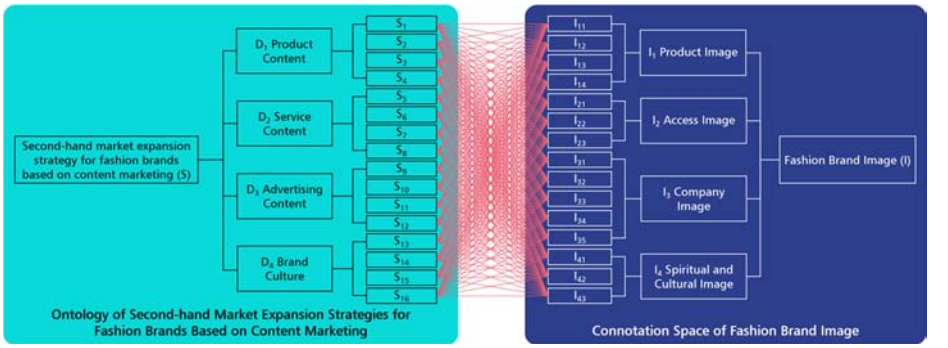
4.3 Experiment III: examining the holistic effects of content marketing strategies in fashion brand second-hand markets on fashion brand image

4.3.1 Experimental design. Experiment III invited 31 participants to participate in the evaluation. As shown in Figure 7, the left part is the second-hand market expansion strategy of the fashion brand based on content marketing, and the right part is the

First dimension	Secondary dimension	Third dimension
Fashion Brand Image	I_1 Product Image	I_{11} Quality (0.083)
		I_{12} Styles (0.083)
		I_{13} Brand Symbols (0.068)
		I_{14} Price (0.078)
	I_2 Access Image	I_{21} Storefront (0.082)
		I_{22} Services (0.084)
		I_{23} Promotion (0.07)
	I_3 Company Image	I_{31} Market Leadership (0.045)
		I_{32} Visibility (0.048)
		I_{33} Reputation (0.049)
		I_{34} Degree of Innovation (0.046)
		I_{35} Social Responsibility (0.048)
	I_4 Spiritual and Cultural Image	I_{41} Users (0.081)
		I_{42} Designers (0.067)
		I_{43} Spokesperson (0.068)

Source: Table created by authors

Table III.
Weighting table of fashion brand image elements



Source: Figure created by authors

Figure 7.
The comprehensive impact of content marketing-based fashion brand second-hand market expansion strategy on fashion brand image

connotation space of the fashion brand image. The specific steps undertaken in the experimental process are outlined below:

(1) First, a training session was performed. The purpose of this experiment about demands was announced to the evaluation team (31 subjects);

(2) To design the questionnaire, we ask each evaluation team member to subjectively evaluate the impact of each content marketing-based second-hand market expansion strategy for fashion brands on each of the tertiary dimensional elements of the fashion brand image connotation space. According to their sensory experience of these elements, each member gives the most appropriate score for the importance of each set of elements in scores 1–5;

(3) Fuzzy logic (TFN) was introduced for data processing to derive the degree of impact of each type of content marketing-based second-hand market expansion strategy for fashion brands on fashion brand image.

4.3.2 Survey design. The questionnaire was designed to investigate the impact of each representative content-based fashion brand second-hand market expansion strategy on the third dimension of each fashion brand image element. The participants scored according to their subjective intentions to obtain the comprehensive impact of each strategy on the fashion brand image.

4.3.3 Questionnaire. Subjects could express their opinion on each statement, measured using a Likert scale. The values "1–5" represent "extremely negative impact," "negative impact," "average," "positive impact" and "extremely positive impact." To ensure the data's reliability, we selected experts or students in the field of clothing as research subjects, and were required to have a strong interest in fashion products.

4.3.4 Data acquisition, quantification and processing. To measure the relative importance of the different strategies, the subjects were asked to evaluate the relative degree of significance between different evaluation strategies by using the fuzzy linguistic scale in Figure 3 and the TFN semantic scale in Table I. Through the fuzzy arithmetic operation by using Equations 2 and 6, the fuzzy pairwise comparison matrices were constructed based on the data collected from the 31 subjects. Please refer to Appendix 2 for the specific calculation process.

4.3.5 Experimental results. The comprehensive influence degree of fashion brand second-hand market expansion strategy based on content marketing on fashion brand image is shown in Table IV.

5. Discussion

The key implications of this study are as follows:

5.1 Theoretical implications

Within the existing body of research, strategies rooted in content marketing encompass a spectrum of approaches, including social media marketing (Bazi *et al.*, 2023), user participation experiences (Bazi *et al.*, 2023; Moriuchi and Takahashi, 2022) and public praise strategies (Mohammad *et al.*, 2020), among others. Nonetheless, a conspicuous gap exists in the literature, characterized by the absence of a comprehensive systematic review and comparison of the relative weights assigned to each of these strategies. This article pioneers the application of

Second-hand market expansion strategy for fashion brands based on content marketing	Weight
S_1 Design Innovation Strategy	0.0635
S_2 Product Quality Strategy	0.064
S_3 Versatile Design Strategy	0.0617
S_4 Price Strategy	0.0574
S_5 Offline Store Shopping Guide Service Strategy	0.0617
S_6 Online Customer Service Strategy	0.0587
S_7 After-sales Service Strategy	0.0603
S_8 Consumer Engagement Strategy	0.0635
S_9 Brand Name and Logo Strategy	0.0627
S_{10} Store Image Strategy	0.0628
S_{11} Image spokesperson strategy	0.0634
S_{12} Public Praise Strategy	0.0651
S_{13} Corporate Culture Strategy	0.0641
S_{14} Life Attitude Strategy	0.0644
S_{15} Personality Differentiation Strategy	0.0649
S_{16} Social Impact Strategy	0.0619

Source: Table created by authors

Table IV. The value of comprehensive influence degree of fashion brand second-hand market expansion strategy on fashion brand image based on content marketing

ontology theory to synthesize a unified ontology pertaining to the strategies employed by fashion brands for expanding within the second-hand market through content marketing.

Furthermore, extant research has posited design strategies that correspond with distinct facets of brand image, encompassing brand culture, logo design (Yoo, 2023), visual imagery (Yoo, 2023) and product packaging. However, an important limitation resides in the lack of quantification of the relative significance of these constituent elements, rendering it arduous to offer strategic recommendations based on the prioritization of brand image components. To address this knowledge gap, this study refines existing theoretical models of brand image, delineates the relative importance of each element and ascertains the construction of a comprehensive and finely grained semantic space pertaining to the brand image of fashion brands.

Furthermore, antecedent investigations have explored the influence of diverse marketing strategies, including visual marketing strategies (Upadhyay *et al.*, 2023) and digital marketing strategies (Muniesa and Giménez, 2020), on market expansion efforts. However, these studies predominantly concentrate on the impact of singular strategies, thus overlooking the imperative of multiple strategy interactions and the imperative for systematic strategy comparisons. This dearth of a comprehensive analytical framework places a burden on marketing managers who must navigate the intricate terrain of strategic decision-making, thus introducing a level of uncertainty into their market expansion endeavors.

Moreover, it is pertinent to note that extant research has typically featured more subjective methodologies and, in some instances, outdated experimental approaches, often plagued by insufficiencies in data support and a dearth of objectivity. Consequently, the present study assumes a pioneering role in the domain of theoretical predictions, constituting a nascent and captivating realm of inquiry. The distinctive research method deployed herein is characterized by its novel character, thereby conferring a substantial enhancement to the theoretical foundations underpinning the study of content marketing strategies within the domain of fashion brands. Specifically, this study introduces an innovative approach employing fuzzy decision-making methods to probe the influence of content marketing strategies on fashion brand expansion, not only advancing methodological novelty but also yielding theoretical innovation.

5.2 Practical implications

This study, from the vantage point of marketing management, endeavors to ascertain the relative priority of implementing these varied strategies, thereby affording valuable guidance to industry managers regarding strategic initiatives aimed at market expansion. Simultaneously, it illuminates the requisite competencies and contextual prerequisites that underpin the successful foray into the second-hand market. Strategies of note, such as "public praise strategy," "personality differentiation strategy," "offline service strategy" and "store image strategy," emerge as potent instruments for augmenting user engagement and inciting consumer purchase behaviors (Yoo, 2023).

Furthermore, as fashion brands embark upon new frontiers within the second-hand market, it is imperative that they meticulously contemplate communication strategies that accentuate the enhancement of brand quality (Akoglu and Özbek, 2022), underscore product differentiation (Rao and Wang, 2023) and convey affirmative lifestyle paradigms. Such endeavors collectively serve to establish a sustainable and favorable brand image (Mizrachi and Tal, 2022).

In alignment with the prevailing sustainability ethos, we strongly advocate that corporate managers deliberate the adoption of a "social impact strategy" as a pathway to evolving into a "social enterprise" (Fuxman *et al.*, 2022). This approach demonstrably

fosters a positive and sustainable brand image, thus making a substantive contribution to the sustainable development trajectory of the apparel industry (Fuxman *et al.*, 2022).

5.3 Limitations of the study and future research agenda

The research results of this article on the weight of fashion brand image components lack a formal verification process and require further investigation. Given the pivotal role that consumer buying behavior assumes in the realm of marketing, future investigations should delve deeper into this area. Additionally, the exploration of "Social Impact Strategies" is a critical direction for the future evolution of fashion brands (Xia *et al.*, 2022).

Furthermore, the present examination does not comprehensively account for the multifaceted factors that impact the expansion of fashion brands into the second-hand market. Within the framework of a holistic management perspective, the efficacy of fashion brand expansion strategies hinges on a spectrum of elements, including strategy quality, execution capabilities and the overarching management system, while overlooking the serendipitous factor (Balzano, 2022). The substantive role of serendipity in broadening the marketing horizons of fashion brands has gained widespread recognition within the realm of academia and industry alike. In its capacity as a recent factor of influence (Balzano, 2022), serendipity also merits consideration for its prospective role in the expansion of the second-hand market.

In conclusion, these avenues of inquiry present promising prospects for future research endeavors in the field.

6. Conclusions

This study primarily explores the differential effects of content-based second-hand market expansion strategies for fashion brands on fashion brand image.

Based on the above experimental data, it is evident that among the various content-based second-hand marketing strategies for fashion brands, the "public praise strategy" exerts the most significant impact on enhancing of the fashion brand image. It encompasses a management process that involves planning, organizing, executing and controlling to satisfy fulfill customers' needs, gain customer satisfaction and loyalty and improve corporate and brand image (Klein *et al.*, 2016). Compared to other traditional marketing methods, this strategy is highly effective, cost-efficient and carries fewer risks. Therefore, when expanding into the second-hand market, fashion brands should prioritize the quality of products, services and overall customer experience to foster positive word-of-mouth and cultivate a strong reputation (Dayani, 2022).

Fashion brands should place greater emphasis on promoting individuality strategies (Esteves, 2021). As fashion products go beyond basic survival and developmental needs, they embody unique, scarce and rare characteristics (Esteves, 2021). Additionally, fashion brands cater to consumers with higher levels of consumption, who seek items that reflect their tastes and social status. Consequently, consumers place less emphasis on product pricing, resulting in a relatively lower impact of price strategy on fashion brand image promotion.

The influence of "Offline Store Shopping Guide Service Strategy" and "Store Image Strategy" on enhancing the fashion brand image shows consistent results. This correlation can be attributed to the significant influence of shopping experiences on consumer purchasing behavior, leading many consumers to prefer physical stores when buying fashion products (Kullak *et al.*, 2023). Therefore, companies should prioritize the training of store staff in terms of professional knowledge and service attitude while creating a natural and pleasant shopping environment for consumers(Kirova, 2023).

Furthermore, the impact of the "Social Impact Strategy" on fashion brand image is moderate. This can be attributed to the profit-oriented nature of most apparel companies, with consumers paying less attention to the social initiatives undertaken by these companies. However, there is a rising trend of "social enterprises" that prioritize social responsibility(Lin *et al.*, 2021). Exploring "Social Impact Strategies" to develop the second-hand market for fashion brands will become a crucial direction for the future development of fashion brands.

ORCID iDs
Lingwen wei https://orcid.org/0009-0006-8348-3504
Yan Hong https://orcid.org/0000-0003-2593-8815

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Appendix 1.
Data Processing

(1) The process of calculating the weights of secondary dimensional elements:
The fuzzy pairwise comparisons matrices were constructed as follows:

$$\begin{pmatrix} & \mathbf{I}_1 & \mathbf{I}_2 \\ \mathbf{I}_1 & (2,\ 3,\ 4) & (3,\ 4,\ 4.66) \\ \mathbf{I}_2 & (1.34,\ 2,\ 3) & (2,\ 3,\ 4) \end{pmatrix}$$

First, by applying Equation 2, we can calculate the fuzzy number as shown below.
$S_{I1} = (5,\ 7,\ 8.66)$
$S_{I2} = (3.34,\ 5,\ 7)$
$S_{T1} = S_{I1} \oplus S_{I2} = (8.34,\ 12,\ 15.66)$
Using Equation (7):
$\widetilde{S}_{I1} = S_{I1} \odot [S_{I1} \oplus S_{I2}]^{-1} = (5,\ 7,\ 8.66) \odot \left(\frac{1}{15.66},\ \frac{1}{12},\ \frac{1}{8.34}\right) = (0.319,\ 0.583,\ 1.038)$

$\widetilde{S}_{I2} = (0.213, 0.417, 0.839)$

Thus, according to Equation (10), the numerical values of the evaluation criteria were obtained. Then, according to Equation (11), the ordering vector, W'_I of I_1, I_2 were obtained as follows:

$$d_{I1} = V(I_1 \geq I_2) = 1$$

$$d_{I2} = V(I_2 \geq I_1) = 0.757$$

Using classic normalization operations Equation (12), the normalized weight vector can be defined as follows:

$$W'_{I1} = 0.569$$

$$W'_{I2} = 0.431$$

By performing a classic normalization operation, using Equation (12), the normalized KPI index can be obtained.

$$W_{I1} = 0.312$$

$$W_{I2} = 0.236$$

The fuzzy pairwise comparisons matrices were constructed as shown below.

	I_3	I_4
I_3	(2, 3, 4)	(2.4, 3.34, 4.14)
I_4	(1.86, 2.66, 3.6)	(2, 3, 4)

First, by applying Equation 2, we can calculate the fuzzy number as shown below.

$S_{I3} = (4.4, 6.34, 8.14)$

$S_{I4} = (3.86, 5.66, 7.6)$

$S_{T2} = S_{I3} \oplus S_{I4} = (8.26, 12, 15.74)$

Using Equation (7),

$$\widetilde{S}_{I3} = S_{I3} \odot S_{T2}^{-1} = (4.4, 6.34, 8.14) \odot \frac{1}{15.74}, \frac{1}{12}, \frac{1}{8.26} = (0.28, 0.528, 0.985)$$

$$\widetilde{S}_{I4} = (0.245, 0.471, 0.920)$$

Thus, according to Equation (10), the numerical values of the evaluation criteria were obtained. Then, according to Equation (11), the ordering vector W'_I of I_3, I_4 were obtained as follows:

$$d_{I3} = V(I_3 \geq I_4) = 1$$

$$d_{I4} = V(I_4 \geq I_3) = 0.919$$

Using classic normalization operations Equation (12), the normalized weight vector can be defined as follows:

$$W'_{I3} = 0.521$$

$$W'_{I4} = 0.479$$

By performing a classic normalization operation, using Equation (12), the normalized KPI index can be obtained.

$$W_{I3} = 0.236$$

$$W_{I4} = 0.216$$

(2) The weight calculation process of the constituent elements of the subdivision of the three-level dimension under the product image:

The fuzzy pairwise comparisons matrices were constructed as shown below.

	I_{11}	I_{12}	I_{13}	I_{14}
I_{11}	(2, 3, 4)	(2.14, 3.12, 4.06)	(2.84, 3.84, 4.54)	(2.06, 3.02, 3.98)
I_{12}	(1.94, 2.88, 3.86)	(2, 3, 4)	(2.74, 3.74, 4.48)	(2.36, 3.34, 4.28)
I_{13}	(1.46, 2.16, 3.16)	(1.52, 2.26, 3.26)	(2, 3, 4)	(1.74, 2.58, 3.58)
I_{14}	(2.02, 2.98, 3.94)	(1.72, 2.66, 3.64)	(2.42, 3.42, 4.26)	(2, 3, 4)

First, by applying Equation 2, we can calculate the fuzzy number as shown below.

$S_{I11} = (9.04, 12.98, 16.58)$

$S_{I12} = (9.04, 12.96, 16.62)$

$S_{I13} = (6.72, 10, 14)$

$S_{I14} = (8.16, 12.06, 15.84)$

$S_{T3} = S_{I11} \oplus S_{I12} \oplus S_{I13} \oplus S_{I14} = (32.96, 48, 63.04)$

Using Equation (7):

$$\widetilde{S}_{\mathrm{I11}} = S_{I11} \odot S_{T3}{}^{-1} = (0.143, 0.27, 0.503)$$

$$\widetilde{S}_{\mathrm{I12}} = (0.143, 0.27, 0.504)$$

$$\widetilde{S}_{\mathrm{I13}} = (0.107, 0.208, 0.425)$$

$$\widetilde{S}_{\mathrm{I14}} = (0.129, 0.251, 0.481)$$

Using Equation (9):

$V(I_{11} \geq I_{12}) = 1$; $V(I_{11} \geq I_{13}) = 1$; $V(I_{11} \geq I_{14}) = 1$; $V(I_{12} \geq I_{11}) = 0.999$; $V(I_{12} \geq I_{13}) = 1$; $V(I_{12} \geq I_{14}) = 1$; $V(I_{13} \geq I_{11}) = 0.819$; $V(I_{13} \geq I_{12}) = 0.82$; $V(I_{13} \geq I_{14}) = 0.873$; $V(I_{14} \geq I_{11}) = 0.946$; $V(I_{14} \geq I_{12}) = 0.947$; $V(I_{14} \geq I_{13}) = 1$;

Thus, according to Equation (10), the numerical values of the evaluation criteria were obtained. Then, according to Equation (11), the ordering vector, W'_{I} of I_{11}, I_{12}, I_{13}, I_{14} were obtained as follows:

$d_{I11} = V(I_{11} \geq I_{12}, I_{13}, I_{14}) = \mathrm{MIN}(1, 1, 1) = 1$

$d_{I12} = V(\mathrm{I}_{12} \geq I_{11}, I_{13}, I_{14}) = \mathrm{MIN}(0.999, 1, 1) = 0.999$

$d_{I13} = V(\mathrm{I}_{13} \geq I_{11}, I_{12}, I_{14}) = \mathrm{MIN}(0.819, 0.82, 0.873) = 0.819$

$d_{I14} = V(\mathrm{I}_{14} \geq I_{11}, I_{12}, I_{13}) = \mathrm{MIN}(0.946, 0.947, 1) = 0.946$

Using classic normalization operations Equation (12), the normalized weight vector can be defined as follows:

$$W'_{I11} = 0.266$$
$$W'_{I12} = 0.265$$
$$W'_{I13} = 0.218$$
$$W'_{I14} = 0.251$$

By performing a classic normalization operation, using Equation (12), the normalized KPI index can be obtained.

$$W_{I11} = 0.083$$
$$W_{I12} = 0.083$$
$$W_{I13} = 0.068$$
$$W_{I14} = 0.078$$

(3) The weight calculation process of the three-level dimension constituent elements subdivided under the channel image:

The fuzzy pairwise comparisons matrices were constructed as shown below.

	I_{21}	I_{22}	I_{23}
I_{21}	(2, 3, 4)	(1.94, 2.92, 3.82)	(2.56, 3.56, 4.38)
I_{22}	(2.18, 3.08, 4.06)	(2, 3, 4)	(2.78, 3.76, 4.52)
I_{23}	(1.62, 2.44, 3.44)	(1.48, 2.24, 3.22)	(2, 3, 4)

First, by applying Equation 2, we can calculate the fuzzy number as shown below:

$S_{I21} = (6.5, 9.48, 12.2)$

$S_{I22} = (6.96, 9.84, 12.58)$

$S_{I23} = (5.1, 7.68, 10.66)$

$S_{T4} = S_{I21} \oplus S_{I22} \oplus S_{I23} = (18.56, 27, 35.44)$

Using Equation (7):

$$\widetilde{S}_{\mathrm{I}121} = S_{I21} \odot S_{T4}{}^{-1} = (0.183, 0.351, 0.657)$$

$$\widetilde{S}_{\mathrm{I}122} = (0.196, 0.364, 0.678)$$

$$\widetilde{S}_{\mathrm{I}123} = (0.144, 0.284, 0.574)$$

Using Equation (9):

$V(I_{21} \geq I_{22}) = 0.972$; $V(I_{21} \geq I_{23}) = 1$; $V(I_{22} \geq I_{21}) = 1$; $V(I_{22} \geq I_{23}) = 1$; $V(I_{23} \geq I_{21}) = 0.854$; $V(I_{23} \geq I_{22}) = 0.825$;

Thus, according to Equation (10), the numerical values of the evaluation criteria were obtained. Then, according to Equation (11), the ordering vector, W'_I of I_{21}, I_{22}, I_{23} were obtained as follows:

$d_{I21} = V(I_{21} \geq I_{22}, I_{23}) = \mathrm{MIN}(0.972, 1) = 0.972$

$d_{I22} = V(I_{22} \geq I_{21}, I_{23}) = \mathrm{MIN}(1, 1) = 1$

$d_{I23} = V(I_{23} \geq I_{21}, I_{22}) = \mathrm{MIN}(0.854, 0.825) = 0.825$

Using classic normalization operations Equation (12), the normalized weight vector can be defined as

$$W'_{I21} = 0.347$$
$$W'_{I22} = 0.357$$
$$W'_{I23} = 0.295$$

By performing a classic normalization operation, using Equation (12), the normalized KPI index can be obtained.

$$W_{I21} = 0.082$$
$$W_{I22} = 0.084$$
$$W_{I23} = 0.07$$

(4) The weight calculation process of the constituent elements of the three-level dimension subdivided under the company image:

The fuzzy pairwise comparisons matrices were constructed as shown below.

	I_{31}	I_{32}	I_{33}	I_{34}	I_{35}
I_{31}	(2, 3, 4)	(1.96, 2.9, 3.82)	(1.72, 2.64, 3.6)	(1.92, 2.86, 3.8)	(1.9, 2.78, 3.72)
I_{32}	(2.18, 3.1, 4.04)	(2, 3, 4)	(2.02, 2.96, 3.92)	(2.2, 3.16, 4.04)	(2.06, 2.92, 3.84)
I_{33}	(2.4, 3.36, 4.28)	(2.08, 3.04, 3.98)	(2, 3, 4)	(2.48, 3.48, 4.34)	(2, 2.94, 3.88)
I_{34}	(2.2, 3.14, 4.08)	(1.96, 2.84, 3.8)	(1.66, 2.52, 3.52)	(2, 3, 4)	(2, 2.9, 3.86)
I_{35}	(2.28, 3.22, 4.1)	(2.16, 3.08, 3.94)	(2.12, 3.06, 4)	(2.14, 3.1, 4)	(2, 3, 4)

First, by applying Equation 2, we can calculate the fuzzy number as shown below:

S_{I31} = (9.5, 14.18, 18.94)

S_{I32} = (10.46, 15.14, 19.84)

S_{I33} = (10.96, 15.82, 20.48)

S_{I34} = (9.82, 14.4, 19.26)

S_{I35} = (10.7, 15.46, 20.04)

$S_{T5} = S_{I31} \oplus S_{I32} \oplus S_{I33} \oplus S_{I34} \oplus S_{I35}$ = (51.44, 75, 98.56)

Using Equation (7):

$$\widetilde{S}_{I31} = \widetilde{S}_{I31} \odot \widetilde{S}_{T5}^{-1} = (0.096, 0.189, 0.368)$$

$$\widetilde{S}_{I32} = (0.106, 0.202, 0.386)$$

$$\widetilde{S}_{I33} = (0.111, 0.211, 0.398)$$

$$\widetilde{S}_{I34} = (0.1, 0.192, 0.374)$$

$$\widetilde{S}_{I35} = (0.108, 0.206, 0.39)$$

Using Equation (9):

$V(I_{31} \geq I_{32}) = 0.953$; $V(I_{31} \geq I_{33}) = 0.922$; $V(I_{31} \geq I_{34}) = 0.989$; $V(I_{31} \geq I_{35}) = 0.938$; $V(I_{32} \geq I_{31}) = 1$; $V(I_{32} \geq I_{33}) = 0.968$; $V(I_{32} \geq I_{34}) = 1$; $V(I_{32} \geq I_{35}) = 0.985$; $V(I_{33} \geq I_{31}) = 1$; $V(I_{33} \geq I_{32}) = 1$; $V(I_{33} \geq I_{34}) = 1$; $V(I_{33} \geq I_{35}) = 1$; $V(I_{34} \geq I_{31}) = 1$; $V(I_{34} \geq I_{32}) = 0.965$; $V(I_{34} \geq I_{33}) = 0.933$; $V(I_{34} \geq I_{35}) = 0.95$; $V(I_{35} \geq I_{31}) = 1$; $V(I_{35} \geq I_{32}) = 1$; $V(I_{35} \geq I_{33}) = 0.983$; $V(I_{35} \geq I_{34}) = 1$;

Thus, according to Equation (10), the numerical values of the evaluation criteria were obtained. Then, according to Equation (11), the ordering vector, W'_I of I_{31}, I_{32}, I_{33}, I_{34}, I_{35} were obtained as

$d_{I31} = V(I_{31} \geq I_{32}, I_{33}, I_{34}, I_{35})$ = MIN(0.953, 0.922, 0.989, 0.938) = 0.922

$d_{I32} = V(I_{32} \geq I_{31}, I_{33}, I_{34}, I_{35})$ = MIN(1, 0.968, 1, 0.985) = 0.968

$d_{I33} = V(I_{33} \geq I_{31}, I_{32}, I_{34}, I_{35})$ = MIN(1, 1, 1, 1) = 1

$d_{I34} = V(I_{34} \geq I_{31}, I_{32}, I_{33}, I_{35})$ = MIN(1, 0.965, 0.933, 0.95) = 0.933

$d_{I35} = V(I_{35} \geq I_{31}, I_{32}, I_{33}, I_{34})$ = MIN(1, 1, 0.983, 1) = 0.983

Using classic normalization operations Equation (12), the normalized weight vector can be defined as

$$W'_{I31} = 0.192$$
$$W'_{I32} = 0.201$$
$$W'_{I33} = 0.208$$
$$W'_{I34} = 0.194$$
$$W'_{I35} = 0.205$$

By performing a classic normalization operation, using Equation (12), the normalized KPI index can be obtained.

$$W_{I31} = 0.045$$
$$W_{I32} = 0.048$$
$$W_{I33} = 0.049$$
$$W_{I34} = 0.046$$
$$W_{I35} = 0.048$$

(5) The weight calculation process of the constituent elements of the subdivision of the three-level dimension under the spiritual culture:

The fuzzy pairwise comparisons matrices were constructed as shown below.

	I_{41}	I_{42}	I_{43}
I_{41}	(2, 3, 4)	(2.74, 3.74, 4.48)	(2.64, 3.62, 4.4)
I_{42}	(1.52, 2.26, 3.26)	(2, 3, 4)	(2.1, 2.98, 3.84)
I_{43}	(1.6, 2.38, 3.36)	(2.16, 3.02, 3.9)	(2, 3, 4)

First, by applying Equation 2, we can calculate the fuzzy number as shown below:

$S_{I41} = (7.38, 10.36, 12.88)$
$S_{I42} = (5.62, 8.24, 11.1)$
$S_{I43} = (5.76, 8.4, 11.26)$
$S_{T6} = S_{I41} \oplus S_{I42} \oplus S_{I43} = (18.76, 27, 35.24)$

Using Equation (7):

$$\widetilde{S}_{I41} = S_{I41} \odot S_{T6}{}^{-1} = (0.21, 0.384, 0.687)$$

$$\widetilde{S}_{I42} = (0.159, 0.305, 0.592)$$

$$\widetilde{S}_{I43} = (0.163, 0.311, 0.6)$$

Using Equation (9):

$V(I_{41} \geq I_{42}) = 1$; $V(I_{41} \geq I_{43}) = 1$; $V(I_{42} \geq I_{41}) = 0.83$; $V(I_{42} \geq I_{43}) = 0.986$; $V(I_{43} \geq I_{41}) = 0.843$; $V(I_{43} \geq I_{42}) = 1$;

Thus, according to Equation (10), the numerical values of the evaluation criteria were obtained. Then, according to Equation (11), the ordering vector, W'_I of I_{41}, I_{42}, I_{43} were obtained as

$d_{I41} = V(I_{41} \geq I_{42}, I_{43}) = \text{MIN}(1, 1) = 1$
$d_{I42} = V(I_{42} \geq I_{41}, I_{43}) = \text{MIN}(0.83, 0.986) = 0.83$
$d_{I43} = V(I_{43} \geq I_{41}, I_{42}) = \text{MIN}(0.843, 1) = 0.843$

Using classic normalization operations Equation (12), the normalized weight vector can be defined as

$$W'_{I41} = 0.374$$
$$W'_{I42} = 0.31$$
$$W'_{I43} = 0.316$$

By performing a classic normalization operation, using Equation (12), the normalized KPI index can be obtained.

$$W_{I41} = 0.081$$
$$W_{I42} = 0.067$$
$$W_{I43} = 0.068$$

Appendix 2.
Data Acquisition, Quantification and Processing

(1) Statistics

	I_{11}	I_{12}	...	I_{42}	I_{43}
S_1	(3.03, 4.03, 4.68)	(3.45, 4.45, 4.87)	...	(3.29, 4.26, 4.77)	(2.81, 3.74, 4.52)
S_2	(3.55, 4.52, 4.84)	(2.90, 3.87, 4.52)	...	(2.74, 3.71, 4.55)	(2.81, 3.77, 4.58)
S_3	(3.32, 4.32, 4.87)	(2.77, 3.74, 4.48)	...	(3.10, 4.10, 4.81)	(2.71, 3.71, 4.55)
⋮	⋮	⋮	⋱	⋮	⋮
S_{14}	(3.52, 4.52, 4.94)	(3.29, 4.29, 4.90)	...	(3.10, 4.10, 4.87)	(2.94, 3.94, 4.68)
S_{15}	(3.19, 4.19, 4.77)	(3.45, 4.45, 4.94)	...	(3.26, 4.26, 4.87)	(2.77, 3.77, 4.55)
S_{16}	(2.90, 3.90, 4.58)	(2.71, 3.71, 4.55)	...	(2.74, 3.74, 4.58)	(2.97, 3.97, 4.68)

(2) Multiply by the relative weight of each indicator of fashion brand image

The relative weights of each index in the connotation space of fashion brand image in Experiment 2 were weighted and calculated. The weighted fuzzy data set for each strategy can be derived as follows:

	I_{11}	I_{12}	...	I_{42}	I_{43}
S_1	(0.25, 0.33, 0.39)	(0.29, 0.37, 0.40)	...	(0.22, 0.29, 0.32)	(0.19, 0.25, 0.31)
S_2	(0.29, 0.37, 0.40)	(0.24, 0.32, 0.37)	...	(0.18, 0.25, 0.30)	(0.19, 0.26, 0.31)
S_3	(0.28, 0.36, 0.40)	(0.23, 0.31, 0.37)	...	(0.21, 0.27, 0.32)	(0.18, 0.25, 0.31)
⋮	⋮	⋮	⋱	⋮	⋮
S_{14}	(0.29, 0.37, 0.41)	(0.27, 0.36, 0.44)	...	(0.21, 0.27, 0.33)	(0.20, 0.27, 0.32)
S_{15}	(0.27, 0.37, 0.40)	(0.29, 0.37, 0.41)	...	(0.22, 0.29, 0.33)	(0.19, 0.26, 0.31)
S_{16}	(0.24, 0.32, 0.38)	(0.22, 0.31, 0.38)	...	(0.18, 0.25, 0.31)	(0.20, 0.27, 0.32)

(3) By applying Equation 2, we can calculate the fuzzy number as shown below.

S_1 = (3.14, 4.13, 4.72); S_2 = (3.17, 4.15, 4.74); S_3 = (3.03, 4.02, 4.70); S_4 = (2.82, 3.79, 4.49);

S_5 = (3.03, 4.03, 4.68); S_6 = (2.86, 3.85, 4.59); S_7 = (2.96, 3.95, 4.63); S_8 = (3.12, 4.12, 4.73);

S_9 = (3.09, 4.08, 4.72); S_{10} = (3.10, 4.09, 4.71); S_{11} = (3.12, 4.12, 4.74); S_{12} = (3.21, 4.21, 4.79);

S_{13} = (3.16, 4.16, 4.81); S_{14} = (3.17, 4.17, 4.82); S_{15} = (3.20, 4.20, 4.78); S_{16} = (3.03, 4.03, 4.71)

$S_{T7} = S_1 \oplus S_2 \oplus S_3 \oplus S_4 \oplus S_5 \oplus S_6 \oplus S_7 \oplus S_8 \oplus S_9 \oplus S_{10} \oplus S_{11} \oplus S_{12} \oplus S_{13} \oplus S_{14} \oplus S_{15} \oplus S_{16}$ = (49.21, 65.09, 75.37)

(4) By applying Equation 7, we can calculate the initial weights as shown below.

$\widetilde{S_1} = S_1 \odot S_{T7}{}^{-1}$ = (0.042, 0.063, 0.096)

$\widetilde{S_2}$ = (0.042, 0.064, 0.096)

$\widetilde{S_3}$ = (0.040, 0.062, 0.095)

$\widetilde{S_4}$ = (0.037, 0.058, 0.091)

$\widetilde{S_5}$ = (0.040, 0.062, 0.095)

$\widetilde{S_6}$ = (0.038, 0.059, 0.093)

$\widetilde{S_7}$ = (0.039, 0.061, 0.094)

$\widetilde{S_8}$ = (0.041, 0.063, 0.096)

$\widetilde{S_9}$ = (0.041, 0.063, 0.096)

$\widetilde{S_{10}}$ = (0.041, 0.063, 0.096)

$\widetilde{S_{11}}$ = (0.041, 0.063, 0.096)

$\widetilde{S_{12}}$ = (0.043, 0.065, 0.097)

$\widetilde{S_{13}}$ = (0.042, 0.064, 0.098)

$\widetilde{S_{14}}$ = (0.042, 0.064, 0.098)

$\widetilde{S_{15}}$ = (0.042, 0.065, 0.097)
$\widetilde{S_{16}}$ = (0.042, 0.062, 0.096)
(5) Using Equation (9):

$V(\widetilde{S_1} \geq \widetilde{S_2}) = 0.992$, $V(\widetilde{S_1} \geq \widetilde{S_3}) = 1$, $V(\widetilde{S_1} \geq \widetilde{S_4}) = 1$, $V(\widetilde{S_1} \geq \widetilde{S_5}) = 1$, $V(\widetilde{S_1} \geq \widetilde{S_6}) = 1$, $V(\widetilde{S_1} \geq \widetilde{S_7}) = 1$, $V(\widetilde{S_1} \geq \widetilde{S_8}) = 1$, $V(\widetilde{S_1} \geq \widetilde{S_9}) = 1$, $V(\widetilde{S_1} \geq \widetilde{S_{10}}) = 1$, $V(\widetilde{S_1} \geq \widetilde{S_{11}}) = 1$, $V(\widetilde{S_1} \geq \widetilde{S_{12}})$ 0.976, $V(\widetilde{S_1} \geq \widetilde{S_{13}}) = 0.991$, $V(\widetilde{S_1} \geq \widetilde{S_{14}}) = 0.986$, $V(\widetilde{S_1} \geq \widetilde{S_{15}}) = 0.979$, $V(\widetilde{S_1} \geq \widetilde{S_{16}}) = 1$;

$V(\widetilde{S_2} \geq \widetilde{S_1}) = 1$, $V(\widetilde{S_2} \geq \widetilde{S_3}) = 1$, $V(\widetilde{S_2} \geq \widetilde{S_4}) = 1$, $V(\widetilde{S_2} \geq \widetilde{S_5}) = 1$, $V(\widetilde{S_2} \geq \widetilde{S_6}) = 1$, $V(\widetilde{S_2} \geq \widetilde{S_7}) = 1$, $V(\widetilde{S_2} \geq \widetilde{S_8}) = 1$, $V(\widetilde{S_2} \geq \widetilde{S_9}) = 1$, $V(\widetilde{S_2} \geq \widetilde{S_{10}}) = 1$, $V(\widetilde{S_2} \geq \widetilde{S_{11}}) = 1$, $V(\widetilde{S_2} \geq \widetilde{S_{12}}) = 0.983$, $V(\widetilde{S_2} \geq \widetilde{S_{13}}) = 0.999$, $V(\widetilde{S_2} \geq \widetilde{S_{14}}) = 0.994$, $V(\widetilde{S_2} \geq \widetilde{S_{15}}) = 0.987$, $V(\widetilde{S_2} \geq \widetilde{S_{16}}) = 1$;

$V(\widetilde{S_3} \geq \widetilde{S_1}) = 0.971$, $V(\widetilde{S_3} \geq \widetilde{S_2}) = 0.963$, $V(\widetilde{S_3} \geq \widetilde{S_4}) = 1$, $V(\widetilde{S_3} \geq \widetilde{S_5}) = 0.999$, $V(\widetilde{S_3} \geq \widetilde{S_6}) = 1$, $V(\widetilde{S_3} \geq \widetilde{S_7}) = 1$, $V(\widetilde{S_3} \geq \widetilde{S_8}) = 0.972$, $V(\widetilde{S_3} \geq \widetilde{S_9}) = 0.983$, $V(\widetilde{S_3} \geq \widetilde{S_{10}}) = 0.982$, $V(\widetilde{S_3} \geq \widetilde{S_{11}}) = 0.973$, $V(\widetilde{S_3} \geq \widetilde{S_{12}}) = 0.948$, $V(\widetilde{S_3} \geq \widetilde{S_{13}}) = 0.963$, $V(\widetilde{S_3} \geq \widetilde{S_{14}}) = 0.958$, $V(\widetilde{S_3} \geq \widetilde{S_{15}}) = 0.951$, $V(\widetilde{S_3} \geq \widetilde{S_{16}}) = 0.996$;

$V(\widetilde{S_4} \geq \widetilde{S_1}) = 0.906$, $V(\widetilde{S_4} \geq \widetilde{S_2}) = 0.898$, $V(\widetilde{S_4} \geq \widetilde{S_3}) = 0.935$, $V(\widetilde{S_4} \geq \widetilde{S_5}) = 0.933$, $V(\widetilde{S_4} \geq \widetilde{S_6}) = 0.982$, $V(\widetilde{S_4} \geq \widetilde{S_7}) = 0.956$, $V(\widetilde{S_4} \geq \widetilde{S_8}) = 0.907$, $V(\widetilde{S_4} \geq \widetilde{S_9}) = 0.918$, $V(\widetilde{S_4} \geq \widetilde{S_{10}}) = 0.916$, $V(\widetilde{S_4} \geq \widetilde{S_{11}}) = 0.908$, $V(\widetilde{S_4} \geq \widetilde{S_{12}}) = 0.882$, $V(\widetilde{S_4} \geq \widetilde{S_{13}}) = 0.898$, $V(\widetilde{S_4} \geq \widetilde{S_{14}}) = 0.893$, $V(\widetilde{S_4} \geq \widetilde{S_{15}}) = 0.885$, $V(\widetilde{S_4} \geq \widetilde{S_{16}}) = 0.929$;

$V(\widetilde{S_5} \geq \widetilde{S_1}) = 0.972$, $V(\widetilde{S_5} \geq \widetilde{S_2}) = 0.965$, $V(\widetilde{S_5} \geq \widetilde{S_3}) = 1$, $V(\widetilde{S_5} \geq \widetilde{S_4}) = 1$, $V(\widetilde{S_5} \geq \widetilde{S_6}) = 1$, $V(\widetilde{S_5} \geq \widetilde{S_7}) = 1$, $V(\widetilde{S_5} \geq \widetilde{S_8}) = 0.973$, $V(\widetilde{S_5} \geq \widetilde{S_9}) = 0.985$, $V(\widetilde{S_5} \geq \widetilde{S_{10}}) = 0.983$, $V(\widetilde{S_5} \geq \widetilde{S_{11}}) = 0.975$, $V(\widetilde{S_5} \geq \widetilde{S_{12}}) = 0.948$, $V(\widetilde{S_5} \geq \widetilde{S_{13}}) = 0.964$, $V(\widetilde{S_5} \geq \widetilde{S_{14}}) = 0.959$, $V(\widetilde{S_5} \geq \widetilde{S_{15}}) = 0.952$, $V(\widetilde{S_5} \geq \widetilde{S_{16}}) = 0.998$;

$V(\widetilde{S_6} \geq \widetilde{S_1}) = 0.925$, $V(\widetilde{S_6} \geq \widetilde{S_2}) = 0.917$, $V(\widetilde{S_6} \geq \widetilde{S_3}) = 0.953$, $V(\widetilde{S_6} \geq \widetilde{S_4}) = 1$, $V(\widetilde{S_6} \geq \widetilde{S_5}) = 0.952$, $V(\widetilde{S_6} \geq \widetilde{S_7}) = 0.974$, $V(\widetilde{S_6} \geq \widetilde{S_8}) = 0.926$, $V(\widetilde{S_6} \geq \widetilde{S_9}) = 0.937$, $V(\widetilde{S_6} \geq \widetilde{S_{10}}) = 0.935$, $V(\widetilde{S_6} \geq \widetilde{S_{11}}) = 0.927$, $V(\widetilde{S_6} \geq \widetilde{S_{12}}) = 0.902$, $V(\widetilde{S_6} \geq \widetilde{S_{13}}) = 0.917$, $V(\widetilde{S_6} \geq \widetilde{S_{14}}) = 0.912$, $V(\widetilde{S_6} \geq \widetilde{S_{15}}) = 0.905$, $V(\widetilde{S_6} \geq \widetilde{S_{16}}) = 0.948$;

$V(\widetilde{S_7} \geq \widetilde{S_1}) = 0.950$, $V(\widetilde{S_7} \geq \widetilde{S_2}) = 0.943$, $V(\widetilde{S_7} \geq \widetilde{S_3}) = 0.979$, $V(\widetilde{S_7} \geq \widetilde{S_4}) = 1$, $V(\widetilde{S_7} \geq \widetilde{S_5}) = 0.978$, $V(\widetilde{S_7} \geq \widetilde{S_6}) = 1$, $V(\widetilde{S_7} \geq \widetilde{S_8}) = 0.951$, $V(\widetilde{S_7} \geq \widetilde{S_9}) = 0.963$, $V(\widetilde{S_7} \geq \widetilde{S_{10}}) = 0.961$, $V(\widetilde{S_7} \geq \widetilde{S_{11}}) = 0.952$, $V(\widetilde{S_7} \geq \widetilde{S_{12}}) = 0.927$, $V(\widetilde{7} \geq \widetilde{S_{13}}) = 0.942$, $V(\widetilde{S_7} \geq \widetilde{S_{14}}) = 0.937$, $V(\widetilde{S_7} \geq \widetilde{S_{15}}) = 0.930$, $V(\widetilde{S_7} \geq \widetilde{S_{16}}) = 0.975$;

$V(\widetilde{S_8} \geq \widetilde{S_1}) = 0.999$, $V(\widetilde{S_8} \geq \widetilde{S_2}) = 0.992$, $V(\widetilde{S_8} \geq \widetilde{S_3}) = 1$, $V(\widetilde{S_8} \geq \widetilde{S_4}) = 1$, $V(\widetilde{S_8} \geq \widetilde{S_5}) = 1$, $V(\widetilde{S_8} \geq \widetilde{S_6}) = 1$, $V(\widetilde{S_8} \geq \widetilde{S_7}) = 1$, $V(\widetilde{S_8} \geq \widetilde{S_9}) = 1$, $V(\widetilde{S_8} \geq \widetilde{S_{10}}) = 1$, $V(\widetilde{S_8} \geq \widetilde{S_{11}}) = 1$, $V(\widetilde{S_8} \geq \widetilde{S_{12}}) = 0.975$, $V(\widetilde{S_8} \geq \widetilde{S_{13}}) = 0.991$, $V(\widetilde{S_8} \geq \widetilde{S_{14}}) = 0.986$, $V(\widetilde{S_8} \geq \widetilde{S_{15}}) = 0.978$, $V(\widetilde{S_8} \geq \widetilde{S_{16}}) = 1$;

$V(\widetilde{S_9} \geq \widetilde{S_1}) = 0.988$, $V(\widetilde{S_9} \geq \widetilde{S_2}) = 0.980$, $V(\widetilde{S_9} \geq \widetilde{S_3}) = 1$, $V(\widetilde{S_9} \geq \widetilde{S_4}) = 1$, $V(\widetilde{S_9} \geq \widetilde{S_5}) = 1$, $V(\widetilde{S_9} \geq \widetilde{S_6}) = 1$, $V(\widetilde{S_9} \geq \widetilde{S_7}) = 1$, $V(\widetilde{S_9} \geq \widetilde{S_8}) = 0.988$, $V(\widetilde{S_9} \geq \widetilde{S_{10}}) = 0.998$, $V(\widetilde{S_9} \geq \widetilde{S_{11}}) = 0.990$, $V(\widetilde{S_9} \geq \widetilde{S_{12}}) = 0.964$, $V(\widetilde{S_9} \geq \widetilde{S_{13}}) = 0.979$, $V(\widetilde{S_9} \geq \widetilde{S_{14}}) = 0.974$, $V(\widetilde{S_9} \geq \widetilde{S_{15}}) = 0.967$, $V(\widetilde{S_9} \geq \widetilde{S_{16}}) = 1$;

$V(\widetilde{S_{10}} \geq \widetilde{S_1}) = 0.989$, $V(\widetilde{S_{10}} \geq \widetilde{S_2}) = 0.981$, $V(\widetilde{S_{10}} \geq \widetilde{S_3}) = 1$, $V(\widetilde{S_{10}} \geq \widetilde{S_4}) = 1$, $V(\widetilde{S_{10}} \geq \widetilde{S_5}) = 1$, $V(\widetilde{S_{10}} \geq \widetilde{S_6}) = 1$, $V(\widetilde{S_{10}} \geq \widetilde{S_7}) = 1$, $V(\widetilde{S_{10}} \geq \widetilde{S_8}) = 0.990$, $V(\widetilde{S_{10}} \geq \widetilde{S_9}) = 1$, $V(\widetilde{S_{10}} \geq \widetilde{S_{11}}) = 0.991$, $V(\widetilde{S_{10}} \geq \widetilde{S_{12}}) = 0.965$, $V(\widetilde{S_{10}} \geq \widetilde{S_{13}}) = 0.980$, $V(\widetilde{S_{10}} \geq \widetilde{S_{14}}) = 0.976$, $V(\widetilde{S_{10}} \geq \widetilde{S_{15}}) = 0.968$, $V(\widetilde{S_{10}} \geq \widetilde{S_{16}}) = 1$;

$V(\widetilde{S_{11}} \geq \widetilde{S_1}) = 0.998$, $V(\widetilde{S_{11}} \geq \widetilde{S_2}) = 0.990$, $V(\widetilde{S_{11}} \geq \widetilde{S_3}) = 1$, $V(\widetilde{S_{11}} \geq \widetilde{S_4}) = 1$, $V(\widetilde{S_{11}} \geq \widetilde{S_5}) = 1$, $V(\widetilde{S_{11}} \geq \widetilde{S_6}) = 1$, $V(\widetilde{S_{11}} \geq \widetilde{S_7}) = 1$, $V(\widetilde{S_{11}} \geq \widetilde{S_8}) = 0.999$, $V(\widetilde{S_{11}} \geq \widetilde{S_9}) = 1$, $V(\widetilde{S_{11}} \geq \widetilde{S_{10}}) = 1$, $V(\widetilde{S_{11}} \geq \widetilde{S_{12}}) = 0.974$, $V(\widetilde{S_{11}} \geq \widetilde{S_{13}}) = 0.989$, $V(\widetilde{S_{11}} \geq \widetilde{S_{14}}) = 0.984$, $V(\widetilde{S_{11}} \geq \widetilde{S_{15}}) = 0.977$, $V(\widetilde{S_{11}} \geq \widetilde{S_{16}}) = 1$;

$V(\widetilde{S_{12}} \geq \widetilde{S_1}) = 1$, $V(\widetilde{S_{12}} \geq \widetilde{S_2}) = 1$, $V(\widetilde{S_{12}} \geq \widetilde{S_3}) = 1$, $V(\widetilde{S_{12}} \geq \widetilde{S_4}) = 1$, $V(\widetilde{S_{12}} \geq \widetilde{S_5}) = 1$, $V(\widetilde{S_{12}} \geq \widetilde{S_6}) = 1$, $V(\widetilde{S_{12}} \geq \widetilde{S_7}) = 1$, $V(\widetilde{S_{12}} \geq \widetilde{S_8}) = 1$, $V(\widetilde{S_{12}} \geq \widetilde{S_9}) = 1$, $V(\widetilde{S_{12}} \geq \widetilde{S_{10}}) = 1$, $V(\widetilde{S_{12}} \geq \widetilde{S_{11}}) = 1$, $V(\widetilde{S_{12}} \geq \widetilde{S_{13}}) = 1$, $V(\widetilde{S_{12}} \geq \widetilde{S_{14}}) = 1$, $V(\widetilde{S_{12}} \geq \widetilde{S_{15}}) = 1$, $V(\widetilde{S_{12}} \geq \widetilde{S_{16}}) = 1$;

$V(\widetilde{S_{13}} \geq \widetilde{S_1}) = 1$, $V(\widetilde{S_{13}} \geq \widetilde{S_2}) = 1$, $V(\widetilde{S_{13}} \geq \widetilde{S_3}) = 1$, $V(\widetilde{S_{13}} \geq \widetilde{S_4}) = 1$, $V(\widetilde{S_{13}} \geq \widetilde{S_5}) = 1$, $V(\widetilde{S_{13}} \geq \widetilde{S_6}) = 1$, $V(\widetilde{S_{13}} \geq \widetilde{S_7}) = 1$, $V(\widetilde{S_{13}} \geq \widetilde{S_8}) = 1$, $V(\widetilde{S_{13}} \geq \widetilde{S_9}) = 1$, $V(\widetilde{S_{13}} \geq \widetilde{S_{10}}) = 1$, $V(\widetilde{S_{13}} \geq \widetilde{S_{11}}) = 1$, $V(\widetilde{S_{13}} \geq \widetilde{S_{12}}) = 0.985$, $V(\widetilde{S_{13}} \geq \widetilde{S_{14}}) = 0.995$, $V(\widetilde{S_{13}} \geq \widetilde{S_{15}}) = 0.988$, $V(\widetilde{S_{13}} \geq \widetilde{S_{16}}) = 1$;

$V(\widetilde{S_{14}} \geq \widetilde{S_1}) = 1$, $V(\widetilde{S_{14}} \geq \widetilde{S_2}) = 1$, $V(\widetilde{S_{14}} \geq \widetilde{S_3})$ 1, $V(\widetilde{S_{14}} \geq \widetilde{S_4}) = 1$, $V(\widetilde{S_{14}} \geq \widetilde{S_5}) = 1$, $V(\widetilde{S_{14}} \geq \widetilde{S_6}) = 1$, $V(\widetilde{S_{14}} \geq \widetilde{S_7}) = 1$, $V(\widetilde{S_{14}} \geq \widetilde{S_8}) = 1$, $V(\widetilde{S_{14}} \geq \widetilde{S_9}) = 1$, $V(\widetilde{S_{14}} \geq \widetilde{S_{10}}) = 1$, $V(\widetilde{S_{14}} \geq \widetilde{S_{11}}) = 1$, $V(\widetilde{S_{14}} \geq \widetilde{S_{12}}) = 0.990$, $V(\widetilde{S_{14}} \geq \widetilde{S_{13}}) = 1$, $V(\widetilde{S_{14}} \geq \widetilde{S_{15}}) = 0.993$, $V(\widetilde{S_{14}} \geq \widetilde{S_{16}}) = 1$;

$V(\widetilde{S_{15}} \geq \widetilde{S_1}) = 1$, $V(\widetilde{S_{15}} \geq \widetilde{S_2}) = 1$, $V(\widetilde{S_{15}} \geq \widetilde{S_3}) = 1$, $V(\widetilde{S_{15}} \geq \widetilde{S_4}) = 1$, $V(\widetilde{S_{15}} \geq \widetilde{S_5}) = 1$, $V(\widetilde{S_{15}} \geq \widetilde{S_6}) = 1$, $V(\widetilde{S_{15}} \geq \widetilde{S_7}) = 1$, $V(\widetilde{S_{15}} \geq \widetilde{S_8}) = 1$, $V(\widetilde{S_{15}} \geq \widetilde{S_9}) = 1$, $V(\widetilde{S_{15}} \geq \widetilde{S_{10}}) = 1$, $V(\widetilde{S_{15}} \geq \widetilde{S_{11}}) = 1$, $V(\widetilde{S_{15}} \geq \widetilde{S_{12}}) = 0.997$, $V(\widetilde{S_{15}} \geq \widetilde{S_{13}}) = 1$, $V(\widetilde{S_{15}} \geq \widetilde{S_{14}}) = 1$, $V(\widetilde{S_{15}} \geq \widetilde{S_{16}}) = 1$;

$V(\widetilde{S_{16}} \geq \widetilde{S_1}) = 0.974$, $V(\widetilde{S_{16}} \geq \widetilde{S_2}) = 0.967$, $V(\widetilde{S_{16}} \geq \widetilde{S_3}) = 1$, $V(\widetilde{S_{16}} \geq \widetilde{S_4}) = 1$, $V(\widetilde{S_{16}} \geq \widetilde{S_5}) = 1$, $V(\widetilde{S_{16}} \geq \widetilde{S_6}) = 1$, $V(\widetilde{S_{16}} \geq \widetilde{S_7}) = 1$, $V(\widetilde{S_{16}} \geq \widetilde{S_8}) = 0.975$, $V(\widetilde{S_{16}} \geq \widetilde{S_9}) = 0.987$, $V(\widetilde{S_{16}} \geq \widetilde{S_{10}}) = 0.985$, $V(\widetilde{S_{16}} \geq \widetilde{S_{11}}) = 0.977$, $V(\widetilde{S_{16}} \geq \widetilde{S_{12}}) = 0.951$, $V(\widetilde{S_{16}} \geq \widetilde{S_{13}}) = 0.966$, $V(\widetilde{S_{16}} \geq \widetilde{S_{14}}) = 0.961$, $V(\widetilde{S_{16}} \geq \widetilde{S_{15}}) = 0.954$;

(6) Thus, according to Equation (10), the numerical values of the evaluation criteria were obtained. Then, according to Equation (11), the ordering vector, W_1 of S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_8, S_9, S_{10}, S_{11}, S_{12}, S_{13}, S_{14}, S_{15}, S_{16} were obtained as

$$\begin{aligned} d(\mathrm{S}_1) &= V(\widetilde{S_1} \geq \widetilde{S_2}, \widetilde{S_3}, \widetilde{S_4}, \widetilde{S_5}, \widetilde{S_6}, \widetilde{S_7}, \widetilde{S_8}, \widetilde{S_9}, \widetilde{S_{10}}, \widetilde{S_{11}}, \widetilde{S_{12}}, \widetilde{S_{13}}, \widetilde{S_{14}}, \widetilde{S_{15}}, \widetilde{S_{16}}) \\ &= \min\{0.992, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0.976, 0.991, 0.976, 1\} = 0.976; \end{aligned}$$

$$d(\mathrm{S}_2) = 0.983;$$

$$d(\mathrm{S}_3) = 0.983;$$

$$d(\mathrm{S}_4) = 0.882;$$

$$d(\mathrm{S}_5) = 0.948;$$

$$d(\mathrm{S}_6) = 0.902;$$

$$d(\mathrm{S}_7) = 0.927;$$

$$d(\mathrm{S}_8) = 0.975;$$

$$d(\mathrm{S}_9) = 0.964;$$

$$d(\mathrm{S}_{10}) = 0.965;$$

$$d(\mathrm{S}_{11}) = 0.974;$$

$$d(\mathrm{S}_{12}) = 1;$$

$$d(S_{13}) = 0.985;$$

$$d(S_{14}) = 0.99;$$

$$d(S_{15}) = 0.997;$$

$$d(S_{16}) = 0.951;$$

(7) Using classic normalization operations Equation (12), the normalized weight vector can be defined as

$W'_{S1} = 0.0635$, $W'_{S2} = 0.064$, $W'_{S3} = 0.0617$, $W'_{S4} = 0.0574$, $W'_{S5} = 0.0617$, $W'_{S6} = 0.0587$, $W'_{S7} = 0.0603$, $W'_{S8} = 0.0635$, $W'_{S9} = 0.0627$, $W'_{S10} = 0.0628$, $W'_{S11} = 0.0634$, $W'_{S12} = 0.0651$, $W'_{S13} = 0.0641$, $W'_{S14} = 0.0644$, $W'_{S15} = 0.0649$, $W'_{S16} = 0.0619$.

Corresponding author
Yan Hong can be contacted at: hongyan@suda.edu.cn