Transactions on Economics, Business and Management Research
ISSN: 2960-1789, eISSN: 2960-2254 | Volume 10
MEEA 2024

Consumer Behavior in the Digital Marketplace: A Fuzzy Evaluation Approach

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Abstract. With the growing prevalence of the internet and the development of logistics, consumers face increasingly complex choices when shopping online. Therefore, this article introduces fuzzy comprehensive evaluation to address these shopping issues. In analyzing consumers' purchase decision-making problems for online shopping, it is essential to subjectively evaluate products, such as price, quality, and reputation. By constructing fuzzy relationships and assigning weights, this method effectively handles the ambiguity and uncertainty of evaluation information, reflecting consumers' subjective preferences in actual shopping decisions. This study concludes that quality is the dominant factor among numerous commodity factors,and it also established a shopping decision model, which aids consumers in making the best decisions during their shopping, thereby enhancing shopping efficiency and satisfaction. The results indicate that compared to traditional methods, this method can more accurately focus on consumer purchase intention and improve the understanding of shopping decisions. The paper summarizes the fuzzy comprehensive evaluation of its application value in shopping problems, pointing out that it can better simulate human fuzzy decision-making processes and provide a more practical shopping decision assistance tool. This study not only enriches the application of fuzzy comprehensive evaluation theory in consumer behavior research, but also provides consumers with a scientific and practical shopping decision support method.

Keywords: Fuzzy Comprehensive Evaluation; Shopping Decisions; Consumer Behavior.

1. Introduction

With the rapid development of e-commerce and the improvement of consumption level, online shopping has become one of the main shopping methods for consumers. However, in the face of a dazzling array of products, complex price strategies, and multi-dimensional brand competition, consumers often need to make decisions during the shopping process, and it is difficult for consumers to effectively evaluate them, which is largely affected by factors such as personal preferences, price sensitivity, and brand loyalty, which is likely to lead to continuous consumer disputes. Traditional evaluation methods, such as simple weighted average or evaluation based on a single index, are often difficult to accurately capture consumers' diversified shopping needs and uncertainties, resulting in decision-making results that may deviate from consumers' actual wishes, and then interfere with consumers' purchase decisions.

In order to improve the quality of online shopping and eliminate consumer disputes, this study introduces fuzzy comprehensive evaluation theory, which is a decision-making method based on fuzzy mathematics, the core of which is to process and quantify fuzzy information that is difficult to describe with accurate numerical values. The fuzzy comprehensive evaluation theory transforms consumers' fuzzy cognition and subjective preference into fuzzy sets that can be processed by mathematical models and realizes the effective evaluation of complex shopping problems by establishing an evaluation index system, determining a fuzzy evaluation matrix and synthesizing evaluation functions.

The application of this theory aims to construct an evaluation model that can reflect consumers' real purchase intentions, which can not only consider explicit indicators such as price, quality, brand reputation, and shopping environment of goods, but also capture consumers' indescribable subjective feelings in the shopping process, such as shopping atmosphere, service attitude and other hidden

factors. By assigning different weights to each index, the fuzzy comprehensive evaluation method can generate a comprehensive evaluation value according to the relative importance of consumers to each factor, so as to provide consumers with a decision-making basis that is closer to the actual needs.

On the basis of theoretical introduction and method construction, this study will verify the application effect of fuzzy comprehensive evaluation method in shopping problems through practical cases, so as to reflect consumers' subjective preferences in actual shopping decisions. At the same time, through the in-depth discussion of the fuzzy comprehensive evaluation method, we will also examine its limitations and challenges in practical application, such as the subjectivity of weight determination, model complexity, etc., and explore possible improvement directions, such as combining big data and artificial intelligence technology, to achieve the optimization and upgrading of the method in the future.

In summary, this chapter emphasizes the significant role of fuzzy synthesis evaluation in managing shopping-related complexities by providing a structured, scientific evaluation framework for shopping centers and e-commerce platforms. By boosting consumer satisfaction and enhancing business competitiveness, this method becomes a powerful tool for navigating the evolving landscape of consumer preferences and market trends.

2. Literature Review

2.1. Overview of Fuzzy Comprehensive Evaluation

The fuzzy comprehensive evaluation method is a powerful and flexible decision support tool, which is derived from the fuzzy set theory, proposed by Professor Zadeh in 1965, and aims to deal with the fuzzy, uncertain and multi-criteria decision-making problems that are widely used in real life. In the context of consumers' shopping decisions, fuzzy comprehensive evaluation provides a theoretical basis for constructing a comprehensive and accurate decision-making model by quantifying consumers' subjective evaluation and fuzzy cognition.

In the context of shopping analysis, fuzzy comprehensive evaluation offers a systematic way to assess shopping centers' overall strength and attractiveness. By considering factors such as the product quality, price, and brand reputation, this method helps improve decision-making processes and enhance the shopping experience for consumers.

The application of fuzzy comprehensive evaluation typically involves several steps, including determining evaluation criteria, constructing evaluation matrices, assigning weights to criteria, conducting fuzzy synthesis evaluation, and resolving ambiguity.

Furthermore, the advantage of the fuzzy comprehensive evaluation method is that it can deal with fuzzy information, fully consider the subjective preferences of consumers, and adapt to multi-criteria decision-making problems. However, this method also has certain limitations, such as the subjectivity of weight determination may affect the objectivity of the evaluation, and the complexity of the calculation process may have an impact on real-time decision-making. In order to overcome these limitations, future research can improve the efficiency and accuracy of fuzzy comprehensive evaluation in practical applications by optimizing weight determination methods, such as using multi-expert consensus, and using big data and artificial intelligence technologies.

Overall, fuzzy comprehensive evaluation proves to be a valuable tool in addressing complex decision-making problems in the shopping domain. By offering a structured and scientific evaluation basis, this method enhances consumer satisfaction, improves business competitiveness, and navigates the challenges of the ever-evolving shopping landscape.

2.2. Construct an Evaluation Index System for Consumers to Make Purchase Decisions

The fuzzy comprehensive evaluation method ensures the comprehensiveness of shopping demand analysis by constructing a multi-level evaluation index system. For example, the system can include

product quality (e.g., durability, functionality, design, etc.), price (e.g., absolute price, cost performance, promotional strategy, etc.), brand reputation (e.g., popularity, word-of-mouth, history, etc.), user experience (e.g., ease of use, comfort, design, etc.), personal needs and preferences (e.g., emotional experience in the shopping process, projection of personal values, social interaction, etc.).

2.2.1. Product quality.

Product quality refers to the degree to which the product meets the requirements of customers, laws and regulations and other relevant parties. Commodity quality is an unbiased evaluation of a product's characteristics, such as design, durability, performance, and safety. The quality performance of products in terms of performance, durability, and safety is one of the important indicators for consumers to consider purchasing, and it is also one of the first factors for consumers to consider. In recent years, due to the incomplete disclosure of quality information in the construction process of commercial housing, consumers cannot accurately understand the quality information in a timely manner, resulting in information asymmetry caused by the inconsistency between the actual quality and the quality of sales promotion. The number of complaints about the quality of commercial housing is increasing year by year, which will undoubtedly deepen consumers' concerns about the quality of commercial housing. Consumers are aware of quality issues and are concerned about the quality of commercial housing. According to the theory of consumer purchase decision, consumers' purchase decisions are affected by their psychological factors, and the perception of commodity housing quality problems is such a psychological factor [1].

An important assumption in new institutional economics is the incompleteness and asymmetry of market information. Due to information asymmetry, consumers, when faced with incomplete product information, may bear the risk associated with uncertainty as they infer product quality when making purchases [2]. This assumption is also applicable to the research on the impact of the quality evaluation system of commercial housing in the process of consumer purchase decision-making.

2.2.2. Price.

Whether the price of the product is reasonable and competitive compared with the market price is one of the important factors for consumers to consider in decision-making. More often than not, the motivation to stimulate consumer consumption is not that the price of a product in the same industry is much lower than that of other products, but that the price of the same product is lower than the price of other products at a certain point in the year. For example, in the pre-sale activities of online shopping platforms, the price is the main direction of promotion by the platform and merchants, and it is also the advantage of pre-sale activities that is mainly different from general retail activities. Merchants will pass on the price advantage of pre-sold products through various preferential means and generate strong psychological stimulation for consumers. In the process of making decisions, consumers will also consider the value of the product and the purchase cost, so as to pursue the minimization of the purchase cost and the maximization of the use value in the decision-making. With the continuous improvement of consumers' living standards and the upgrading of consumer demand, consumers have higher and higher requirements for the utility value of products and are more inclined to choose brand products [3].

2.2.3. Brand reputation.

Factors such as the popularity, reputation, and credibility of the brand to which the product belongs will affect the degree of trust that consumers have in the product. Word-of-mouth and evaluation: The evaluation of other consumers and the impact of word-of-mouth on the product are also important references for consumers when making purchase decisions. Research shows that most consumers are more inclined to buy products from well-known big brands than to try small and medium-sized brands. When the reputation of a big brand. Word of mouth is damaged, and it is easy to change consumers' purchasing decisions. Online word-of-mouth can be used on social networking sites such as Weibo and Facebook, as well as on e-commerce sites such as Dianping, Taobao and Amazon [4].

Consumers can use online word-of-mouth to communicate and disseminate relevant information about sellers, brand characteristics, and product and service quality, thereby influencing the purchase and consumption behavior of other consumers [5].

2.2.4. User experience.

Factors such as the ease of use, comfort, and design of a product can influence consumers' purchasing decisions. The results of one study showed that although product appearance is not a core attribute for practical goods, it still has a significant impact on consumers' product preferences and choices. As the complexity of product appearance increases, consumers' preference for products decreases [6]. For example, in the context of the novel coronavirus pandemic, consumers' online shopping behavior has shifted to consumer awareness and experience. The greater the improvement in customer experience, the more positive and faster consumers will make shopping decisions [7]. Moreover, nowadays the development potential of fresh fruit e-commerce is huge, but consumers still have concerns about whether to choose to buy fruit online. To achieve the sustainable development of fresh fruit e-commerce, it is necessary to clarify the influencing factors and mechanisms that affect consumers' migration to online channels, so as to improve the consumption experience, optimize emotional interaction, increase the conversion rate of consumers' online consumption, and realize the long-term penetration of consumers' migration to online consumption [8].

2.2.5. Individual needs and preferences.

Factors such as individual consumers' needs, preferences, and habits can also influence their purchasing decisions. The factors that affect the individual needs and preferences of consumers mainly include age, occupation, marital status, income, education, etc. People's preferences and needs are closely related to age, income and other factors, and consumers are also affected by the family life cycle, the city where the family lives, the occupation and economic status of the family members, and the individual's consumption level, product and brand choice, and the value orientation affects its response to some external stimuli. From an individual's point of view, will greatly influences an individual's behavior [1]. Purchase intent reflects the likelihood that a customer will purchase a product or service [9]. For example, studies have found that the deeper the intimacy, the greater the purchasing power generated by consumers, and consumers are more inclined to buy price-increasing products for their partners. The deepening of intimacy decreases consumers' cognitive control in purchasing decisions and increases consumers' emotional arousal [10].

3. Methodology and Results

3.1. Data Collection and Analysis

3.1.1. Data source.

In this study, the data was obtained by distributing the questionnaire to the targeted buyers of an online store on Taobao. This method is easy to operate, although subjective, but to the greatest extent possible, the obtained data will be comprehensively screened and calculated to obtain valid data. The surveyed Taobao users are all from the Internet, covering various groups and regions, in order to meet the accuracy of the data, the questionnaire will not be affected by a specific aspect and has a certain representativeness. In the indicator layer of this chart, the questionnaire describes the usage experience of the products on this online store, using terms such as excellent, good, average, poor, and inferior (Table 1).

Table 1. Evaluation Index System for Purchase Decision of Consumers on Taobao.

Target Layer	Benchmark Layer	excellent	good	average	poor	inferior
An evaluation index system for Taobao's online store consumers to make purchase decisions	quality	0.381	0.253	0.203	0.163	0
	Price	0.237	0.137	0.255	0.077	0.294
	Brand reputation	0.299	0.243	0.189	0.157	0.112
	User experience	0.144	0.197	0.102	0.214	0.343
	Individual needs and preferences	0.379	0.324	0.283	0.014	0

3.1.2. Model Selection.

The equation (1) used in this article is:

$$\text{'M}(\wedge,\oplus)\text{'} = \min \quad j=1,2,\ldots n \tag{1}$$

Represents the degree of membership of the comprehensive evaluation set '' obtained by the fuzzy comprehensive evaluation with respect to comment . is a measure of the magnitude of the influence of factor in the overall evaluation. is the membership of the object's comment from the set of factors.

The characteristic of this model is that is adjusted to∧ (i=1,2,... ,m), and then it is added to,with an upper bound. This model is a comprehensive evaluation of the 'equilibrium average' type in which each comment ' takes into account various factors at the same time. When using this model, it should be noted that each cannot be too large, otherwise there may be a situation where ' is equal to 1; Each ' should not be too small, otherwise it may be possible that ' is equal to the sum of ' and the information of the one-factor evaluation will be lost.

3.2. Application of Fuzzy Comprehensive Evaluation in Shopping Scenarios

3.2.1. Establish a set of factors and comments of the evaluation object.

Set up the selection of goods sold in an online store: factor set U=,amongrespectively represent 'product quality', 'price' ,'brand reputation', 'user experience', and 'individual needs and preferences'. When consumers make purchase decisions, they rate the performance of the product. The comment collection V=,amongrespectively represent excellent, good, average, poor, and inferior.

3.2.2. Single-factor evaluation.

Each factor in U (i=1, 2, 3,4,5) was evaluated as a single factor, and the five factors were evaluated in the form of survey reports and questionnaires (data source: calculated from the survey report and questionnaire), and the results were as follows:

== (0.381, 0.253, 0.203, 0.163, 0)

== (0.237, 0.137, 0.255, 0.077, 0.294)

== (0.299, 0.243, 0.189, 0.157, 0.112)

== (0.144, 0.197, 0.102, 0.214, 0.343)

== (0.379, 0.324, 0.283, 0.014, 0)

Each single factor evaluation set was used as a row to form a fuzzy comprehensive evaluation matrix in the equation (2):

3.2.3. Fuzzy Set of Determinant Importance.

The weight values of each factor are set according to the factors given by multiple experts, and then the multiple weight values of each factor are averaged. The proportions of these five factors in the consumer evaluation index system of Taobao shopping respectively are as follows: 36%, 10%, 12%, 18% and 24%. Thus, we obtain the fuzzy set of factor importance on U is =(0.36, 0.1, 0.12, 0.18, 0.24).

3.2.4. Determine the comprehensive evaluation model and calculate the fuzzy comprehensive evaluation set.

The model M(∧,⊕) was selected to obtain the fuzzy comprehensive evaluation set as =×=(0.964, 0.91, 0.765, 0.554, 0.586).

3.2.5. Comprehensive evaluation.

Because the maximum weight in is 0.964, according to the principle of maximum membership, the product satisfaction of the Taobao online store is considered to be excellent.

4. Conclusion

In conclusion, this study concludes a way to help consumers understand product positioning. In future online shopping processes, fuzzy evaluation methods can be employed to establish a shopping decision model, which aids consumers in making the best decisions during their shopping, thereby enhancing shopping efficiency and satisfaction. Overall, this study contributes to the growing body of research on decision support systems and optimization techniques in the field of consumer behavior analysis. By highlighting the potential of fuzzy synthesis evaluation as a valuable tool for addressing complex decision-making problems in the shopping domain, this research sets the stage for further advancements in the field. Embracing the uncertainties and complexities of the shopping landscape, fuzzy synthesis evaluation emerges as a promising approach for enhancing consumer satisfaction and business competitiveness in the ever-evolving e-commerce industry.

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