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# User Acceptance of Information Feed Advertising: A Hybrid Method Based on SEM and QCA

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**Abstract:** It is of great significance for enterprises' development to effectively use mobile Internet to carry out information feed advertising. This paper aims to study the influence factors and effect of the users' acceptance intention of information feed advertising through empirical analysis to provide references for further optimizing information feed advertising strategy. Traditional quantitative analysis methods, such as the Structural Equation Model (SEM), can only measure a single factor's influence from an individual perspective. Therefore, we introduce the Qualitative Comparative Analysis (QCA) and present a two-stage hybrid method based on SEM and QCA. In the first stage, we analyze the influence of a single variable on the acceptance intention of information feed advertising by SEM. Then, in the second stage, we analyze the impact of different variable combinations by QCA. Based on the actual questionnaire data, we define six independent variables and use AMOS, SPSS, and fsQCA to carry out SEM analysis and the fuzzy-set-based QCA analysis, respectively. The SEM analysis results show that the four factors (including consistency, informativeness, sociability, and advertising reward) have a significant positive impact on user acceptance of information feed advertising. On the contrary, perceived advertising clustering has a significant negative impact. In addition, accuracy has no considerable effect. The QCA analysis reveals that seven constructs of six variables can all significantly enhance information feed ads' acceptance intention.

**Keywords:** information feed advertising; user acceptance; structural equation model; qualitative comparative analysis

## 1. Introduction

In the era of mobile Internet, the needs of users are more and more diversified and personalized. Driven by technology, the entire media ecology has entered the era of mobile media, and significant changes have taken place in content distribution, presentation, and advertising forms [1]. In this context, enterprises' traditional robust persuasive advertising communication paradigm cannot attract more users. Information feed advertising is an Internet display advertisement embedded in the information of social-media platforms. It can display advertisements one by one according to the platforms' presentation mode and support interactive user participation [2]. According to a recent report [3], the scale of China's mobile advertising market is expected to exceed 400 billion yuan in 2020. Information feed advertising will become the primary mode of mobile advertising, relying on accurate communication and a high conversion rate. In addition, the pursuit of more scientific and precise delivery of information feed advertising can bring new mobile marketing opportunities. With the gradual commercialization of 5 g communication in China, the information feed advertising based on a mobile short video will develop more rapidly. Under these development trends, adapting to the information feed advertising mode and how to carry out information feed advertising and marketing effectively have become new problems to be solved.

At present, there is some research on information feed advertising. Some scholars believe that information feed advertising has adverse effects in practice, such as the lack of advertising avoidance and persuasion, and whether such ads can provide users with useful information [4,5]. These are the key reasons for determining whether users accept information feed advertising. The application effect of information feed advertising ultimately depends on the acceptance of users. As a new marketing mode on the mobile commerce platform, information feed advertising also attaches great importance to information feed advertising's marketing promotion at such a rapid development stage [6]. Therefore, effectively using resources to make users better accept the information feed advertising has become an urgent problem to be studied. Specifically, there are three main problems in the adoption of information feed advertising:

- (1) What factors will affect users' willingness to accept information feed advertising?
- (2) Are these factors positive or negative for the user acceptance of information feed advertising?
- (3) How can the combination of these factors affect the user's willingness to accept information feed advertising?

At present, the domestic and foreign research on the user acceptance of information feed advertising focuses on analyzing relevant influencing factors from the users' perspective, but there are still some limitations. On the one hand, the current research mainly focuses on analyzing which influencing factors are positive promotion or negative inhibition. Most researchers only observe the influence of independent elements; on the other hand, the traditional data analysis methods mostly use linear regression to study the average effect of various influencing factors on a specific cumulative behavior or result. Generally speaking, there is a lack of an overall analysis perspective. This paper focuses on the configuration of different combinations of conditional variables and the combined analysis of the influencing factors of users' willingness to accept information feed advertising.

This paper studies the influence of single or multiple factors and explores how the combination of influencing factors of users' willingness to accept information feed advertising affects the user acceptance of information feed advertising. Briefly, we make the following contributions in this paper:

- (1) To describe the impact of information feed advertising on users' acceptance intention, this paper proposes six influencing factors from the perspective of the characteristics of information feed advertising and the social network characteristics in the mobile Internet environment. Compared with existing studies, this paper considers the advertising effect, the factors of information feed advertising itself, and the social network characteristics in the mobile Internet environment, comprehensively describing the impact of information feed advertising on user acceptance.
- (2) To quantitatively describe the influence of various factors on users' acceptance of information feed advertising and analyze the impact of a combination of different factors on users' willingness to accept information feed advertising, we propose a two-stage hybrid research method based on SEM and QCA. In the first stage, SEM is used to analyze the influence of a single variable on user acceptance of information feed advertising. Then, in the second stage, the QCA method analyzes the effect of different variable combinations on user acceptance of information feed advertising. Compared with the existing work, our hybrid research method can analyze the influence of a single factor and further explore the impact of different combinations of various factors, which can better meet the practical application needs of information feed advertising.
- (3) Based on the actual network questionnaire data, we verify the hybrid research method. The SEM analysis shows that consistency, informativeness, sociality, and advertising reward have a significant positive impact on the user acceptance of information feed advertising, while perceived advertising clustering has a significant negative effect on user acceptance of information feed advertising. In addition, accuracy has no significant impact on user acceptance of information feed advertising. The QCA analysis reveals that seven different configurations of six variables can significantly enhance the user acceptance of information feed advertising. Thus, enterprises can

improve user acceptance of information feed advertising, and the industry can choose the appropriate combination of factors according to its resource allocation conditions to maximize the user's willingness to accept information feed advertising.

The rest of the paper is structured as follows. In Section 2, we briefly describe the related work of this study. Section 3 gives the research design. Section 4 presents data analysis and empirical results. Finally, in Section 5, we conclude the entire paper and discuss future work.

## 2. Related Work

Information feed advertising is an online advertisement embedded in the information of the social media platform. It can be integrated with the platform features and displayed one by one according to the platform information presentation mode, which can support users' interactive participation [2]. The most intuitive form of presentation is embedded in social media's information feed, which is usually interspersed between other platform contents to transmit brand content preview [3]. Facebook first launched information feed advertising, and then it was advanced by social-media platforms such as Twitter, Instagram, QQ, and WeChat [7]. A report of the IAB (Interactive Advertising Bureau) summarizes three kinds of information feed advertising [8]:

- (1) Information feed advertising is an integral part of user experience;
- (2) Information feed advertising exists in the user's daily activity flow;
- (3) The form (appearance and perception) and function of information feed advertising are consistent with the social media platform's information.

Based on the above characteristics, the interference cost of information feed advertising is significantly reduced. Unnecessary advertising information will not be delivered to users, so users can easily accept information seed advertising [7].

What are the main factors that affect the acceptance of information feed advertising? Aiming to answer this question, Broeck et al. [9] experimentally found that users' willingness not to accept advertisements placed in Facebook information stream was significantly higher than that in the Facebook sidebar. In the literature [5], researchers explored avoidance related factors such as perceived autonomy, perceived freedom threat, and perceived intrusion based on psychological resistance theory to understand better why users accept information feed advertising on Facebook. From the variables related to WeChat as social media, such as the number of WeChat friends, and the variables related to advertising, researchers studied the influencing factors of user participation in the information feed advertising in WeChat friend circles [10]. Kim et al. [11] proved that perceived consistency positively impacts advertising attitude, brand attitude, and purchase intention [11]. Harms et al. [12] conducted in-depth interviews with 22 advertising industry practitioners to understand whether brand-related information (such as brand name, brand logo, and product) need highlighting in information feed advertising. The results showed that brand information's saliency was negatively related to the original perception of advertising, and lower initial perception brought negative evaluation to advertising. The research in [13] used the Technology Acceptance Model (TAM) to study health advertising on social media. They constructed the audience trust and acceptance research model to analyze the relevant factors influencing the user trust and acceptance of online health advertising. Other people explored the dynamic accuracy of information feed advertising on user acceptance [14].

There are qualitative and quantitative research methods on the user acceptance of information feed advertising from the perspective of research methods. The quantitative research methods include the survey method, first-hand data analysis, laboratory experiments, etc. The previous studies generally adopted the quantitative approach of regression analysis. On the other hand, some qualitative research methods were also used in data analysis, such as the interview method and the case analysis [4–7,9–14].

To sum up, the previous research on the user acceptance of information feed advertising focused on the characteristics of information feed advertising and social media characteristics. It analyzed the relevant influencing factors from user acceptance. However, most of the current research on the

influencing factors of the user acceptance of information feed advertising was mainly toward analyzing which influencing factors are positive promotion or negative inhibition. The traditional data analysis methods mostly use the linear regression method to study the average effect of various influencing factors on a specific cumulative behavior or result.

### 3. Research Design

#### 3.1. Variables and Hypothesis

##### (1) Variables

There is only one dependent variable in this study: the user's willingness to accept information feed advertising. The independent variables include the factors that affect the user acceptance of information feed advertising. Since the characteristics of advertising and the related operations of advertising publishing platforms significantly impact the user acceptance of advertising, we define the variables from the related advertising attributes of information feed advertising and advertising publishing platforms. These factors include consistency, accuracy, informativeness, sociality, advertising reward, and perceived advertising clustering. The basis for the selection of these variables is detailed below:

*Consistency.* Information feed advertising is an Internet display advertisement embedded in information streaming media platforms. Information feed advertising has characteristics consistent with social media platforms and context information. Previous research showed that the design of information feed advertising is compatible with the social media platform [15,16], which weakens the interference to users' browsing or reading information. The consistency of information feed advertising positively impacts user perception of information processing fluency. The information processing fluency theory points out that people's perception of the difficulty of processing information affects their response to information, and believes that, when people perceive information with high fluency when processing information, it is easier to cause positive feedback from users [17].

*Accuracy.* Based on big data, information feed advertising accurately depicts users, analyzes user behavior, accurately captures user needs, and realizes accurate delivery to users. With the development of information feed advertising, big data, and machine learning technology, it is possible to realize intelligent collaborative recommendation of information feed advertising and improve information feed advertising accuracy. In the modern era, with more and more advanced technologies, users are increasingly pursuing convenient operation and access to useful information to avoid being trapped in miscellaneous details. However, when users see that the pushed information feed advertisement matches their interests or needs, it saves users' efforts and time for searching. Therefore, the information feed advertising that meets the user's needs has won their initial recognition to browse or further accept advertisements.

*Informativeness.* Informativeness refers to the content of effective products or services provided by advertisements. Advertising information will directly affect users' cognition and understanding of products or services. The most basic advertising function is to provide users with the information content of products or services. Ducoffe pointed out that the primary reason to support advertising was that users could obtain effective advertising content from advertising [18]. Information feed advertising could further provide users with high-quality and exciting products or services. Thus, users can get greater harvest and satisfaction from the effectiveness of information seed advertising.

*Sociality.* Sociality refers to the degree to which the computer media communication environment can promote social space's emergence by allowing social support [19]. Information feed advertising integrates the page interaction technology of social function, making users actively participate in the interaction with information feed advertising. Therefore, in the context of information feed advertising, users can click to view, like, and comment on information feed advertising. In addition, other users' participation behavior can be observed, which meets users' social needs, so it has the characteristics of sociality. Specifically, information feed advertising's sociality represents the degree to which users can meet their social impulses by interacting with other users through information feed advertisements.

According to the social existence theory, if social media can give individuals the same feeling as a face-to-face conversation, individuals will have better psychological feelings. That is to say, they will experience a sense of social existence, and sociality can enhance the perceived pleasure of users and create an immediate sense of belonging among individuals [20]. Moreover, the sociality of information feed advertising can meet the psychological needs of users for social interaction. The interactive media experience constructs a learning community based on real society for information feed advertising, dramatically improving users' participation and activity [21].

*Advertising reward.* Advertising reward refers to the incentive measures that advertisers provide users with product gifts, coupons, etc. Differing from users' active search, information feed advertising is passively accepted by users. Therefore, it may cause a particular aversion. In practice, to attract users and reduce users' aversion, some information feed advertisements will provide advertising, such as coupons and gifts. These reward measures can let users experience practical benefits. Users are generally rational, and advertising rewards can improve users' perceived benefits [22], so they may accept information feed advertising because of advertising rewards.

*Perceived advertising clustering.* Too much advertising and too high advertising frequency will cause cognitive pressure on users, which will cause an aversion to advertising. Perceived advertising clustering is used to describe the user's perception of the number of platform ads and the media attributes of platform advertising [23]. It is generally embedded in information for information feed advertising and is displayed one by one according to the platform information presentation mode. Therefore, if the social platform pushes too many information feed advertisements to the users, forming a perceptual advertising cluster, it will worsen users' perception of advertising and cause boredom to information.

## (2) Hypothesis

In this study, based on the above six variables, we aim to verify the following hypotheses:

**Hypothesis 1 (H1).** *Consistency has a positive impact on the user acceptance of information feed advertising.*

**Hypothesis 2 (H2).** *Accuracy has a positive impact on the user acceptance of information feed advertising.*

**Hypothesis 3 (H3).** *Informativeness has a positive impact on the user acceptance of information feed advertising.*

**Hypothesis 4 (H4).** *Sociality has a positive effect on the user acceptance of information feed advertising.*

**Hypothesis 5 (H5).** *Advertising reward has a positive impact on the user acceptance of information feed advertising.*

**Hypothesis 6 (H6).** *Perceived advertising clustering has a negative impact on the user acceptance of information feed advertising.*

**Hypothesis 7 (H7).** *Different groups of variables have different impacts on the user acceptance of information feed advertising.*

Note that hypotheses 1 to 6 are toward the impact of a single factor on the user acceptance of information feed advertising, while hypothesis 7 is toward the impact of various groups of multiple factors. In this study, we use separate methods to verify these hypotheses. For verifying hypotheses 1 to 6, we use the SEM model, and, for hypothesis 7, we use the fsQCA approach. Next, we detail the research method of this study.

### 3.2. Research Method

This paper proposes a two-stage hybrid research method, which combines the Structural Equation Model (SEM) with the Qualitative Comparative Analysis (QCA). The SEM's primary purpose is to analyze the influence of a single factor on the user acceptance of information feed advertisements. The purpose of QCA is to analyze the impact of different variable combinations on the user acceptance of information feed advertisements. It is necessary to carry out qualitative comparative analysis in selecting the actual information feed advertising strategy. First of all, the positive or negative effects of a single factor on the user acceptance of information feed advertising can only show the impact of a single factor. However, they can not explain how to combine multiple factors in the actual information feed advertising. Secondly, not all information feed advertising enterprises can maximize all the influencing factors. For example, suppose some enterprises are unwilling to advertise rewards and advertise on social networks, the two factors of sociality and advertising rewards will be missing. How to maximize the user acceptance of information feed advertising becomes challenging. The introduction of the qualitative comparative analysis method can solve the above problems.

Basically, our research model consists of the following stages.

#### (1) Stage 1: Performing the SEM Analysis

In the first stage, the SEM model is used to study the influence of a single factor on the user acceptance of information feed advertising. Structural equation modeling (SEM) is a method to establish, estimate, and test causality. The model contains both observable and potential variables. The SEM model can use multiple regression, path analysis, factor analysis, covariance analysis, and other methods to clearly analyze the effect of a single factor on the overall and the relationship between individual indicators.

#### (2) Stage 2: Performing the QCA Analysis

The QCA analysis is a research method between the case-oriented approach and the variable-oriented approach [24,25]. This method combines the advantages of the traditional qualitative research methods, taking the membership relationship between sets as the primary means. It uses Boolean algebra to explore how antecedents' combination causes observable changes or discontinuities in the interpreted results [26]. The QCA method systematically examines the conditions for an event's occurrence and the interaction and possible relationship combinations between the internal generating conditions. It attempts to explain the core conditions contributing to the event's occurrence, the interrelationship between the conditions, and the complex combination of conditions that stimulate the event's occurrence. Thus, it can deepen the understanding of the complicated causal relationship of the event [27].

The basic principle of Boolean algebra used by qualitative comparative analysis in data coding is to use dichotomy to deal with different conditions by 0/1. If a condition appears, it is indicated by 1, and, if a condition does not occur, it is represented by 0. However, in the actual case analysis, some conditional variables cannot be clearly coded as 0 or so the fuzzy-set QCA method (fsQCA) is typically used. For conditions that cannot be clearly coded, there is a membership score between 0 and 1, dealing with degree change and partial membership [28]. Compared to the SEM analysis, the fsQCA method is asymmetric, i.e., the relationship between cause and condition is asymmetric. Thus, multiple approaches or solutions may lead to the same result and causal complexity, indicating the interdependence of cause conditions and multiple concurrent causalities formed by different combinations.

The fsQCA method is suitable for studying social sciences, including economics and management [25]. It has been rapidly applied in management research in recent years and has been used in questionnaire design, second-hand data, and case studies [28]. Moreover, the effective integration of the fsQCA method and mainstream statistical analysis methods have provided a broad opportunity to expand the social science theory's descriptive, predictive, and explanatory power [29].

For example, the previous research analyzed the influencing factors of customer complaint behavior on customer loyalty in B2C E-commerce. It used the SEM model and fsQCA to test the relationship among distribution, interaction and procedural justice, positive and negative emotions, service compensation satisfaction, and trust [30]. With the help of fsQCA, another work analyzed the influencing of user characteristics and intensive factors on user behavior [31]. Alonso dos Santos et al. (2018) used the SEM model and fsQCA to analyze the cancellation of sports sponsorship in sports virtual brand community [32]. The study of Duarte et al. (2019) showed that six combinations of seven antecedent variables were sufficient for users’ willingness to accept mobile medical care [33]. Gligor et al. (2020) considered customers’ background and explored two methods of qualitative comparative analysis, including fsQCA and the multiple regression analysis, to explain the factors influencing customers’ participation in the brand advertising [34].

Based on the SEM analysis and the summary of different levels of influencing factors, this paper explores the combination of factors influencing user acceptance of information feed with the QCA method’s help. The introduction of the QCA method makes us not limited to studying a single factor, but also does not rely on researchers’ subjective will. The conclusion is more objective and exploratory. Through the combination of the SEM model and QCA method, we can not only find the independent influence of a single factor but also mine the combination effect of user’s intention, which can further analyze the user’s willingness to accept information feed advertising.

### 3.3. Questionnaire Design and Data Collection

The questionnaire in this study was measured by the Likert 5 scale. The respondents chose 1 (very disagree) to 5 (very agree) to rate the questions. The observation indicators are set based on classic literature and users’ willingness to accept information feed advertisements. The questionnaire consists of three parts: sample screening questionnaire, demographic questionnaire, independent variable, and dependent variable questionnaire:

- (1) Sample questionnaire. This part of the questionnaire mainly detects the useful samples, ensuring that the users are experiencing information feed advertising.
- (2) Demographic questionnaire. This part mainly measures the gender, age, and educational background of the respondents.
- (3) Independent and dependent variable questionnaire. This part of the questionnaire is the core of the whole questionnaire design, as shown in Table 1.

In this study, 262 questionnaires were collected through an online survey. After eliminating invalid questionnaires such as data missing, 229 valid questionnaires were obtained, with an effective rate of 87.4%. The sample size is more than 200, and the ratio of a sample size to measurement items is 10.9:1, which meets the analysis requirements of the SEM model.

**Table 1.** Variables and sources.

Variable	Question	Source
Consistency	YZ1: In terms of form, I think the information feed advertisement is very similar to other information on the page, so it is not abrupt	Fan et al. [35]
	YZ2: From the design point of view, information feed advertising is very similar to other information on the page	
	YZ3: From the perspective of content language style, information feed advertising is very close to other information on the page	

**Table 1.** *Cont.*

Variable	Question	Source
Accuracy	JZ1: I think the content of information feed advertisement and push is more consistent with the reading content I have been browsing or browsing in the past	Kamaruddin et al. [36]
	JZ2: I feel that the information feed advertisement has pushed me the information that meets my needs in a more appropriate period	
	JZ3: I think information feed advertising provides information about products or services that I am currently or in the past interested in	
Informativeness	XX1: Information feed advertising enables me to access product and service information easily.	Ducoffe [18] Cheng et al. [37]
	XX2: Information feed advertising is a valuable source of information about products and services	
	XX3: Information feed advertising can help me to understand the latest information of products and services	
Sociality	SJ1: Information feed advertising allows me to interact with other people in real-time and interesting ways	Madlberger et al. [4]
	SJ2: Information feed advertising helps me interact with others	
	SJ3: In general, I think information feed advertising can much promote social interaction	
Advertising reward	JL1: If I can take part in the lottery and give away goods at the same time, I am more willing to receive information feed advertising	Yang et al. [22]
	JL2: If I can get discount coupons for products at the same time, I prefer to receive information feed advertising	
	JL3: If I can get bonus packets at the same time, I prefer to receive information feed advertising	
Perceived advertising clustering	QJ1: I think there are too many information seed ads	Chen et al. [38]
	QJ2: I think the amount of information seed advertising is boring	
	QJ3: I think social media is an advertising medium	
Acceptance Intention	JS1: I'll take a look at the information seed ads if I need to	Venkates et al. [39]
	JS2: I occasionally need information feed advertising	
	JS3: I can accept information feed advertising	

The descriptive statistical results of the sample are as follows: the proportion of male and female is 47.6% and 52.4%; the age group is mainly between 18 and 30 years old, accounting for 88.2% of the total sample; the number of undergraduates and above accounts for 89.9%, and the sample of master's degree or above accounts for 49.7%; in the occupation, the proportion of students studying is 55.4%, and that of enterprise employees is 32.7%.

#### 4. Data Analysis and Results

##### SEM Analysis

##### (1) Reliability and validity test

In the SEM analysis, the measurement reliability of the variables needs to be measured by three indicators, including Cronbach's  $\alpha$  coefficient, combination reliability value (CR), and average extracted

square difference (AVE). The critical criteria of these three indicators are 0.7, 0.7, and 0.5, respectively. In this study, all the research variables met the critical values, as shown in Table 2.

**Table 2.** Reliability and convergence validity test.

Variable	Item	Factor Loading	Cronbach's $\alpha$	AVE	CR
Consistency	yz1	0.680	0.83	0.628	0.834
	yz2	0.867			
	yz3	0.819			
Accuracy	jz1	0.752	0.757	0.511	0.756
	jz2	0.619			
	jz3	0.765			
Informativeness	xx1	0.822	0.859	0.673	0.861
	xx2	0.796			
	xx3	0.843			
Sociality	sj1	0.851	0.879	0.738	0.894
	sj2	0.845			
	sj3	0.880			
Advertising Reward	jl1	0.800	0.851	0.656	0.851
	jl2	0.840			
	jl3	0.789			
Perceived Advertising Clustering	qj1	0.821	0.816	0.604	0.819
	qj2	0.833			
	qj3	0.666			
Acceptance Intention	js1	0.806	0.843	0.642	0.843
	js2	0.797			
	Js3	0.800			

Another analysis of SEM is the convergence validity test. The standardized factor loads of the seven significant variables of the model were higher than 0.6 and reached significant levels, as shown in Table 2; the combined reliability was more significant than 0.7. The average variance extraction rate was greater than 0.5. On the whole, the model met the requirements of convergence validity.

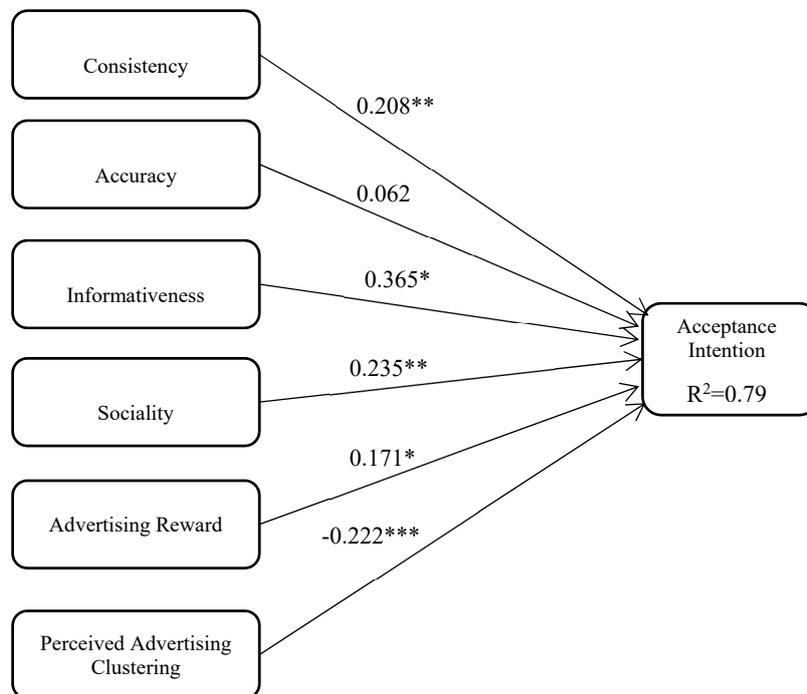
The last one is the discriminant validity test, and the results are shown in Table 3. The correlation coefficient of each variable is less than the square root of the average variance extraction rate of the corresponding variable, which indicates that the model has good discriminant validity.

**Table 3.** Discriminant validity test.

	Consistency	Accuracy	Information	Sociality	Advertising Reward	Perceived Advertising Clustering	Acceptance Intention
Consistency	0.792						
Accuracy	0.474	0.715					
Informativeness	0.421	0.703	0.820				
Sociality	0.382	0.585	0.633	0.786			
Advertising Reward	0.374	0.525	0.420	0.402	0.859		
Perceived Advertising Clustering	0.005	-0.029	-0.119	-0.016	0.143	0.777	
Acceptance Intention	0.512	0.629	0.689	0.620	0.471	-0.191	0.918

(2) SEM validation

The SEM model measures the relationship between latent variables and latent variables. This paper uses AMOS 22.0 to verify the path coefficients among the research model’s potential variables. The path between the coefficients is shown in Figure 1.



**Figure 1.** SEM test design (\*\*\*) denotes  $p < 0.001$ , \*\* means  $p < 0.01$ , \* indicates  $p < 0.05$ ; R<sup>2</sup> is the decisive coefficient).

As shown in Figure 1, consistency has a significant positive impact on users’ willingness to accept information seed advertising ( $\beta = 0.208, p < 0.01$ ). Hypothesis H1 has been verified, which indicates that the higher the consistency between information feed advertising and social media, the higher the user’s willingness to accept information feed advertising. Informativeness positively affects users’ acceptance intention ( $\beta = 0.365, p < 0.05$ ), and hypothesis H3 has been verified, which indicates that information feed covers a wide information range. The more informative the content is, the higher the user’s willingness to accept information feed advertising. Sociality has a significant positive impact on the user’s acceptance intention ( $\beta = 0.235, p < 0.01$ ), assuming that H4 has been verified, which indicates that the higher the sociality of the information feed advertising, the higher the user’s willingness to accept the information feed advertising. Advertising reward has a significant positive impact on the user’s acceptance intention ( $\beta = 0.171, p < 0.05$ ). Thus, hypothesis H5 is verified, which indicates that the higher the reward level of information feed advertising, the higher the user’s willingness to accept information feed advertising. Perceived advertising clustering has a significant negative impact on user’s acceptance intention ( $\beta = -0.222, p < 0.001$ ), and hypothesis H6 has been verified, which shows that the higher the user’s perceived advertising clustering, the lower the user’s willingness to accept information feed advertising. Accuracy is not significantly positive to influence the user’s acceptance intention ( $\beta = 0.062, p > 0.05$ ), and hypothesis H2 has not been verified. As a result, the decision coefficient of acceptance intention is 0.79, which means that the model explains 79% variance variation of users’ intention of information seed advertising, and the explanation degree is good. The model fitting index is shown in Table 4, which reaches the theoretical value, and the fitting degree is good.

**Table 4.** Model fitting degree.

Statistical Test	$\chi^2/df$	SMRM	RMSEA	AGFI	NFI	RFI	CFI	IFI	PGFI	PNFI	PCFI
Ideal Value	<2.00	<0.08	<0.05	>0.80	>0.90	>0.90	>0.90	>0.90	>0.50	>0.50	>0.50
Acceptable Value	<3.00	<0.1	<0.08	>0.70	>0.80	>0.80	>0.80	>0.80			
Our Value	2.345	0.0549	0.077	0.812	0.871	0.883	0.921	0.922	0.628	0.697	0.737

Table 5 summarizes the test results of the six research hypotheses (H1–H6). According to the empirical results of the questionnaire survey data, H2 performance is not significant. The other assumptions are significant.

**Table 5.** Summary of hypotheses validation in the SEM analysis.

No.	Hypothesis	Validation Result
H1	Consistency has a positive impact on the user acceptance of information feed advertising.	Established
H2	Accuracy has a positive impact on the user acceptance of information feed advertising.	Not Established
H3	Informativeness has a positive impact on the user acceptance of information feed advertising.	Established
H4	Sociality has a positive effect on the user acceptance of information feed advertising.	Established
H5	Advertising reward has a positive impact on the user acceptance of information feed advertising.	Established
H6	Perceived advertising clustering has a negative impact on information feed advertising acceptance intention.	Established

### 5. Qualitative Comparative Analysis (QCA)

Based on the SEM analysis, we have obtained the influencing factors (i.e., consistency, accuracy, informativeness, sociality, advertising reward, and perceived advertising clustering) of information feed advertising. Next, we will apply the fuzzy set qualitative comparative analysis (fsQCA) to study the effect of the combination of these factors and try to understand how the different combinations will impact the users’ willingness to accept information feed advertising.

The fsQCA method includes the following processes [28]: extraction of dependent variables; data acquisition; data calibration, necessity analysis, and adequacy analysis. We will set up different constructs of variables and measure their impact on user acceptance of information seed advertising.

#### (1) Data calibration

In this step, we establish the combinations of various factors that affect the user acceptance of information feed advertising [40]. Since this study’s sampling data is a numerical type of 5-point Likert, we need to convert data to the value between 0 and 1 scale before analysis. All the variables are directly calibrated, and three anchors need to be set, namely full membership, intersection, and total non-subordination [41]. Many studies choose to use percentiles to calibrate the scale [42], and it is necessary to deal with the relationship between the measurement scale and the actual distribution of the sample [43]. In this study, the sample data score distribution is relatively concentrated. The calculation is completed by the calibrate function in the fsQCA software.

#### (2) Necessity analysis

Based on data calibration, we test the necessity of a single antecedent variable. The consistency of the necessity fuzzy subset relation is shown in Formula (1), and coverage is shown in Formula (2):

$$consistency(X_i \leq Y_i) = \frac{\sum \min(X_i, Y_i)}{\sum X_i} \tag{1}$$

$$coverage(X_i \leq Y_i) = \frac{\sum \min(X_i, Y_i)}{\sum Y_i} \tag{2}$$

Here,  $Y_i$  is the result set and as  $X_i$  is the condition set. When the consistency is over 0.9, the condition is necessary and becomes a superset of the result set [44]. The necessity analysis of the calibrated data was carried out to obtain a single antecedent variable’s consistency and coverage, as shown in Table 6. The results show that the consistency coefficient of the six antecedents’ existence or non-existence in this study are all lower than 0.9, which indicates that none of the antecedents in this study is necessary.

**Table 6.** Necessity analysis results (~indicates that the antecedent variable does not exist or the level is low).

	Coherence	Coverage
Consistency	0.793424	0.754576
~Consistency	0.453408	0.577646
Accuracy	0.654932	0.798182
~Accuracy	0.501603	0.493763
Informativeness	0.876503	0.805453
~Informativeness	0.410425	0.548553
Sociality	0.706415	0.816707
~Sociality	0.544988	0.561004
Advertising Reward	0.725661	0.773023
~Advertising Reward	0.499519	0.556458
Perceived Advertising Clustering	0.564715	0.624733
~Perceived Advertising Clustering	0.643303	0.689886

### (3) Adequacy analysis

The truth table should be constructed first for adequacy analysis. Different combinations of multiple antecedent variables form different constructs. The truth table is the result list of all cases classified according to different constructs. Then, the consistency threshold and frequency threshold are set to remove the construct with lower consistency or frequency in the truth table. Among them, consistency refers to how the result variable can be deduced for the combination, and the consistency threshold is generally set as 0.8. For the frequency threshold, the sample size should not be less than 80% of the total sample size [45]. In this study, the consistency threshold is set to 0.8, and the frequency threshold is set to 2.

The optimal solution and the simplified solution of the user’s willingness to accept information feed advertising are obtained through the truth table obtained. We use the symbol  $\otimes$  to indicate that the antecedent variable needs not to exist in the construct. The symbol  $\ominus$  is used to indicate that the existence of the antecedent variable does not affect the results [41]. Furthermore, the antecedent variables included in both the reduced solution and the optimized solution are regarded as the core condition, and the antecedent variables only included in the optimal solution but excluded by the reduced solution are regarded as the marginal conditions. This study concludes that the core condition is informativeness and the absence of perceived advertising clustering. In the construct table, the core conditions are represented by the symbol  $\oplus$ , and the marginal conditions are represented by the symbol  $\odot$ , as shown in Table 7.

**Table 7.** Results of adequacy analysis for seven constructs.

	User Acceptance of Information Feed Advertising						
	Construct 1	Construct 2	Construct 3	Construct 4	Construct 5	Construct 6	Construct 7
Consistency	⊗	⊙	⊖	⊙	⊖	⊙	⊙
Accuracy	⊗	⊖	⊙	⊙	⊙	⊗	⊗
Information	⊙	⊙	⊙	⊙	⊙	⊗	⊙
Sociality	⊖	⊙	⊗	⊖	⊙	⊗	⊗
Advertising Reward	⊖	⊗	⊙	⊙	⊙	⊗	⊗
Perceived Advertising Clustering	⊗	⊗	⊗	⊗	⊙	⊗	⊙
Initial Coverage	0.24466	0.28604	0.25662	0.33721	0.33456	0.19134	0.16247
Special Coverage	0.04362	0.04515	0.01387	0.05373	0.14924	0.01275	0.02414
Coherence	0.88179	0.95939	0.98888	0.98271	0.93543	0.81212	0.92681
Overall Coverage				0.727426			
Overall Coherence				0.872547			

⊗: the antecedent variable needs not to exist in the construct. ⊖: the existence of the antecedent variable does not affect the results. ⊙: the antecedent variable is a marginal condition to the construct. ⊙: the antecedent variable is a core condition to the construct.

In Table 7, coherence reflects the degree to which a given construct is a sufficient condition for the result, and the coverage assessment interprets the result by the set relation of consistency test, which reflects the empirical correlation of constructs, that is, how much the given construct determines the result variable. As shown in Table 7, the overall coherence is higher than the acceptable threshold (0.75), which indicates that all constructs have good reliability and are sufficient conditions for user acceptance of information feed advertising. The overall coverage is about 0.727, indicating that these seven constructs account for a considerable proportion of the results.

All constructs provide different combinations of factors. According to the fsQCA analysis, we have the following conclusions:

- Construct 1 indicates that information feed advertising is highly informative, consistent, accurate, and social. No matter what the advertising reward is, users will accept the information feed advertising if they do not perceive the advertising clustering.
- Construct 2 indicates that information feed advertising is highly informative, consistent, and social, and there is no advertising reward. No matter how accurate it is, users will accept the information feed advertising when they do not perceive advertising clustering.
- Construct 3 indicates that information feed advertising is highly informative and accurate, with advertising rewards and low sociality. Regardless of the consistency, users will accept the information feed advertising when they do not perceive advertising clustering.
- Construct 4 indicates that information feed advertising is highly informative, consistent, accurate, and has advertising rewards. No matter how social it is, users will accept information feed advertising when they do not perceive advertising clustering.
- Construct 5 indicates that information feed advertising is highly informative, accurate, and social, and there are advertising rewards. No matter how consistent, users will accept the information feed advertisement even though they have perceived the advertisement clustering.
- Construct 6 means that information feed advertising has high consistency, low information, consistency, accuracy, and sociality. There is no advertising reward, and users have no perception of advertising clustering. They will have the willingness to accept information feed advertising.
- Construct 7 indicates that the information feed advertising is highly informative and consistent, and its accuracy and sociality are low, and there is no advertising reward. Although users perceive advertising clustering, they will still be willing to accept information feed advertising.

As a result, we can see that hypothesis 7 (H7) is established according to the fsQCA study.

## 6. Conclusions

In this paper, we presented a two-stage hybrid model to study the influencing factors and effects of user acceptance of information feed advertising. The results of the SEM analysis in the first stage show: (1) consistency has a significant positive impact on user acceptance; (2) informativeness has a significant positive impact on user acceptance; (3) sociality has a significant positive impact on user acceptance; (4) advertising reward has a significant positive impact on user acceptance; (5) perceived advertising clustering has a significant negative impact on user acceptance, and (6) accuracy has no significant positive effect on user acceptance. The fsQCA analyzing results in the second stage shows that combining different factors can effectively enhance users' willingness to accept information feed advertising.

### 6.1. Research Implications

The results of the study can offer some insightful implications for future research on information feed advertising. Although previous studies have studied information feed advertising [5,14,35], a few of them focused on the advertising effect of information feed in the mobile Internet environment. In this study, we defined a new variable set based on mobile Internet and information feed advertising features, which can reflect the consistency, accuracy, informativeness, sociality, advertising reward, and perceived advertising clustering of the information feed advertising effect. Regarding the research model, this study's unique contribution is that we propose to combine SEM and fsQCA to measure the impact of various factors on user acceptance of information feed advertising. Such a model can utilize the advantages of quantitative analysis and qualitative analysis, considering the impact of a single factor and revealing the impact of selective multiple factors. We believe that this idea can also be applied to other fields to deliver more convincing results.

A critical finding of this study is that it is unnecessary to consider all influencing factors to advance information feed advertising. Through the fsQCA analysis, we also noted that any combination of the designed factors could emphasize some aspects but neglect other ones. To this end, enterprises can choose appropriate constructs according to their real demands and environments. For example, even when some factors have a low impact on a specific construct, users may also be willing to accept information feed advertising. In addition, although there is a significant negative influence factor of perceived advertising clustering, users will also have the willingness to accept information feed advertising when other influencing factors have a high impact. This is much important for enterprises to develop information feed advertising because not all of them can develop infrastructures or systems to emphasize every factor.

### 6.2. Limitations and Future Work

This study also has some limitations that are needed to be further investigated in the future. First, the questionnaire in this study mainly covered young people, i.e., 88.2% of them were under 30 years old, which might introduce cognitive bias and made the results of this study not popular for other user groups, e.g., old people. Although young people mostly adopt mobile Internet and information feed advertising, there are also some old people and many mid-aged people using the mobile Internet. Thus, it is better to conduct questionnaires over users of a wide range of ages. Second, currently, the samples of the questionnaire barely consider people with basic studies, which may make the results only valid for people with a high academic background. However, including people with basic studies in the survey is still a problem because many are not experienced using smartphones and mobile devices. Third, in this study, we did not consider the differences among information feed advertising platforms. It could be better to consider the influence of the platform in future work. Finally, although hundreds of valid questionnaires are theoretically enough to conduct data analysis, such a number is relatively small to draw reliable and robust conclusions in the big data era.

Thus, in the future, some research issues are worth further investigating. First, a further study on secondary data collected from some crowdsourcing platforms like Amazon Mechanical Turk [46] could better analyze user acceptance of information feed advertising. Second, because other factors could impact users' decision-making behavior, future work can be focused on other possible factors, such as users' educational background and ages. Finally, in addition to the SEM and fsQCA model, it is also worth studying other research models within the big data and mobile Internet context [47]. Third, as current information feed advertising mechanisms need to collect user information, reflecting the impact of user privacy in user acceptance of information feed advertising is still an open problem [48]. Finally, with the development of social networks and web 2.0, incredible information, such as poisoned data and fake advertisement, becomes a critical issue in decision-making based on web information [49,50]. Although evaluating data quality and information credibility is mainly related to computer algorithms, it is useful to consider the impact of data quality and advertising credibility in the user acceptance of information feed advertising in the future.

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