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## A Study on the effect of product recommendation system on customer satisfaction: focused on the online shopping mall\*

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### Abstract

**Purpose:** The purpose of this study is to understand the effect of the unique product recommendation system on customer satisfaction. **Research design, data and methodology:** The survey method used the self-recording way in which the respondents selected for the study and distributed 300 questionnaires, and with due personal care, researchers collected all the distributed questionnaires. **Results:** The result implies that the characteristics of the product recommendation system should be more secure and developed. **Conclusions:** The aspects of the product recommendation system were selected as factors of price fairness, accuracy, and quality through previous studies, and the empirical analysis of the effect of the characteristics of the product recommendation system on customer satisfaction was summarized as follows. Among the attributes of the product recommendation system, the attributes of price fairness, accuracy, and quality affect customer satisfaction. Among them, the beta value of quality was the highest, and the effect of quality was the largest among the three factors. Based on the results of the study, the implications for the characteristics of the product recommendation system are summarized as follows. The aspects of the product recommendation system have a positive effect on customer satisfaction, so it is necessary to fill the needs of consumers based on the survey focused on quality

**Keywords :** Product recommendation system, Recommendation system, Online shopping mall, Customer satisfaction

**JEL Classification Code :** L81, M31, P46.

### 1. Introduction

The existing economic activity method means of transaction, the target of the operation, and range of information communication networks have changed according to the spread of information communication networks due to the innovative development of information communication technology to modern people. Due to this development, purchasing various products through various purchasing channels has become daily life for modern people. In line with this, companies that sell products are

encouraging consumers to consume using the product recommendation system in online shopping malls. The product recommendation system is a system that recommends the products that meet the needs of customers by using statistical techniques and knowledge discovery technology and focuses on cross-selling and sales increase. It refers to a technology that recommends products that have previously purchased or products that are in the same category based on search records, or products with similar patterns and conditions. The introduction of the purchase recommendation system makes consumers feel perceived newness (Wilton & Myers, 1986), and they encounter various new product information that they did not expect, and the uncertainty about the product becomes lower due to the cumulative effect of information, and the possibility of purchasing increases. However, it is not yet a satisfactory level, and there is also a lack of empirical research on whether such product recommendation service is made of customer satisfaction. Therefore, this study is to survey buyers who use a product recommendation system, one of the personalized services. The purpose of this study is to identify the effects of a product recommendation system on

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customer satisfaction based on price fairness, quality, and accuracy, which are characteristics of a product recommendation system, and to suggest implications and limitations that can be used more widely through this.

## 2. Theoretical Background

### 2.1. Previous studies on internet shopping malls

When a customer needs help in an Internet shopping mall, when he or she wants to know about a specific product purchase, there is a problem during the purchase process. However, offline, the clerk can help with appropriate customer response, while online, which can not face customers, is a personalized service that can help customers' shopping activities. Personalized service refers to a service that provides customized marketing based on the behavior of a customer when he or she accesses an Internet shopping mall. Personalized services can provide personalized services to customers who are experiencing confusion in the rapidly increasing information and a flood of products by sharing detailed information about customers in situations where they need a lot of effort when they find specific products or information they want. One of the personalized services is to identify the behavior on the payment page of the customer who is accessing the site and connect the customer counseling center or customer Q & A to help the customer solve the problem, thereby preventing the customer from leaving. If a customer wants to look at or test a product for a long time in an offline store, if a clerk comes up and offers a personalized service that recommends products that match customers and encourages them to purchase, they can recommend the product appropriate to customers in similar situations online. If a customer sees various pages of a lipstick category at the shopping mall and searches with related keywords, the probability of participating in the event or purchasing the product can be increased by providing activities or contents related to the lipstick. If you recommend the product to the customer, you can experience the help of the clerk who has experienced offline online. Customer information is needed to provide optimized products and service contents to each customer. By collecting and analyzing existing behavior information of customers, it is necessary to predict the behavior of users in the future and provide a product recommendation system accordingly

### 2.2. Previous studies on the characteristics of the product recommendation system

A personalized recommendation system means providing appropriate content or services based on the preference of

each user. (Lee & Lee, 2007). Previous studies have suggested the influence of recommendation system utilization on the customer decision-making process and recommendation result (Tam & Ho, 2006). Users exposed to recommendation content generated based on individual preference can explore the material with less effort and save more shopping completion time (Tam & Ho, 2006). In other words, if the number of products that should be considered in decision making is reduced by the system that provides recommendations, users' product search efforts are also reduced (Son & Seo, 2006). Despite the decrease in effort and duration of product search, customers have adopted more products from personalized recommendation lists than random recommendation lists, and accordingly, individual-related web content is considered more useful (Tam & Ho, 2006).

#### 2.2.1. Accuracy

According to a study by Liang et al. (2007), user satisfaction with the recommendation system can be increased depending on how accurate recommendation is provided. Therefore, if suggestions suitable for user preference are provided, the user can form a more positive attitude toward the recommendation system. The reason why accuracy is the most crucial characteristic in most recommendation systems is that the recommendation system has focused on how much the prediction ability has improved for users. Therefore, many previous studies have suggested algorithms to improve the prediction ability of the recommendation system. Thus, the accurate recommendation providing expertise provided by the recommendation system can be used as a usefulness evaluation scale for evaluating the recommendation system by the user.

#### 2.2.2. Quality

In the case of Mittal and Lassar (1996), the relationship between personalization and service quality was studied, and it was concluded that personalization is an essential factor in determining service quality in a business where social interaction between a service provider and customer is excluded. In this study, they empirically confirmed that personalization has a positive effect on service quality and that this effect has more influence on the customization of people than the personalization of goods. Therefore, the quality providing ability provided by the recommendation system can be used as a usefulness evaluation scale for evaluating the recommendation system by the user.

#### 2.2.3. Price fairness

Holbrook (1996) said that when recommending a product without consideration of price response, the effect of favoring a product may be small, and if recommending a

product considering the reaction to the price together, it can satisfy various price preferences of the customer. Therefore, the ability to provide price fairness provided by the recommendation system can be used as a usefulness evaluation scale for evaluating the recommendation system by the user.

The purpose of this study is to investigate the effect of quality, price fairness, and accuracy of personalized online service on customer satisfaction.

### 2.3. Preceding research on customer satisfaction

Olive (1997) can be defined as a judgment on whether the fulfillment state is provided at a pleasant level, and that customer satisfaction is different from the process of processing the performance of the product and service, the process of inconsistency formation, or the happiness of a single emotional state. Lee (2007) defines the sum of emotions and emotions that appear after experiencing products or services or overall evaluation. Customer satisfaction can be seen in two perspectives. First, customer satisfaction as a general concept means the difference between the service level expected by customers and the provided service based on the predicted discrepancy paradigm by Zeithaml et al. (1993). The definition of satisfaction is more meaningful in transaction marketing by Gronroos (1994), which uses the evaluation of service function in a short period as an essential indicator of customer satisfaction. On the other hand, Bendapudi and Berry (1997) said that customer satisfaction means a positive evaluation of overall relationship and experience with specific service providers in relationship marketing in a broader sense.

For this customer satisfaction, online shopping malls also value customer satisfaction and quantify it as satisfaction. Satisfaction is a marketing method that calculates how much satisfaction customers are satisfied with the products and services they purchase when they purchase a product, and it is called customer satisfaction or consumer satisfaction. Consumer satisfaction includes not only the quality and performance of the product but also the service and after-sales service of the Internet shopping mall. In a comprehensive sense, how much did the customer meet the expectations from the supply of the product

## 3. Research design

### 3.1. Research hypotheses

The purpose of this study is to empirically analyze the effect of the characteristics of the product recommendation system on customer satisfaction targeting individuals who

have experience using a product recommendation system in internet shopping.

**H1:** The characteristics of the product recommendation system will have a positive effect on customer satisfaction.

**H1-1:** Accuracy among the characteristics of the product recommendation system will have a positive effect on customer satisfaction.

**H1-2:** Price fairness among the characteristics of the product recommendation system will have a positive effect on customer satisfaction.

**H1-3:** Quality of product recommendation system characteristics will have a positive effect on customer satisfaction.

### 3.2. Measurement and Definition of Variables

To measure the characteristics and customer satisfaction of the product recommendation system, which is a research model component suggested in this study, the following operational definitions were made. These product recommendation system characteristics are measured by the Likert 5-point scale, considering the aspects of accuracy, quality, and price fairness based on previous studies.

#### 3.2.1. Accuracy

According to Herlocker (2004), accuracy means how well the predicted customer preference and actual preference fit, and the efficiency of the product recommendation system is divided into services that provide products and information that meet users. Based on previous studies, the accuracy factor items of the product recommendation system were measured with four issues of preference, interest, product classification, and favorite products

#### 3.2.2. Price fairness

PZB (1988) defined service quality as "attitude or evaluation" regarding service excellence through target group interviews (FGI). Lewis and Booms (1983) described the service quality as "the degree of how the Indian service is consistent with the customer's expectation"; that is, the quality of the product recommendation system is defined as the evaluation of the product quality that users can accept and the consistency with customer expectation. The quality factors of the product recommendation system are measured with five items of use period, product quality, quality expectation, useful product, and causticity ratio

#### 3.2.3. Quality

Sergelen-Darhantoya, Park and Lee (2019) classified the price fairness of the product recommendation system as the recognition of users due to the price appropriateness of the

product or service and the additional price benefit. Based on the previous studies, the price fairness factor of the product recommendation system was measured with five items of a reasonable amount, extra profit, service, price, and appropriateness.

### 3.2.4. Customer satisfaction

Oliver (1997) said, "Satisfaction is a response to what consumers achieve, and it is evaluated by how much the quality of product or service or the level of pleasure that can be satisfied by the consumption of the service itself is improved." In other words, customer satisfaction is classified as a result of comparing with customer's expectations after the customer who uses the internet shopping mall consumes the product or service. Based on previous studies, five factors were measured: overall satisfaction, personal satisfaction, continuous use, service satisfaction, and preemption.

### 3.3. Sample design and analysis method

The subjects of this study were limited to adult male and female consumers in their 20s or older who have used Internet shopping malls for the last three months. A total of 300 people were surveyed through online questionnaires for about 17 days from October 15 to 31. The study verified the suitability and research hypothesis of the research model through the tongue survey method, and distributed 300 copies of the distributed copies and used 300 copies for analysis. The questionnaire, which is the survey tool, was prepared by referring to the previous studies.

Besides, SPSS 26.0 program was used to analyze the collected data. The characteristics of the product recommendation system were confirmed through reliability analysis after refining the constructs by using the principal component factor analysis. The reliability analysis of each factor using the Cronbach's alpha coefficient was conducted, and the effect of the product recommendation system characteristics, which is the purpose of this study, on customer satisfaction was investigated.

## 4. Empirical analysis

### 4.1. General characteristics of the sample

<Table 1> shows the results of demographic frequency analysis of the survey respondents. According to the demographic frequency analysis, 55.3% of the total of 166 males and 134 females accounted for 44.7% of the total samples, and males showed a slightly higher level of response than females. Besides, the age of the subjects in their 20s was 30.0% of the total samples, 20.7% of the

whole samples in their 30s, and 62 in their 30s, 19.7% of the total samples in their 40s and 59 in their 50s. The average household income of the surveyees was 5.0% of the full sample of 15 people with less than 2 million won, 10.7% of the total sample of 32 people with less than 2 million won, 21.7% of the full sample of 65 people with less than 3 million won, 23.7% of the total sample of 71 people with less than 4 million won, and 38.7% of the full sample of 116 people with more than 5 million won. The average number of purchasers was 35.0%, 2-3 times a month, and the average number of purchases was 2-3 times a month.

**Table 1:** Demographic frequency analysis data

		Frequency	%	sum (%)
Sex	Male	166	55.3	300 (100%)
	Female	134	44.7	
Age	20-29	114	38.0	300 (100%)
	30*39	62	20.7	
	40-49	59	19.7	
	50-59	43	14.3	
	Over 60	22	7.3	
Average family income (million won)	Under2	15	5.0	300 (100%)
	2 - under 3	33	10.7	
	3 - under 4	65	21.7	
	4 - under 5	71	23.7	
	Over 5	116	38.7	

## 4.2. Reliability and Validity Analysis of Measurement

### 4.2.1. Exploratory Factor Analysis and Reliability Test Results for the Characteristics of Commodity Recommendation System

In this survey, factor analysis was conducted to verify the validity of the measurement tool, and the principal component analysis was used to extract the factors, and the varimax rotation was used to rotate the elements. The number of extraction factors was selected based on Eigen Value 1. The KMO measurements were based on 0.6, which is known to be strict, and the commonality was 0.4, which is universally used, and factor loadings were 0.4. There were no conceptually inconsistent items. As a result of inputting 14 measurement tools for the articles about the characteristics of the product recommendation system, the factors affecting customer satisfaction were numerically indicated. Reliability analysis conducted to identify the reliability of each variable, and the results are as follows. This study shows that the measured, theoretical variables have a Cronbach's alpha coefficient of 0.880 or more, and the Cronbach's alpha coefficient is 0.6 or more, which means that the abnormal measurement items are measured

at a relatively constant level. The results were presented in <Table 2>.

**Table 2:** Reliability and Validity of Product Recommendation System

	Item	Components			Cronbach's $\alpha$
		1	2	3	
Price fairness	PF4	.815	.230	.195	.920
	PF3	.798	.298	.214	
	PF2	.788	.259	.279	
	PF5	.773	.194	.299	
	PF1	.745	.351	.236	
Accuracy	AC2	.225	.841	.268	.909
	AC1	.244	.828	.146	
	AC4	.260	.781	.283	
	AC3	.351	.774	.158	
Quality	Q2	.126	.077	.799	.880
	Q1	.269	.213	.669	
	Q5	.405	.445	.648	
	Q4	.430	.473	.627	
	Q3	.473	.400	.604	
eigen value		8.123	1.269	1.016	
%variance		58.023	67.088	74.342	

**4.2.2. Exploratory Factor Analysis and Reliability Test Results for Customer Satisfaction**

Factor analysis was conducted to verify the validity of the measurement tool, and the principal component analysis was used to extract the factors, and the varimax rotation was used to rotate the elements. The number of extraction factors was selected based on eigen Value 1. The KMO measurements were based on 0.6, which is known to be strict, and the commonity was 0.4, which is universally used, and factor loadings were 0.4. The result of inputting the measurement tool of 5 items of customer satisfaction showed that it had a continuous effect. The reliability and validity test results also showed that the Cronbach's alpha coefficient was .799, which was measured at a constant level as the Cronbach's alpha coefficient was 0.6 or more. The results were presented in <Table 3>.

**Table 3:** Reliability and Validity of Customer Satisfaction

	Item	Components	Cronbach's $\alpha$
		1	
Customer satisfaction	CS1	.920	.799
	CS3	.917	
	CS5	.902	
	CS2	.867	
	CS4	.725	
eigenvalue		3.777	
%variance		75.535	

**4.3. Hypothesis verification**

To verify hypotheses 1-1, 1-2, 1-3, multiple regression analysis was conducted to examine the influence of price fairness, accuracy, and quality, which are differentiating factors of product recommendation system, on customer satisfaction. The results are as shown in <Table 4>.

**Table 4:** Result value of linear regression

Independent variable	Dependent variable	Standard error	B	t-value	Sig.stat	Statistics
Customer satisfaction	subj.norm	.104		-1.468	.143	R <sup>2</sup> = 0.819 F= 445.116 P= 0.000
	Price fairness	.044	.117	2.692	.008	
	Accuracy	.040	.270	6.707	.000	
	Quality	.043	.701	16.370	.000	

As a result of examining the multicollinearity among independent variables, it was found that the tolerance limit was more significant than the general standard of 0.1, and the variance expansion factor (VIF) was smaller than 10, which means that the multicollinearity is not a big problem. The results of <Table 4> show that the regression equation, which is analyzed at 0.819, explains about 81.9% of the total variation. F value was 445.116(p<0.000), which was significant at the significance level. As a result of regression analysis, since the statistical significance level is lower than 0.05, the characteristics of the product recommendation system have a positive effect on customer satisfaction, so hypothesis 1-1, 1-2, 1-3 were all adopted. In the influence of each independent variable, quality, accuracy, and price fairness affect the order.

**5. Conclusions**

This study aims to understand the effect of product recommendation system characteristics on customer satisfaction. The data for empirical analysis was collected from male and female adults in their 20s or older nationwide using a convenience sampling method for 16 days from October 15 to October 31, 2019. The survey method used the self-recording method in which the respondents filled out the questionnaire items directly by using the questionnaire, and 300 copies were distributed and collected without any problems. The characteristics of the product recommendation system were selected as factors of price fairness, accuracy, and quality through previous studies, and the empirical analysis of the effect of the characteristics of the product recommendation system

on customer satisfaction was summarized as follows.

Among the characteristics of the product recommendation system, all the attributes of price fairness, accuracy, and quality affect customer satisfaction. Among them, the beta value of quality was the highest, and the effect of quality was the largest among the three factors. Based on the results of the study, the implications for the characteristics of the product recommendation system are summarized as follows.

The characteristics of the product recommendation system have a positive effect on customer satisfaction, so it is necessary to fill the needs of consumers based on the survey focused on quality. The limitations of this study are as follows.

First, further analysis is needed on the factors that use the product recommendation system proposed in this study. Since the elements based on previous studies were based on the past lifestyle, it is insufficient to reflect all the results of the system suitable for customers using the product recommendation system, and it is necessary to study according to the changes of additional customers because it can not be said that the characteristics that meet the expectations of current customers are sufficiently reflected.

Second, the survey was conducted by a convenience sampling method, so there is a limit to the generalization of data. The survey results showed that 300 responses were obtained, but the number of appropriate interventions for statistical analysis is insufficient. Therefore, in future studies, additional surveys can be conducted to draw new conclusions. Thus, in a prospective study, it is necessary to analyze various and accurate factors that meet the needs of current customers by complementing these limitations. Therefore, it will be a useful research direction if the research on multiple ages is carried out because the customers who use the product recommendation system will be expanded gradually.

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