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A Study of Consumer Repurchase Behaviors of Smartphones Using Artificial Neural Network

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Abstract: This study analyzed consumer intention to repurchase a smartphone, using an analysis of previous research and suggesting this as a research model. To this end, factors influencing "intention to repurchase" the smartphone were derived as social influence, consumer satisfaction, emotional loyalty, and habit. In addition, statistical analysis was conducted to investigate consumer repurchase intentions and the causal relationships. It is also possible to investigate whether consumer habits are linked to repurchases by analyzing their psychological inclinations; therefore, in this study, 390 people who repurchased a smartphone over the past two years were surveyed, and data were collected. This study analyzed the causal relationships among the factors using SPSS 24.0. Moreover, the causal relationship analysis was enhanced using the artificial neural network (ANN) algorithm. With multiple regression analysis and the ANN algorithm, consumer satisfaction (0.71), emotional loyalty (0.108), and social influence (0.062) were determined to affect the intention to repurchase. This means that the ANN algorithm can be used over multiple regression analysis and improve the results of the analysis. In addition, this study also provided practitioners with a way to improve their understanding of consumer behavior intention to repurchase smartphones.

Keywords: consumer behavior; intention to repurchase; multiple regression analysis; artificial neural network; consumer satisfaction; emotional loyalty; social influence

1. Introduction

1.1. The Business Phenomenon

Google Insight and the global market research firm CCS predicted that 1.6 billion smartphones would be sold in 2016, with an increase to two billion sold by 2019. South Korea has the highest smartphone penetration rate at 92%, followed by Japan (64%), Germany (75%), the United States of America (USA) (78%), and the United Kingdom (UK) (77%).

With the penetration rate of smartphones being so high in the Korean market, it is more effective to motivate existing consumers to repurchase rather than to focus on new consumers and markets. According to Table 1 [1], smartphones (especially Samsung) have a very high market share, but consumers prefer to repurchase Apple's iPhone over Samsung's Galaxy.

Companies often pay large amounts of money to increase customer loyalty and lure customers away from their competitors. Verizon, a leading United States (US) telecommunications service provider, launched an unlimited plan as an aggressive marketing strategy to secure customers from competitors [2]. Other providers in the same industry, including T-Mobile, AT&T, and Sprint, offer smartphone installment plans and early termination fees to customers who switch from competitors to their services instead. Beyond that, many smartphone manufacturers offer marketing promotions that greatly reduce the purchase price of smartphones when customers sign up for more than two years of service through alliances with mobile communication service providers. In that way, each company

actively implements marketing strategies in mature markets to protect their customers and attract those of competitors. After all, companies know that retaining existing customers is more profitable than finding new ones. Added to that, companies' repurchase strategies often revolve around event promotion. Although all of those strategies can temporarily increase sales, there is a limit to maintaining sustainability. Therefore, companies conduct research on the capacity of various marketing strategies to prompt repurchases among existing customers. With advanced technology, consumers can easily find the products and services they want; however, from a business standpoint, differentiation is becoming more challenging. It is very difficult to create and provide products or services that are superior to competitors and that cannot be imitated in the actual business market. As a result, many companies must compete fiercely within the same market for consumers. In a saturated market, marketing costs often focus on retaining existing consumers rather than new ones; therefore, many companies recently adopted marketing strategies to secure their brand loyalty. It is very important to maintain consumer loyalty in order to increase profits in such a competitive market situation; research shows that, if the service industry reduces its consumer bounce rate by 5%, profits will increase by 25–85% [3]. In other words, from a marketing standpoint, research indicates that managing relationships with existing consumers is more efficient than attracting new consumers and that consumer loyalty is positively related to corporate profit [4,5].

Table 1. Intention to repurchase by smartphone brand [1].

| | | | Intention to Repurchase by Smartphone Brand | | | | |
| | | **Case** | **Samsung Galaxy** | | **Apple IPhone** | **LG G/V/X** | **Other** | **Answer Refusal** |
			S/A/J	**Note**				
Currently Used Smartphone Brand	Samsung Galaxy S/A/J	423	61%	4%	4%	7%	1%	24%
	Galaxy Note	137	6%	67%	6%	5%	1%	15%
	Apple iPhone	161	9%	3%	77%	4%		8%
	LGG/V/X	153	11%	4%	3%	47%	0%	34%

Smartphones have a faster repurchase cycle than other electronic devices; consumer-friendly smart devices (like smartphones) have a lifecycle of only 2.77 years [6]. Because smartphones are used more frequently and consumed more quickly than other electronic devices, it is very important to analyze the factors affecting repurchase intention of this product with a short repurchase cycle. Thus, this study analyzes factors affecting the repurchase of smartphones by South Korean consumers, using the artificial neural network algorithm.

1.2. Research Questions

The research began with the following questions: "Why do consumers repurchase smartphones?" and "What factors affect consumer behaviors of smartphone repurchase?" Thus, this study examined the repurchase factors that influence consumers when they repurchase a smartphone, through the following questions:

1.　What are the factors that affect smartphone repurchase?
2.　How does consumer recognition of smartphone brand relate to consumer satisfaction and purchasing habits (continuous intention to use)?
3.　What do the quality and ease of use, as perceived by consumers, have to do with consumer satisfaction and purchasing habits?

2. Theoretical Background

2.1. Theory of Reasoned Action (TRA)

One of the most important areas of consumer psychology and behavior research is the relationship between consumer attitudes and behaviors. One theory explaining consumer attitudes and intentions to use a product is the theory of reasoned action (TRA). The TRA suggests that consumers carefully

consider the consequences of various behaviors before acting [7]. In other words, consumer behavior is under voluntary control; thus, consumer behaviors can be predicted via their intentions [7]. In addition, the TRA considers subjective norms, in comparison with other models that explain consumer attitudes. Consumers consider the costs of performing their actions and the benefits that may arise as a result of the action before choosing the action that is the most beneficial/least costly [8,9].
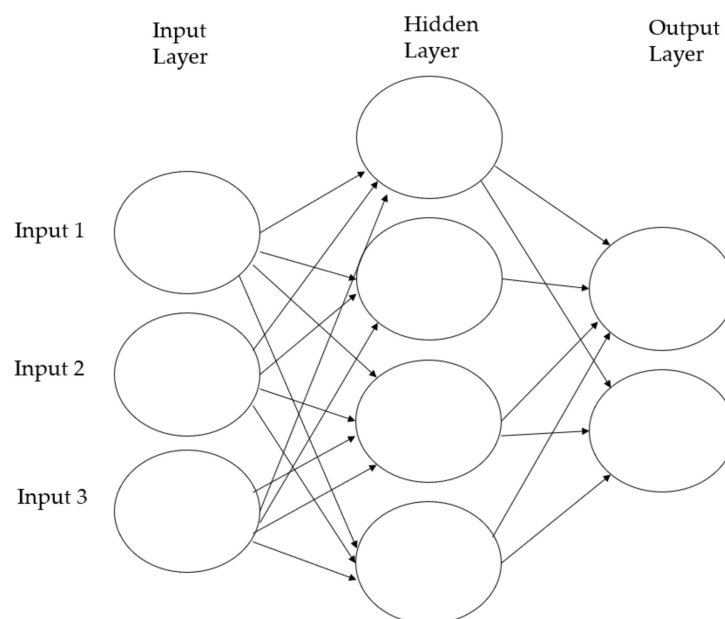
2.2. Heuristics Theory

Heuristic thinking refers to intuitive thinking through experience, rather than analyzing conclusions based on rational thinking [10]; in other words, it involves bias. A heuristic involves satisfaction with "bounded rationality" rather than pursuit of an impossible real rationality [11]. According to heuristics theory, many consumers make decisions based on habits, beliefs, or by following others' decisions, as these approaches are simpler and avoid complications.

This study adopted the heuristics theory as a basis from which to study consumer habit.

2.3. Artificial Neural Network (ANN)

An artificial neural network (ANN) can be defined as an array of highly connected basic processors called neurons. As shown in Figure 1, the multilayer perceptron (MLP) has the same hierarchical structure as a neural network, with at least one intermediate layer between the input layer and the output layer. The MLP has a structure similar to a single-layer perceptron, but it improves the network ability by nonlinearizing the input and output characteristics of the intermediate layer and of each unit, thus overcoming the various disadvantages of the single-layer perceptron. In other words, as the number of layers increases, the properties of the MLP are more enhanced [12].

Figure 1. Multilayer perceptron structure.

X_1, X_2, and X_3 have weights W_1, W_2, and W_3 associated with these inputs. The output Y of the neuron is calculated as shown in Figure 2. The function f is nonlinear and is called the activation function. The purpose of the activation function is to introduce nonlinearity into the output of a neuron, which is important because most real-world data are nonlinear [12].
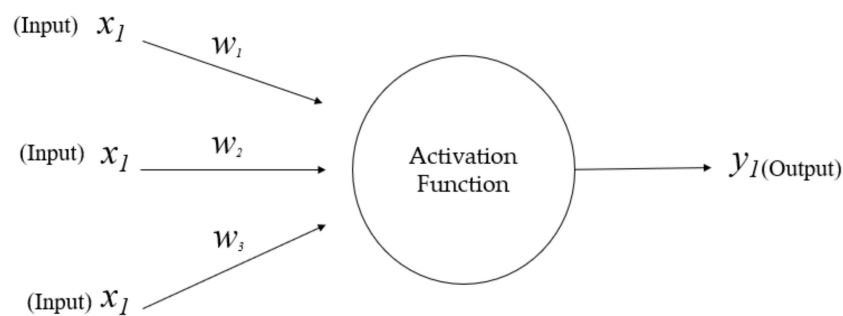
Figure 2. Single neuron.

In mathematical terms, the neuron *k* depicted in Figure 3 can be described by the following equations:

$$u_k = \sum_{j=1}^{m} w_{kj} x_j, \tag{1}$$

$$y_k = \varphi \left(u_k + b_k \right), \tag{2}$$

where φ () is the activation function, u_k is the linear combiner output for the input signals, b_k is the bias, and y_k is the output signal of the neuron [12].
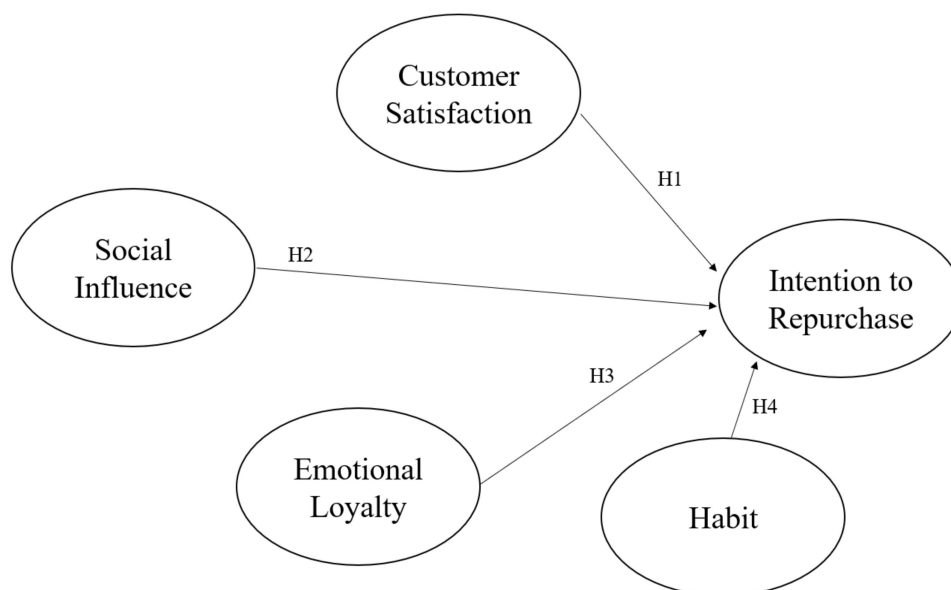

Figure 3. Research model.

3. Literature Review

3.1. Intention to Repurchase

Researchers give a great deal of attention to consumer intentions to repurchase. Henkel et al. (2006) concluded that satisfied consumers have increased service usage levels and increased intentions of future usage [13]; moreover, while examining the importance of satisfaction, Cronin, Brady, and Hult (2000) discovered that consumer satisfaction and repurchase intentions can be increased by offering added value and quality services [14]. Repurchasing and the factors that influence it were investigated by many scholars [15–20]. Repurchasing behavior is defined as a consumer's actual behavior of purchasing the same product or service on more than one occasion. The majority of consumer purchases are repeat purchases [21]. Consumers often repeatedly buy similar products from similar

sellers, and most purchases represent a series of events rather than a single isolated event. Retention is another common term for repurchase [22–24], which is considered to be one of the most important variables in relationship marketing [25]. Repurchase is the actual behavior of the consumer; however, intention to repurchase is defined as the consumer's decision to participate in future activities [26].

3.2. Factors Assumed to Affect the Intention to Repurchase

It can be inferred that keeping existing consumers is more important than attracting new consumers in a competitive environment such as the smartphone market. Most marketing research focuses on consumer satisfaction and consumer intention to use products and services, with the assumption that consumer satisfaction indicates repurchase. However, it is essential to study a variety of consumer behaviors in order to more comprehensively understand consumer repurchase behaviors; therefore, it is necessary to examine factors that deviate from consumer satisfaction-centered repurchasing research. Thus, this study analyzes other factors affecting intention to repurchase.

3.3. Consumer Satisfaction

Oliver (1997) found that consumer satisfaction differs from the joy experienced when purchasing products or services [27], and their expectations were anticipated to be better than their experiences. In addition, the study found that consumer satisfaction is reflected in the evaluation of one's emotions about a product or service. Rust, Zahorik, and Keiningham (1995) showed that consumer satisfaction (a consumer's willingness to revisit or recommend) has a strong impact on loyalty [28]. They also found that consumer satisfaction is influenced by various aspects (product, service quality, store attributes, and corporate marketing activities). Wen et al. (2011) suggested that satisfaction positively affects online repurchase intention [29].

3.4. Social Influence

Social influence is regarded as a critical element in decision-making by people in sociology and in behavioral science. In this study, social influence refers to the extent to which people's social networks influence their behaviors [30]—i.e., the ways in which a person's beliefs, attitudes, thoughts, and actions change as a result of their social interactions [31]. This definition is rooted in social influence theory.

The TRA [7,9] suggests that a person's behavioral intentions depend on their attitude toward the behavior, along with other subjective norms. A subjective norm is the influence had by the people in one's social environment on one's behavioral intentions (i.e., the perception of whether people who are important to them think that they should perform the behavior in question). The concept of subjective norms greatly influenced the formation of the measures of social influence in these two models, as well as many other studies. Venkatesh and Davis (2000) believed that, in voluntary settings, social influences are more likely to operate indirectly through utilitarian outcomes [32].

Currently, word of mouth—a form of social influence—as a marketing communication strategy is famous and globally characterized as a cost-effective and persuasive promotional tool [33].

3.5. Emotional Loyalty

Law, Hui, and Zhao (2004) [18] used Oliver's definition of loyalty as "a deeply held commitment to rebuy or repatronize a preferred product/service consistently in the future, thereby causing repetitive same-brand or same-brand-set purchasing, despite situational influences and marketing efforts having the potential to cause switching behavior". In other words, they viewed loyalty as a consumer attitude rather than a consumer behavior. Behavioral loyalty is solely viewed as a repurchase of the product or service. Dixon et al. (2005) found that loyal consumers are expected to consistently repurchase despite competitive efforts [34]. Emotional loyalty is the ultimate type of loyalty, in which consumers choose a particular brand because they have a personal connection with the brand, regardless of price, convenience, or other external factors. Attractive looks, novel materials, and atypical design technology bring positive emotions to consumers, thereby providing emotional value to them.

Arruda-Filho et al. (2010) recruited iPhone users for interviews and conducted a netnographic analysis that showed consumers may experience social value due to the possession and use of smartphones [35]. They found that consumers may think of iPhone ownership as a symbol of luxury and high social status [35]. In addition, sharing the experience of using smartphones also helps consumer interpersonal relationships. When consumers perceive higher social value from a product/brand, they show greater brand loyalty behaviors, such as disseminating positive information and paying premium prices [36]. Pihlström and Brush (2008) revealed that, when consumers perceive greater emotional value in a product/brand, they show more brand loyalty—as measured by repurchase intentions, willingness to pay, and positive word of mouth [37].

3.6. Habit

Because repetition is a central feature of everyday life, habit research is important for understanding consumer behaviors. Approximately 45% of people's behaviors are repeated almost daily, usually in the same context [38]. Chiu et al. (2012) and Limayem and Cheung (2007) found that consumers tend to purchase products habitually [39,40].

Studies by Anderson and Sullivan (1993) and Jones and Sasser (1995) emphasized the need for extensive research on repurchase intentions [5,41]. In particular, research on consumer psychology actively seeks to secure long-term competitive advantages through favorable relationships between companies and consumers. In a number of previous studies, researchers suggested that, when consumer satisfaction (consumer empirical performance) increases with superior quality of products and services, consumers are more willing to return for purchase. Therefore, companies can expect to increase their sales and establish a sound consumer base by getting consumers to repurchase. Despite the importance of the intention to repurchase, most research focuses on consumer satisfaction, only one factor of that intent.

4. Research Hypotheses and Research Model

4.1. Research Hypotheses

Early studies of consumer behavior explored the relationship between repurchase and satisfaction; however, this relationship is not straightforward. Fornell (1992) studied positive correlations between consumer satisfaction and consumer retention [42]. Wen et al. (2011) found that satisfaction had a positive effect on online intention to repurchase [29]. Tsai, Huang, Jaw, and Chen (2006) discovered that satisfied consumers were more likely to continue their relationship with a particular organization than dissatisfied consumers [43]. This view is supported by many researchers [19,22,41,44–50]. However, Mittal and Kamakura (2001) found that the satisfaction–repurchase relationship could be disrupted due to three main reasons [19]. Additionally, Olson (2002) revealed that, despite the general view that satisfaction is associated with repurchase, few empirical studies associated satisfaction with actual repurchase behavior [51].

Kamakura (2001) pointed out that establishing a direct link between satisfaction assessment and repurchase behavior is not easy for many organizations [19]. In addition, the satisfaction–repurchase relationship can be influenced by various characteristics of the consumers. Despite equal ratings given on satisfaction, repurchase behavior differed significantly, which was attributed to differences in consumer age, education, marital status, sex, and residential area [19]. Many factors complicate satisfaction–repurchase relationships. The problem is that researchers do not consistently define the relationship across studies, which can be operationalized as behavior, attitude, or complex [52].

Consumer satisfaction can occur during different stages of the shopping process (before, during, and after), during the purchase of different types of goods (convenience, shopping, and specialty) [53], and in a traditional or online setting. In addition, different types of consumers exist [54], and they all have varying levels of knowledge about the product [55], which affects their level of satisfaction.

Understanding the importance of a comprehensive review, the study attempts to summarize previously reported findings in order to explain the complex relationship between satisfaction and repurchase. Knowledge of consumer satisfaction and their repurchase behavior will improve companies' ability to develop more effective marketing strategies in the future [56]. Previous studies demonstrated that overall consumer satisfaction with services is strongly related to behavioral intent to reuse the same service provider [57]. Therefore, in this study, the following research hypothesis is established:

Hypothesis 1 (H1). *Consumer Satisfaction Positively Impacts Intention to Repurchase.*

This work also studies the importance of social influence on repurchase intentions [58]. Social influence refers to actions, feelings, thoughts, attitudes, or behaviors related to individual change through interaction with other individuals or groups. In social psychology, it is often associated with the impact of social norms on changes in personal behavior and attitudes [59]. Purchase decisions are related to the need to be respected, and social value is derived by acquiring desirable social status [60]. Some observations were made that consumers do not shop alone. Peers, families, and other groups strongly influence individual purchasing decisions. These reference groups do word-of-mouth marketing and can play an active role in influencing the opinions of others. That influence is sometimes negative or positive in terms of the interests of certain organizations [61].

Hypothesis 2 (H2). *Social Influence Positively Impacts Intention to Repurchase.*

Emotional loyalty is behaviorally expressed by retention [59]. Furthermore, customer loyalty is well recognized as a significant driver of repurchase intention in the online marketing literature [62].

This emotional and affective connection influences consumer behavior (retention, brand repurchase, positive word of mouth) [63]. Brand loyalty is expressed as a tendency to continuously purchase the same brand [64].

Repurchase intentions are mostly tied with brand commitment, but there is an important difference between them. Brand commitment refers to the connection a consumer establishes with a brand, whereas repeat purchase is the purchase of a brand because it is relatively cheaper [65].

Loyal customers are the faithful consumers of a brand who perform repeat purchases and recommend the brand to those around. Firms want their customers to be attached to their brands by strong feelings. Customer satisfaction must be fulfilled for this kind of loyalty. When customers are satisfied, they show commitment to continually buy the same brand and become loyal [66].

Consumers who are committed to the brand become loyal consumers and show consistent repurchase behavior [67]. Therefore, loyalty may affect consumer repurchase behaviors [68]. Repurchase intentions are usually identified through brand commitment, but there are significant differences between the two concepts. Brand commitment means a similar relationship to the attachment that consumers develop for the brand. Therefore, in this study, the following research hypothesis is established based on previous studies:

Hypothesis 3 (H3). *Emotional Loyalty Positively Impacts Intention to Repurchase.*

Research on habits is important for consumer behavior because repetition is a central feature of daily life. About 45% of people's behavior is repeated almost daily and usually in the same context [69,70].

Prior research comparing TRA and related theories with habit as an antecedent of behavioral intentions showed that habit directly affects behavioral intentions [71–73]. Gefen (2000) noted that habitual previous preference to use an online shopping website directly and strongly increased user intentions to continue using the same online shopping website again [74]. Support for the role of habit in repeat purchase intention was provided by Gefen (2000) and Rauyruen and Miller (2009) [74,75].

Habitual behavior exhibits that repurchase is motivated by habit or routines that are facilitated in the decision-making process [76].

Khare and Inman (2006) realized that consumers either purchase the same brand repeatedly or only try new product types within the same brand, depending on the situation [77]. Research also found various types of habitual purchase patterns, such as purchasing various trademarks habitually according to one's values [77]. Consumers tend to buy the same brands of products across different shopping experiences (e.g., Seetharaman, 2004) [78], purchase the same amounts at a given retail store across repeat visits [79], and eat similar types of foods at a meal each day (e.g., Khare & Inman, 2006) [77]. Thus, repetition—and, more specifically, habits—may characterize a significant segment of consumer behavior that can be linked to important marketing outcomes [38].

Anshari et al. (2016) examined the effect of habit on smartphone usage [80]. They found that there is a strong relationship between habit and smartphone usage. As there is a positive effect of habit on consumption behavior and smartphone usage, we think that there may also be a similar one between brand loyalty and re-purchase intention. Therefore, in this study, the following research hypothesis is established based on previous studies:

Hypothesis 4 (H4). *Consumer Habit Positively Impacts Intention to Repurchase.*

4.2. Research Model

Previous research analyses suggested the research model and its components shown in Figure 3. To examine the experiences of consumers using the same brand of smartphone, the research model was developed based on five factors (consumer satisfaction, social influence, emotional loyalty, habit, and intention to repurchase). Relying on the research model, the analysis examined the effects of social influence, consumer satisfaction, emotional loyalty, and habits on the intention to repurchase smartphones.

5. Methodology for Data Collection, Data Analysis, and Measurement

5.1. Data Collection and Sample Size

To analyze the research model, this study collected data on intention to repurchase through surveys for consumers living in South Korea. According to the Pew Research Center (2018), a global market research organization, the country with the highest smartphone penetration rate is South Korea, with 94% of the population using smartphones [81]. Therefore, South Korea is a good market in which to analyze the characteristics of consumers who repurchase smartphones.

Although questionnaires were distributed to 1200 customers, only 390 responses were received and analyzed in order to test the hypotheses, as now mentioned in Section 5.1. Three hundred ninety consumers ($n = 390$) who repurchased smartphones within two years were included in this investigation. The study tested the research hypotheses and attempted to answer the research questions by developing a questionnaire as its research instrument. The items of each construct were adopted from previous literature. All of the items were measured on a five-point Likert scale, where 1 = strongly disagree and 5 = strongly agree. This study calculated the appropriate sample size for the analysis within the level statistical significance; in consideration of the current total population of South Korea, the smartphone penetration rate, the confidence level (95%), and the margin of error (5%), the appropriate sample size could be calculated as 385 people. Therefore, the sample ($n = 390$) in this study is an appropriate size for data analysis.

5.2. Measurement

This study analyzed the behavior of consumers; for this, the research used verified measurement items found in an analysis of previous research. And the results were summarized in Table 2.

Table 2. Measurement items.

Construct	Measurement Items	Related Studies
Social Influence	• Search for information about various mobile phone brands and models from the Professional Association or an independent group of experts • Collect mobile phone information from friends, neighbors, relatives, or coworkers (e.g., how the performance of brand A cell phone is compared to brand B) • My choice of cell phone is influenced by other consumers' word of mouth or some evaluation reports from an independent testing agency (e.g., online cell phone reviews) • My friends' assessments and preferences affect my choices • My family members' preferences affect my cell phone choices • My decision to buy a cell phone is influenced by my classmates' and colleagues' preferences, to meet their expectations • Using a cell phone of a particular brand or model helps show others who I am or who I want to be (successful businessman, female expert, etc.)	[82,83]
Consumer Satisfaction	• Satisfaction with the current smartphone • The current smartphone meets all reasonable requirements • High satisfaction with the quality of my smartphone • Smartphone meets my expectations • The function and design of my smartphone is appropriate for requirements • The function and the design of my smartphone fit my needs/wants • Feeling better with smartphone use • My decision to use my smartphone was a wise one	[84–86]
Emotional Loyalty	• Brand love has a positive impact on willingness to pay a price premium • Love this brand • Passionate about this brand • Very attached to this brand • Willing to pay a premium price to buy this brand of smartphone	[87]
Habit	• Tend to like routine • Rely on what is tried and tested rather than explore something new • I prefer to work happily in my comfort zone rather than challenging myself • Tend to do things in the same order every morning (e.g., get up, go to the bathroom, have a coffee, etc.) • Always sit in the same seat in places such as on the bus, in the cinema, or in church • Sometimes there is a temptation to go to special events, but I generally buy a reliable home brand • If I could, I would probably always pick the same outfit to wear every day • I always like to park my car or bike in the same place • I tend to stick with the familiar version of the software package as long as possible • Always tend to visit the same websites when browsing the internet • In a restaurant, I tend to order dishes that I am familiar with	[88]
Intention to Repurchase	• I intend to continue purchasing the same smartphone in the future • I will continue with the same smartphone in the future • I will regularly use the same smartphone in the future	[84–86]

In this study, 33 items were developed for the questionnaire to address the characteristics of the consumers. The final questionnaire had 17 questions, developed through a pilot test of 78 consumers.

5.3. Analysis

The descriptive statistics of the survey were analyzed using SPSS 24.0 to determine the means and standard deviations of the responses. A factor analysis and a reliability analysis (Cronbach's α test) were conducted to analyze the validity and the reliability of the research variables. To analyze the causal relationship between the variables, the regression analysis model was enhanced by artificial neural network algorithms.

6. Data Analysis

6.1. Descriptive Statistics

In this study, the results of the descriptive statistics of the survey are presented in Table 3.

Table 4 presents the results that explain the characteristics of the respondents who participated in the survey. Male (49.5%) and female (50.5%) respondents participated in this survey in an equal ratio,

and consumers who repurchased smartphones 2–5 times in the last two years accounted for more than 80% of all respondents.

Table 3. Descriptive statistics.

	n	Minimum	Maximum	Mean		Standard Deviation	Variance
				Statistic	Standard Error		
Q4	390	1	5	3.22	0.056	1.039	1.079
Q5	390	1	5	3.10	0.060	1.114	1.240
Q6	390	1	5	3.09	0.060	1.110	1.233
Q8	390	1	5	3.82	0.042	0.786	0.617
Q9	390	1	5	3.55	0.045	0.842	0.710
Q10	390	1	5	3.68	0.043	0.808	0.652
Q11	390	1	5	3.64	0.042	0.783	0.613
Q13	390	1	5	3.66	0.042	0.790	0.624
Q14	390	1	5	3.56	0.042	0.792	0.627
Q15	390	1	5	3.65	0.042	0.783	0.614
Q18	390	1	5	3.15	0.048	0.893	0.798
Q19	390	1	5	2.65	0.050	0.934	0.873
Q20	390	1	5	2.57	0.052	0.965	0.931
Q25	390	1	5	3.03	0.054	1.001	1.002
Q28	390	1	5	2.98	0.054	1.003	1.005
Q29	390	1	5	3.18	0.052	0.972	0.944
Q33	390	1	5	3.35	0.043	0.799	0.638

Table 4. Analysis of survey respondents.

Gender				
	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Man	193	49.5	49.5	49.5
Woman	197	50.5	50.5	100.0
Total	390	100.0	100.0	
Age				
	Frequency	Percentage	Valid Percentage	Cumulative Percentage
20 s	112	28.7	28.7	28.7
30 s	177	45.4	45.4	74.1
40 s	52	13.3	13.3	87.4
50 s	49	12.6	12.6	100.0
Total	390	100.0	100.0	
Number of Smartphone Repurchases				
Number of smartphone repurchases	Frequency	Percentage	Valid Percentage	Cumulative Percentage
2	29	7.5	7.5	7.5
3	91	23.3	23.3	30.7
4	90	23.0	23.0	53.7
5	105	27.0	27.0	80.7
6	33	8.3	8.3	89.1
7	9	2.3	2.3	91.4
8	6	1.4	1.4	92.8
9	1	0.3	0.3	93.1
10	20	5.2	5.2	98.3
12	1	0.3	0.3	98.6
15	3	0.9	0.9	99.4
16	1	0.3	0.3	99.7
17	1	0.3	0.3	100.0
Total	390	100.0	100.0	

6.2. Factor Analysis

In this study, factor analysis was based on the collected data. For factor analysis, maximum likelihood was used as the factor extraction method, and oblimin with Kaiser normalization was used as a factor rotation method [89,90]. In addition, factor analysis indicated that 17 observed variables could be clustered into five latent variables. The results of the factor analysis in this study were validated through the Kaiser–Meyer–Olkin (KMO) test and Bartlett's test. The result of the KMO test was 0.889, which suggests that the factor analysis was appropriate (Table 5).

Based on consumer data, the results of factor analysis included survey results grouped into five factors, and the reliability of the elements that form each factor was determined to be excellent. The results appear in Table 6.

Table 5. Kaiser–Meyer–Olkin (KMO) and Bartlett's tests.

Kaiser–Meyer–Olkin Measure of Sampling Adequacy		0.889
Bartlett's Test of Sphericity	Approximate chi-square	5406.133
	df	528
	Sig.	0.000

Table 6. Factor analysis.

		Factor					Cronbach's Alpha
		1	**2**	**3**	**4**	**6**	
Customer Satisfaction	Q11	0.905					0.896
	Q10	0.883					
	Q9	0.831					
	Q8	0.689					
Social Influence	Q6		0.871				0.784
	Q5		0.716				
	Q4		0.618				
Habit	Q29			0.709			0.708
	Q28			0.661			
	Q25			0.612			
Emotional Loyalty	Q20				0.817		0.8
	Q19				0.745		
	Q18				0.670		
Intention to Repurchase	Q14					0.808	0.848
	Q15					0.773	
	Q13					0.715	
	Q33					0.604	

6.3. Correlation Analysis

This study analyzed the directionality of the factors through correlation analysis between the derived factors, as shown in Table 7.

Table 7. Correlation analysis.

		Social Influence	Emotional Loyalty	Intention to Repurchase	Customer Satisfaction
Social Influence	Pearson correlation	1	0.327 **	0.196 **	0.182 **
	Sig. (2-tailed)		0.000	0.002	0.001
	n	390	390	390	390
Emotional Loyalty	Pearson correlation	0.327 **	1	0.515 **	0.397 **
	Sig. (2-tailed)	0.000		0.000	0.000
	n	390	390	390	390
Intention to Repurchase	Pearson correlation	0.169 **	0.467 **	1	0.728 **
	Sig. (2-tailed)	0.002	0.000		0.000
	n	390	390	390	390
Customer Satisfaction	Pearson correlation	0.182 **	0.397 **	0.728 **	1
	Sig. (2-tailed)	0.001	0.000	0.000	
	n	390	390	390	390

** p-value < 0.01, *n* respondents number.

6.4. Regression Analysis

Regression analysis was performed to analyze the linear causality between several independent and dependent variables in this study. The results are shown in Tables 8–10. The analysis was based on the stepwise method and was analyzed using SPSS 24.0.

Table 8. Regression analysis.

Model	Variables Entered	Variables Removed	Method
1	Customer satisfaction		Stepwise (criteria: probability of F to enter ≤ 0.050, probability of F to
2	Emotional loyalty		remove ≥ 0.100).

Dependent variable: intention to repurchase.

Table 9. Model summary.

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate	Change Statistics					Durbin–Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	0.728 [a]	0.530	0.529	0.47442	0.530	390.500	1	346	0.000	
2	0.753 [b]	0.568	0.565	0.45575	0.038	29.934	1	345	0.000	1.869

[a] Predictors: (constant), customer satisfaction; [b] predictors: (constant), customer satisfaction, emotional loyalty.

Table 10. Coefficients [a].

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Standard Error	Beta		
1	(Constant)	0.996	0.135		7.360	0.000
	Customer satisfaction	0.716	0.036	0.728	19.761	0.000
2	(Constant)	0.780	0.136		5.743	0.000
	Customer satisfaction	0.634	0.038	0.645	16.715	0.000
	Emotional loyalty	0.185	0.034	0.211	5.471	0.000

[a] Dependent variable: intention to repurchase.

According to the results in Table 9, the second research model was analyzed to be highly complete, and the regression analysis results of this model are presented in Table 9.

Table 10 shows the results of analyzing the coefficients of the regression analysis model variables.

6.5. Analysis of Research Model Using ANN (Relative 7:3, Number of Hidden Layers (One))

This study enhanced the analysis of the research model by using the ANN algorithm. To this end, with one hidden layer, two cases were analyzed separately. Tables 11–15 are the results of analyzing the research model assuming one hidden layer. With the ANN algorithm, this study advanced the analysis of the research model.

Table 11. Case processing summary.

		n	**Percentage**
Sample	Training	283	72.75%
	Testing	106	27.25%
Valid		389	100.0%
Excluded		1	
Total		390	

Table 12. Network information. MLP—multilayer perceptron.

Input Layer	Factors	1	Customer satisfaction
		2	Habit
		3	Social influence
		4	Emotional loyalty
	Number of units		51
Hidden Layer(s)	Number of hidden layers		1
	Number of units in hidden layer 1a		8
	Activation function		Sigmoid
Output Layer(s)	Dependent variables	1	Predicted value for MLP predicted value
	Number of units		6
	Activation function		Softmax
	Error function		Cross-entropy

Table 13. Model summary [a].

Training	Cross-entropy error	13.233
	Percentage incorrect predictions	0.0%
	Stopping rule used	1 consecutive step(s) with no decrease in error [a]
Testing	Cross-entropy error	50.596
	Percentage incorrect predictions	7.4%

Dependent variable: predicted value for intention to repurchase; [a] error computations are based on the testing sample.

Table 14. Regression analysis.

Model	Variables Entered	Variables Removed	Method
1	Customer satisfaction		Stepwise (criteria: probability of F to enter ≤ 0.050, probability of F to remove ≥ 0.100).
2	Emotional loyalty		
3	Social influence		

Dependent variable: predicted value for intention to repurchase.

Table 15. Model summary.

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate	Change Statistics					Durbin–Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	0.814 [a]	0.663	0.663	0.34972	0.663	1429.476	1	726	0.000	
2	0.831 [b]	0.690	0.690	0.33463	0.028	65.913	1	725	0.000	
3	0.835 [c]	0.696	0.696	0.33155	0.006	14.557	1	724	0.000	1.869

[a] Predictors: (constant), customer satisfaction; [b] predictors: (constant), customer satisfaction, emotional loyalty; [c] predictors: (constant), customer satisfaction, emotional loyalty, social influence.

Table 16. Coefficients [a].

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Variance Inflation Factors (VIF)
		B	Standard Error	Beta			
1	(Constant)	1.128	0.070		16.190	0.000	
	Customer satisfaction	0.698	0.018	0.814	37.808	0.000	1.000
2	(Constant)	0.892	0.073		12.260	0.000	
	Customer satisfaction	0.636	0.019	0.742	32.982	0.000	1.188
	Emotional loyalty	0.145	0.018	0.183	8.119	0.000	1.188
3	(Constant)	0.805	0.076		10.646	0.000	
	Customer satisfaction	0.621	0.020	0.724	31.832	0.000	1.238
	Emotional loyalty	0.125	0.018	0.158	6.785	0.000	1.290
	Social influence	0.063	0.017	0.086	3.815	0.000	1.211

[a] Dependent variable: predicted value for intention to repurchase.

Table 12 presents material that explains the method of analyzing research models with ANN. In the study presented here, a research model consisting of four independent variables and one dependent variable was subjected to multiple regression analysis. In addition, the sigmoid function, which combines the node and weight of the hidden layer when transmitted from raw data to the hidden layer, was used as an active function in ANN. Beyond that, the softmax function was selected as an activation function for calculating the results from the hidden layer to the output layer.

In this research, when the number of hidden layers was set as one under the ANN algorithm, the third research model was found to be the most complete model.

Model 3 (Table 16) determined that consumer satisfaction (0.621), emotional loyalty (0.125), and social influence (0.063) influenced intention to repurchase, unlike the other models. In addition, it determined that consumer satisfaction had the greatest influence on intention to repurchase.

6.6. Analysis of Research Model Using ANN (Relative 7:3, Number of Hidden Layers (Two))

Tables 17–22 are the results of analyzing the research model by assuming two hidden layers in the ANN algorithm.

Table 17. Case processing summary.

		n	**Percentage**
Sample	Training	283	72.75%
	Testing	106	27.25%
Valid		369	389
Excluded		1	1
Total		370	390

Table 18. Network information.

Input Layer	Factors	1	Customer satisfaction
		2	Habit
		3	Social influence
		4	Emotional loyalty
	Number of units		48
Hidden Layer(s)	Number of hidden layers		2
	Number of units in hidden layer 1 [a]		9
	Number of units in hidden layer 2 [a]		7
	Activation function		Sigmoid
Output Layer(s)	Dependent variables	1	Predicted value for MLP predicted value
	Number of units		5
	Activation function		Softmax
	Error function		Cross-entropy

[a] Excluding the bias unit.

Table 19. Model summary.

Training	Cross-entropy error	13.272
	Percentage incorrect predictions	0.0%
	Stopping rule used	1 consecutive step(s) with no decrease in error [a]
Testing	Cross-entropy error	30.578
	Percentage incorrect predictions	6.8%

Dependent variable: predicted value for intention to repurchase; [a] error computations are based on the testing sample.

Table 20. Regression analysis.

Model	Variables Entered	Variables Removed	Method
1	Customer satisfaction		Stepwise (criteria: probability of F to enter ≤ 0.050, probability of F to remove ≥ 0.100).
2	Emotional loyalty		
3	Social influence		

Dependent variable: predicted value for intention to repurchase.

Table 21. Model summary.

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate	Change Statistics					Durbin–Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	0.843 [a]	0.710	0.710	0.32800	0.710	1754.999	1	726	0.000	
2	0.855 [b]	0.731	0.731	0.31626	0.021	55.218	1	725	0.000	
3	0.859 [c]	0.737	0.737	0.31310	0.006	15.515	1	724	0.000	1.869

[a] Predictors: (constant), customer satisfaction; [b] predictors: (constant), customer satisfaction, emotional loyalty; [c] predictors: (constant), satisfaction, emotional loyalty, social influence.

Table 22. Coefficients [a].

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Standard Error	Beta		
1	(Constant)	0.836	0.071		11.801	0.000
	Customer satisfaction	0.783	0.019	0.843	41.893	0.000
2	(Constant)	0.646	0.073		8.868	0.000
	Customer satisfaction	0.724	0.020	0.779	36.741	0.000
	Emotional loyalty	0.128	0.017	0.158	7.431	0.000
3	(Constant)	0.558	0.076		7.380	0.000
	Customer satisfaction	0.710	0.020	0.764	35.834	0.000
	Emotional loyalty	0.108	0.018	0.133	6.070	0.000
	Social influence	0.062	0.016	0.083	3.939	0.000

[a] Dependent variable: predicted value for intention to repurchase.

The analysis results of Table 21 show that the third research model was the most complete when the number of hidden layers was set to two under the ANN algorithm.

Model 3 (Table 22) determined that consumer satisfaction (0.710), emotional loyalty (0.108), and social influence (0.062) influenced repurchase intention, unlike the other models. In addition, it determined that consumer satisfaction had the greatest influence on repurchase intention.

7. Research Results

This study found that consumer satisfaction positively affects intention to repurchase. In addition, it was determined that emotional loyalty affects intention to repurchase. According to the multiple regression analysis, only customer satisfaction and emotional loyalty affect intention to repurchase. In the original analysis, social influence did not affect intention to repurchase. This is due to the limit of this study, in that it did not consider the relationship between each independent variable. Therefore, the stepwise analysis of variables was limited. To address these limitations, this study more clearly analyzed the causal relationship between variables using the ANN algorithm.

This paper analyzed the validity and validity of the research hypotheses through statistical analysis. The results of the analysis are summarized in Table 23. In this study, the research model in Figure 3 was analyzed by using regression analysis and the ANN algorithm, as summarized in Table 24. The results of this approach showed that the analysis model (root-mean-square error (RMSE) (0.313)) was most complete with two hidden layers in the ANN algorithm—that is, the third model in Table 24 was the research model with the highest completeness. In other words, the research hypotheses (H1, H2, and H3) were accepted in this study when analyzed using the ANN algorithm. In this model, the coefficients of consumer satisfaction, emotional loyalty, and social influence were improved compared to the first and second research models. This paper analyzed the validity and validity of the research hypotheses through statistical analysis. The results of the analysis are summarized in Table 23.

Table 23. Analysis and comparison of research models.

Research Hypothesis	Research Model No. (1)	Research Model No. (2)	Research Model No. (3)
Consumer satisfaction positively impacts intention to repurchase (H1)	Accept	Accept	Accept
Social influence positively impacts intention to repurchase (H2)	Reject	Accept	Accept
Emotional loyalty positively impacts intention to repurchase (H3)	Accept	Accept	Accept
Consumer habit positively impacts intention to repurchase (H4)	Reject	Reject	Reject

Table 24. Analysis and comparison of research models. RMSE—root-mean-square error.

Research Model No.	1	2	3
Analysis method	Regression analysis	Regression analysis (number of hidden layers (one))	Regression analysis (number of hidden layers (two))
	R Square (0.568)	*R* Square (0.696)	*R* Square (0.736)
	RMSE (0.456)	RMSE (0.332)	RMSE (0.313)
(Constant)	0.780	0.805	0.558
Satisfaction	0.634	0.621	0.710
Emotional loyalty	0.185	0.125	0.108
Social influence	-	0.063	0.062

8. Research Implication

8.1. Theoretical Implication

This study introduced the TRA (Theory of Reasoned Action) and Heuristic theory, which are effective theories to explain consumer behavior. The results of this study seem to be very simple; however, this approach studied consumer behavior from a different perspective than other studies. The result of this study was a deviation from the rational aspect of consumer behavior research on the

premise of reason to the irrational aspect based on emotion, highlighting the necessity of expanding consumer behavior research. In other words, this is a novel exploration not found in previous studies and is a meaningful research result that can expand the scope of research with differentiation from existing studies. However, it was not found that the heuristic variable, a variable of irrational concept, plays an important role among the variables of TRA. On the other hand, social influence was found to affect consumer purchasing behavior. The concept of TRA is based on rational reason, but the results of this study explain that the TRA should be expanded. In other words, when social influence was added to the existing TRA variables, it was found that a more explanatory research model was completed through the ANN algorithm. This is the result of the study that suggested the possibility of overcoming the theoretical limitations of the TRA's lack of explanation ability by measuring social influence variables as important variables among the TRA's variables. In other words, this is an analysis result that can infer the necessity of expanding the premise of rational reason as an additional test result that effectively explains consumer choice behavior.

8.2. Managerial Implication

So far, companies only introduce a fragmented customer strategy, such as purchasing products at discounted prices, when they repurchase the same brand products as those used to date, to encourage customers to repurchase. Today, however, customer tendencies and characteristics are more diverse. Therefore, intention to repurchase should also be studied from various perspectives.

This paper found that consumer satisfaction, emotional loyalty, and social influence have a direct impact on consumer intentions to repurchase a smartphone. However, the effect of social influence on intention to repurchase was found to be insignificant.

If the product is expensive (like a smartphone), analysis showed that the consumer uses the product and repurchases the product if satisfied. Therefore, in order to motivate consumers to repurchase smartphones, companies should provide consumers with positive information about any new features and the utilization value of the smartphone. This information can enhance the consumer's usability of the product, which positively affects satisfaction with the product. Therefore, companies need to consider a number of strategies to increase consumer intentions to repurchase smartphones. Primarily, consumer satisfaction needs to be improved by demonstrating differentiated functions of smartphones and the convenience and services they provide. Information that can improve the usability of the product, as well as information about its superior quality, affects the satisfaction of consumers. This has a positive effect on repurchase.

Therefore, companies need to consider several strategies to enhance customer intention to repurchase smartphones. Firstly, they might improve customer satisfaction by enhancing the functions of smartphones and the convenience and services that they provide. Secondly, it is necessary for them to provide positive information to customers through social influence such as word of mouth.

8.3. Differentiation from Previous Research

Previous studies focused on models of repurchase intention using customer loyalty and customer satisfaction as independent variables. Moreover, several researchers identified satisfaction and attitude as major antecedents of customer repurchase intention [91,92]. According to such research, satisfaction is the overall level of a customer's pleasure and contentment resulting from experience with the service. However, the precise relationship between customers' learned dispositions and preferences for perceived alternatives remains unclear [93].

This paper discussed consumer repurchase intention by considering social influence, customer satisfaction, emotional loyalty, and customer habit. Differences between past research and this paper include the following:

- This study examined whether customer habits directly affect their repurchase intention;
- Marketing strategies for repurchase customers can differ from those for other competitors;

- This study involved analyzing factors of social influence that directly affect repurchase intention.

9. Research Limitation and Further Study

This study analyzed the research hypotheses by collecting survey data from consumers in South Korea. However, bias in consumer analysis can cause problems when data are only collected from consumers in certain countries, which can limit the objectivity of the research model. Therefore, in the future, it will be necessary to further analyze the research hypotheses by expanding the survey to consumers living in the US and elsewhere.

In addition, it is necessary to study the first-time smartphone purchase intention of consumers (not repurchase) and compare those results with the results of this study. In addition, it is necessary to deeply analyze and study all factors that affect consumer satisfaction with regard to smartphones.

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