Hindawi
Human Behavior and Emerging Technologies
Volume 2023, Article ID 2683458, 20 pages
https://doi.org/10.1155/2023/2683458

Review Article

A Study on the Improvement Direction of Artificial Intelligence Speakers Applying DeLone and McLean's Information System Success Model

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Received 9 November 2022; Revised 25 January 2023; Accepted 28 March 2023; Published 27 April 2023

Academic Editor: Zheng Yan

Recently, many artificial intelligence speakers have been released on the market worldwide. However, the AI speaker thinks autonomously, which is a characteristic of AI. There seems to be no element to talk about. Even answering the question of this study and saying, "It's not like an artificial intelligence speaker, it's like a slightly advanced Internet-connected radio." To determine the difference between these released technologies and users' expectations in detail, we tried to analyze whether the quality and value of artificial intelligence speakers affect the positive (+) effect on use and user satisfaction. Finally, we tried to determine if it comes with user benefits. As a result of analyzing DeLone and McLean's IS SUCCESS model, it was found that the information quality provided by the artificial intelligence speaker is used, but it is difficult to deliver satisfaction, but the service and system quality deliver user satisfaction. Moreover, it was found that perceived pleasure had no positive effect on the use or user satisfaction. It is necessary to upgrade to a level that can provide information providing quality and enjoyment that users can perceive. This means that it is a system with built-in voice recognition to answer questions connected to the Internet.

1. Introduction

Recently, various products utilizing artificial intelligence have been introduced into the market. Among these products, the artificial intelligence speaker is one of the most frequently encountered in daily life. Artificial intelligence speakers on the market include Amazon Echo, Amazon Tap, and Amazon Echo Dot (second gen). In Korea, there are the KT GiGA GINI, LG ThinkQ, Naver Wave, and Kakao AI speakers. In China, there is the Xiaomi artificial intelligence speaker. Key features common to most artificial intelligence speakers through voice recognition include the ability to ask general questions, tell the weather, play music, set timers/alarms, provide reminders/to-do-lists, update calendars, home automation, stream news, find local businesses, play games, order products, and order food. In a presentation about the major uses of Statista's artificial intelligence speakers in 2017, these functions were listed [1]. Statista GmbH is a German company that operates the world's largest research platform, and it has 1,000,000 resources, 18,000 sources, and 80,000 topics. Marketing the artificial intelligence speaker involves an emphasis on entertainment, for example, the device can turn to visual and sound systems through speech recognition. As described above, there are many artificial intelligence speakers on the market, and the number of users is increasing. Artificial intelligence speakers that provide various functions in our lives have now become a part of our lives. Moreover, it is true that there is a high expectation that the characteristics of artificial intelligence will be reflected because of the name of the artificial intelligence speaker. However, because of interviewing some users during the survey for this study, the characteristics of artificial intelligence were not found. Only automated features, already entered, installed features are said to be installed.

Even among those who have experience using artificial intelligence speakers, it is not an artificial intelligence speaker but simply a speaker connected to the Internet. For AI speakers to penetrate the market and succeed, they will need to have AI characteristics. Here, the characteristics of artificial intelligence refer to extended data connection, collection, reasoning, and learning about certain data. In other words, for an AI speaker to enter the market and succeed, it does not talk about alternatives like a set answer but suggests various alternatives, like humans, and suggests intelligent alternatives rather than automated functions. In fact, products launched in the artificial intelligence speaker market must at least provide anthropomorphic functions.

Because of this, some of the respondents are very pessimistic. Worse, they used to talk about automated or evolved radios. To determine whether the pessimistic stories of some users are true, we intend to test them by using the existing model for the technological success model. Here, respondents were based on their experience of using it at the individual level. Of course, future studies will expand and measure the experience of using artificial intelligence speakers at the group level or organization level. This is because it is difficult to primarily grasp individual detailed characteristics when measured at the group or organizational level. This is because the primary personal characteristics are difficult to measure for individual usage time, purpose of use, and age group. In future research, we intend to identify the perception of the user experience at the individual level of artificial intelligence at the group or organizational level, identify the usage time, purpose, and age group, and present improvements for each customer group for the artificial intelligence speaker to be released on the market. Here, the technology success model is to prove whether the developed technology is satisfactory to users in terms of quality to succeed. To test this, the fitted model is as follows. To determine the quality of artificial intelligence speakers, we use DeLone and McLean's information system success model to measure use, user satisfaction, and net benefits according to specific factors related to information, service, and system quality [2]. These three types of quality and the model used in this study are outlined in detail below.

2. Theoretical Background

2.1. Existing Research on AI Speakers

2.1.1. Existing Research on Major AI Speakers. In a study by [3], it was analyzed whether the matching of expectations for digital assistants such as Apple's Siri and Amazon's Alex had a positive (+) effect on customer satisfaction. As a result, it had a positive effect on user satisfaction in accordance with the initial expectation and the expected confidence in the expectation felt, while also having a positive (+) effect on user satisfaction. Perceived trust and information privacy also had a positive (+) effect on user satisfaction. Additionally, it was analyzed whether perceived trust or personal information protection had a moderating effect when the expectations confirmed by the user experience gave customer satisfaction. As a result of the analysis, it was found that there was no moderating effect. There is user satisfaction with Siri and Alex's digital assistants. External factors such as perceived trust and privacy did not affect the already established user satisfaction. In other words, it was found that expectations for Siri and Alex were consistent with user values and thus had a positive (+) effect on user satisfaction. A study by [4] analyzed whether the smart voice assistant speaker had a positive effect on group harmony that induces social bonding and sharing. Antecedent variables of hedonic motivation, compatibility, and perceived security that affect satisfaction were set. Satisfaction was also investigated whether it influenced continued use intentions and habits. It was also analyzed whether the number of uses, such as various uses, influenced the intention of continuous use. It was examined whether the habit affects the intention to continue use.

Finally, it was analyzed whether the intention to continue using and habits affect group harmony. First, hedonic motivation, compatibility, and perceived security all had a positive (+) effect on the antecedent variables affecting satisfaction. However, this satisfaction had a negative (-) effect on the intention to continue using. However, the habit had a positive (+) effect. Finally, it is concluded that satisfaction influences the intention to continue using through habit and ultimately creates group harmony. It has a positive effect on the number of people who use it with various uses that affect its continuous use. Here, hedonic means pleasure, and compatibility means using it according to my current situation. In the study of [5], they analyzed whether artificial intelligence assistant-assisted smart speakers affect perceived sociability effects. Their research posed the following two questions: "RQ1. Whether human-like social factors embedded in AI assistants drive continuance usage intention." "RQ2. Whether social responses may facilitate continuance usage and online purchase intention through AI assistants." As a result of the analysis, parasocial interaction and media richness had a positive (+) effect on perceived usefulness, perceived ease of use, and trust. In addition, usefulness, ease of use, and trust had a positive (+) effect on the intention to continue to use and intention to purchase online, as they showed usage attitudes. Here, media richness means "feedback immediacy, language variety, cue multiplicity, and personalization", and para-social interaction is to reinforce more social interactions with users. Here, it is suggested that human-like characteristics are constructed. This way, we tried to find the identity of artificial intelligence by setting human-like characteristics as antecedent variables of AI assistant-supported smart speakers. A summary of the previous studies is as follows. In existing studies, it is unusual to use the term smart speaker instead of the word artificial intelligence speaker in common. The smart speaker they studied has already rejected the artificial intelligence factor. Even with human-like characteristics, it only expresses an assistant like a secretary but does not clearly suggest the term artificial intelligence speaker. Ease of use, pleasure, trust, quasisocial interaction, media richness, and consistency with the expected function were tested as antecedent variables for intention to use and continued use.

2.1.2. Existing Research on User Value Provided by AI. A study by [6] suggests that while Amazon sells innovative products to impulsive buyers, it can generate short-term profits, but it is not sustainable. It is undeniable that there are many impulsive purchases of smart speakers even in the market. However, existing research suggests that generating profits through such impulse buyers is not conducive to market growth. In the study of [7], to develop a smart speaker with a level of "human-like" and "professional assistant role," artificial intelligence technologies to better recognize the user's voice and speak naturally like a human suggest that this development is necessary. It is also said that there is a need to improve the device's design and user interface. The artificial intelligence speaker has a function to operate or stop peripheral devices connected to the Internet of Things through voice recognition. It is still vulnerable to personal information and security as it is connected to the Internet to control peripheral devices.

A study by [8] points out that the IoT is vulnerable to personal information and security. This is a factor corresponding to stability among the quality characteristics of artificial intelligence speakers. In the study of [9], self-disclosure and reciprocity were set as antecedent variables to test whether they had a positive (+) influence on intimacy, trust, and interactional enjoyment. Finally, it was investigated whether user satisfaction affects the intention to use. As a result of the analysis, self-exposure in movie recommendation had a positive (+) effect on trust and mutual enjoyment, and reciprocity had a positive (+) effect on intimacy, trust, and interactional enjoyment. However, intimacy did not have a positive effect on user satisfaction. In other words, it is not only the conversation agent that works to get good movie recommendations, but the user should also try to expose and interact with a lot of information. Interaction is necessary to improve the quality of service when users use artificial intelligence speakers by launching products. In the study of [10], hospitality services in hotels were tested based on the theory of "Artificial-Intelligent-Device-Use-Acceptance" (AIDUA). The conclusion drawn from the study of [10] is that when the hospitality service is used as an artificial intelligence device, the user's acceptance intention was evaluated based on social impact, pleasure motive, anthropomorphism, performance and effort expectation, and emotions on artificial intelligence devices. It was set as a leading variable. As a result of the study, it was concluded that it is difficult to expect emotions from artificial intelligence. In addition, anthropomorphism also had a positive effect on the user's acceptance intention, although it was like a human, but not at a satisfactory level. In this study, we also try to set anthropomorphism as a major factor in evaluating the level that users expect from AI speakers. This is because social influence, pleasure motives, performance, and effort expectations are generally applicable factors even if the system does not include artificial intelligence. In the study of [11, 12], the technology acceptance factors of smart thermostats were analyzed in smart home technology. In his study, techno-coolness was set as the main antecedent variable. Here, techno-coolness includes the factors of modern, futuristic, advanced feel, and fun. In this study, we will focus on advanced feeling. To measure this advanced feeling, it is decided to measure the quality of services provided and the perceived enjoyment of information, services, and systems. A study by [13] found that the technology readiness index, consumer engagement, perceived risk, and trust for smart home technologies were correlated with consumer adoption intentions. How it influences was tested. Consumers' perception of smart home technology was measured in two ways. One was analyzed through the consumer's general technology perception and imagination participation experience. As a result, the antecedent variable of optimism had a positive (+) effect on perceived risk and trust. Innovation has a positive (+) effect on consumer engagement. Among the negative factors of the antecedent variables, discomfort, and insecurity were a positive (+) effect on perceived risk and trust. Consumer engagement here means that a company conducts customized marketing to its customers. Summarizing the results, discomfort, and insecurity with smart home technologies create perceived risks that become unacceptable to consumers.

Optimism is that even consumers who have perceived risks do not accept smart home technology as soon as they feel it. Innovation has a positive influence on consumer engagement and embraces smart home technology. Trust was also found to have a positive (+) effect on consumer engagement. In this study, the results of [13] are applied as follows. Before measuring the positive or negative variables of the intention to accept new technologies, the user experience of the artificial intelligence speaker itself is presented as a service provision quality standard. This is because the user's evaluation or recognition itself must precede the user's perception of positive and negative. In the study of [14], voice user interface is a function commonly used in smartphones, computers, smart home devices, and automotive systems. However, the user of the voice user interface (VUI) was tested assuming that there were significant variables among trust, perceived risk, perceived pleasure, and mobile self-efficacy because of the test, and all the set antecedent variables had a positive (+) effect. It is concluded that perceived risk (personal information protection problem) has a greater effect on perceived ease of use on VUI usage behavior. In addition, it is concluded that women play a more important role than men in the effects of trust and mobile self-efficacy. Among the antecedent variables of previous studies, the factor to be applied in this study is perceived enjoyment, which is an antecedent variable assumed to influence intention to use and use value, trust in systems, information, and services, perceived risk, and self-efficacy to be analyzed by setting as a submeasurement variable [15]. Study the user acceptability of a platform to access information through the voice interface of a smart speaker. In their study, product-related characteristics were set as antecedent variables such as function, design, brand, and price. Platform-related characteristics, perceived service availability, perceived network size, perceived complementarity, and privacy concerns were set as antecedent variables. They investigated how antecedent variables affect perceived values and intentions. As a result of the study, platform-related variables had a greater impact on customers'

adoption of smart speakers than product-related characteristics. In their study, it can be said that product-related characteristics, which are intuitive selection factors of users, do not make them feel use value. Based on these results of previous studies, we intend to measure the quality attributes that are perceived empirically while using, rather than the user value of artificial intelligence speakers that can be intuitively recognized [16], by studying smart consumers participating in voluntary value creation activities to conceptualize smart experience cocreation and smart service cape as smart services and smart consumers increase. In the smart service environmental dimension, the measurement variables of aesthetics, superior function, social presence, perceived interaction, and perceived personalization were set. Smart experience cocreation was measured by constructing cognitive, hedonistic, social/personal, and practical/economic dimensions. As a result, it was found that the technological environment cues of smart service cape comprehensively affect smart experience cocreation, and that the cocreation experience ultimately affects the formation of consumer service brand assets and word-of-mouth effects. This study primarily aims at measuring the hedonistic factor among the dimensions of smart experience cocreation.

As suggested in previous studies, measuring the cognitive, social, personal, practical, and economic dimensions is practically difficult because it does not reach the service provision level of AI speakers. In the study of [17], the main service in the smart home is regarded as the Internet of Things, but it is pointed out that the spread of the smart home is progressing more slowly than expected. To find this reason, an analysis of smart homes was performed from the demand side. It was tested using the technology acceptance model, and as a result, it was found that compatibility, perceived ease of use, and perceived usefulness had a positive (+) effect on purchase intention. In addition, it is revealed that, unlike other information and communication technology services or products in terms of purchase timing, older consumers are more likely to purchase a smart home within a certain period than younger consumers. His research suggests that a market strategy to promote smart home purchases to young consumers is necessary to increase market demand. The background to be studied in this study and [17] is different in terms of market dissemination. The artificial intelligence speaker researched in this study is to release a so-called "plausible artificial intelligence speaker" without technological advancement in the market spread and then release it to the market as an artificial intelligence speaker. In other words, the market spread is fast, but the reality is that the level of technology has not kept pace. However, in the study of [17], the reason for the slow market penetration of IoT in smart home services is to be determined. This phenomenon means that although the level of technology to provide services has been achieved to some extent, the target setting for customer groups should focus on young people as well. Therefore, we want to first measure the level of technology called artificial intelligence speakers on the market as a quality factor. According to a study by [18], the influence of interaction style on consumers' brand perception was investigated while enjoying personalized and autonomously optimized services as the Internet of Things (IoT) became more popular. Interaction style here refers to communication like a friend and communication like an engineer. Here, communication, like an engineer, refers to an act that is more formal in a formal way. As a result, the friend-like interaction style and the engineer-like style more positively created warmth in the brand. In addition, the brand attachment of users mediated by brand warmth and brand competence was also revealed. Ultimately, it has an interaction effect with brand attachment. The study of [18] also did not measure the level of the Internet of Things itself but studied what strategically selected brand communication for services/products could make the brand attachment. In this study, an artificial intelligence speaker was provided to consumers who said, "Try it once, we don't care if it does not meet your expectations" in a state where market penetration does not match the technology. It is clearly not the time to discuss brand communication at this level. Therefore, in this study, the level of technology perceived by consumers for the AI speaker itself is evaluated as quality. As a result of the existing research analysis, the difference between the artificial intelligence speaker and the general speaker can be presented as follows. Table 1 shows the comparison between the AI speaker and the general speaker.

The differences between this study and the existing studies recently published in 2020-2021 are as follows. [19] analyzed customers' technology readiness and service perception as the investment managed by artificial intelligence increased. A customer data set was constructed targeting 404 potential customers of Robo-advisor stores in North America, and the level of technical readiness, characteristics of potential customers, and user perception of consulting services by the artificial intelligence of robo-advisors were investigated. As a result, users are technically positive about robo-advisors, and their anxiety is reduced. This study and [19] are similar in first measuring the level of technical readiness for artificial intelligence services, but there is a difference in deriving points for improvement by examining user perceptions of the AI speaker's own products and the quality of the services provided. See also [19], which investigated the user perception of an artificial intelligence service (robo-advisor vs. artificial intelligence advisor) whose algorithms related to finance and investment were verified. However, this study did not investigate user perceptions of artificial intelligence products or services applied to specific algorithms such as finance and investment in their lifetime. In the study of [20], the intention to use artificial intelligence services for hospitality services was studied. In conclusion, from the point of view of AI designers and business managers, it is said that factors such as hedonistic motives, emotions, and hospitality should be reflected in the implementation of AI services for Generation Z. The difference in this study is that the subject and scope of the study are different. In the study of [20], the intention and acceptability of the use of artificial intelligence services from the perspective of the managers of hospitality services, that is, catering, lodging, leisure facilities, and commercial facilities. It has been studied. However, this study did not measure the use of artificial intelligence in specific areas such as hospitality services.

Table 1: Differences between AI speakers and regular speakers.

Division	Process	Explanation
Artificial intelligence speaker [17, 19, 20]	Input	Voice recognition
	Process	Data processing for the relevant area through pattern analysis of all contents connected to the Internet and information Currently, it is not at the level of anthropomorphism like a person using artificial intelligence such as deep learning
	Output	Sound (speaking, music, alarm), peripheral operation Feedback: none, this is a function that handles repeated requests from some users
	Feedback	None, this is a function that handles repeated requests from some users
General speaker [18]	Input	Electronic terminal for connecting an external sound source
	Process	Including part of mixing and equalizer such as digital sound source amplification, sound synthesis, transformation, and repetition
	Output	Sound
	Feedback	None

Previously, [19] suggested that the receptivity and willingness to use in a specific area where artificial intelligence is used were measured. In this study, the quality of the technology level of products and services released on the market under the name of so-called artificial intelligence speakers was fundamentally measured by measuring the receptivity and willingness to use by ordinary people in our daily life. [21] conducted an empirical study with 168 US customers to understand customer perceptions and responses to the advent of humanoid robots. As a result, it is suggested that customers' awareness of the robot's human similarity and intention to use a humanoid service robot have increased. In addition, because of analyzing various risk avoidance propensities as a modulating variable, it was found that customers with high-risk aversion tend to avoid using humanoids when they are perceived as like machines. [21] and this study may differ in that measuring the intention to use a humanoid robot at the same level as a human being and measuring the intention to use a speaker that includes the function of artificial intelligence depend on the skill level of the subject. It is completely different. Artificial intelligence speaker, so-called smart speaker, cannot completely rule out a kind of "human-like" thing, but at the current level, the quality of the product itself measures the so-called artificial intelligence speaker at the same level as a speaker connected to the Internet. [22] confirmed and tested the protection motivation theory (PMT below) to explain the guest's intention to adopt artificial intelligence (AI) and robotics as a protective measure against COVID-19. The main measurements were centered on hospitality management practices and the changed behavior of guests in the current COVID-19 crisis. Measurements suggest that applications in artificial intelligence and robotics, cleanliness and hygiene, health care, and wellness are expected to be effective. In other words, artificial intelligence robotics can revive hotels and restore customer trust by creating safe hotels at the same time.

The originality of their research suggests that it is a study that integrates artificial intelligence and robots to expand PMT and emphasizes how emergency action selection can bring a technological revolution. The difference between their study and this study is that it reflects the special situation of COVID-19 and studies whether artificial intelligence and robotics are effective, especially for hospitality services such as hotels. However, in this study, although we are still in the current situation of COVID-19, we want to analyze the quality of the AI speaker first before reflecting on the situational factors of the AI speaker. In the study of [22, 23], they analyzed whether customer trust can be restored with respect to the robotization of hospitality services. The questionnaire was collected twice from 711 individuals of Generation Z in Spain.

As a result of the analysis, Gen Z customers believed that robots reduce the risk of infection in hotels, and the anthropomorphism of robots thinking and acting like humans increases the effectiveness of preventing COVID-19 regardless of the situation in which the robot is used. It is said that the intention to make a reservation was increased by using a robot [23]. Research suggests that the use of automated robots can lower the risk of infection and attract more hotel guests in the context of COVID-19. However, in this study, it is not to test what kind of efficacy there is in the application stage of artificial intelligence speakers. As we have said repeatedly before, the current AI speaker does not have the level of technology applied to check whether it is effective or not in which field. In fact, using DeLone and McLean's IS success model to determine whether what this researcher is claiming is correct, we will first analyze the quality level and suggest which areas to improve. The relationship between the focus and variables to be studied in previous studies and this study and the results are summarized in Table 2.

2.2. DeLone and McLean's IS Success Model

2.2.1. Information Quality. In this study, we apply DeLone and McLean's concept of information system success to measure information quality. First, to understand the concept of information quality, it is necessary to understand the evolutionary process by which the model came into

Table 2: Summary of analysis of existing research.

Authors	Main used variable	Results
Brill et al. (2019) [3]	(A) Perceived trust, information privacy (D) User's satisfaction	User value of Siri and Alex (+)
Lee et al. (2019) [4]	(A) Hedonic motivation, compatibility, perceived security (D) User's satisfaction	Both the antecedent variables have a positive (+) effect on the dependent variable which is satisfaction. However, negative (-) influence on intention to continue use
Hsieh and Lee (2021) [5]	(A) Perceived usefulness, perceived ease of use, and trust, anthropomorphic (D) Continuous use	As for the antecedent variable, three factors had a positive (+) effect, but only anthropomorphic factors such as people had a negative (-) effect on the intention to continue use
Farah et al. (2020) [6]	(A) Affective experience with brands, impulsiveness, word of mouth, continued interaction with Amazon's purchasing solutions (D) Continuous purchase	If the existing impulsive buyer used the smart speaker, the impulsive purchase continues. However, market share is not sustainable
Han and Yang (2020) [7]	(A) Device design, user interface, personal information, and security (D) Intention to continue use	Among the antecedent variables, personal information and security have a negative (-) effect on the dependent variable
Lee (2020) [8]	(A) IoT is vulnerable to personal information and security (D) Stability	The risk of privacy infringement of IoT affects the stability (-)
Lee and Choi (2017) [9]	(A) Self-disclosure and reciprocity, intimacy, trust, and interactional enjoyment (D) Satisfaction, continuous use	Among the antecedent variables, only intimacy has a negative (-) effect on satisfaction
Lin et al. (2019) [10]	(A) Social impact, pleasure motive, anthropomorphism, performance, and effort expectation, emotions (D) User's acceptance intention	Although anthropomorphism had a positive (+) effect on the acceptance intention dependent variable, it is difficult to expect a level like that of humans
Mamonov and Koufaris (2020) [11, 12]	(A) Techno-coolness includes factors of modern, futuristic, advanced feel, and fun (D) Perceived enjoyment of information, services, and systems	Techno-coolness has a positive (+) effect on the intention to accept technology in smart home service.
Mulcahy et al. (2020) [13]	(A) Optimism, innovation, discomfort, and insecurity (D) Perceived risk and trust, user's adoption intention	Discomfort and insecurity negatively affect user adoption intention
Nguyen et al. (2019) [14]	(A) Voice user interface (VUI) information quality, system quality, information satisfaction, and system satisfaction Perceived usefulness, perceived ease of use, mobile self-efficacy, trust, perceived enjoyment, and perceived risk (D) Attitude toward VUI use, VUI use continuance intention	Mobile self-efficacy and trust influence negative (-)
Park et al. (2018) [15]	(A) Perceived usefulness, perceived ease of use, perceived enjoyment, and perceived privacy risks (D) Intention to adopt smart speakers	Perceived ease of use negatively (-) affects. Intention to adopt smart speakers
Roy et al. (2019) [16]	(A) Aesthetics, superior functionality, social presence, perceived interactivity, and perceived personalization (D) Smart experience cocreation, consumers' service brand equity, and word of mouth intentions	All antecedent variables have a positive (+) effect on smart consumer experience cocreation, brand equity, and word of mouth

Table 2: Continued.

Authors	Main used variable	Results
Shin et al. (2018) [17]	(A) Compatibility, perceived ease of use, and perceived usefulness (D) Purchase intention	For smart home/product, both antecedent variables have a positive (+) effect on purchase intention
Wu et al. (2017) [18]	(A) Interaction style (friend-like and engineer-like communication) (D) Consumers' brand perception	Friend-like interaction style has a greater influence on brand intimacy. User's brand intimacy is mediated by brand warmth and competence
Flavian et al. (2021) [19]	(A) Technology readiness (optimism, innovativeness, discomfort, insecurity, and awareness) (D) Intention to use AI (robo-advisors)	Innovativeness and discomfort had a negative (-) effect on the dependent variable
Vitezić &Perić (2021) [20]	(A) Anthropomorphism, hedonic, social influence, performance expectancy, effort expectancy (D) Emotion, willingness to use AI devices	Only anthropomorphism has a negative (-) effect on the dependent variable
Belanche et al. (2020) [21]	(A) Humanoid anthropomorphism (D) Intention to use humanoid service robot	In a group with high-risk aversion among customers, if a humanoid feels like a machine rather than a human, the intention to use it is low
Gaur et al. (2021) [22]	(A) Artificial intelligence and robotics, cleanliness and hygiene, health care and wellness (D) Research direction of AI robotics	By integrating AI robots to secure customer trust in the hotel industry, an alternative means to a pandemic such as COVID-19
Gaur et al. (2021) [22]&Romero and Lado (2021) [23]	(A) Health history, health importance, perceived susceptibility, prevention efficacy, anthropomorphism, and social presence (D) Attitude, booking intentions	Antecedent variables A positive (+) effect on the dependent variable. Anthropomorphism positively affects prevention efficacy and attitude

(A): antecedent variable; (D): dependent variable.

being. In early 1992, DeLone and McLean proposed an initial model including individual factors that influence organizations, in which system quality and information quality were included as the leading variables mediating between use and user satisfaction [24]. Information quality was added as another leading variable in 2002 and 2003 by many researchers [2, 25]. Then, use was divided into use and intention to use. User satisfaction remained the same, but the dependent variables that affected individual influence were eliminated, and net benefits were added as a final dependent variable. In DeLone and McLean's updated information system success model of 2003, information quality can be measured by the following factors: completeness, ease of understanding, personalization, relevance, and security. Variables measuring information quality began to refer to e-commerce success metrics as of 2003 [2]. Thus, information quality can now be measured not only in general information systems but also in electronic devices such as artificial intelligence speakers. For example, in the case of completeness, the following questions may be asked: Does the AI speaker completely answer the user's question? Does the user easily understand the information? Is the information conveyed personally? and Is the appropriate information delivered to the user? [26]. In addition, factors related to security can be measured for the benefit of those using artificial intelligence speakers in financial transactions [27].

2.2.2. Service Quality. In DeLone and McLean's updated information systems success model of 2003, service quality can be measured by examining the following characteristics: assurance, empathy, and responsiveness, all of which are applicable in the context of e-commerce. The service quality construct proposed by DeLone and McLean was initially developed in 1988 using some of the SERVQUAL metrics proposed by [28].

The purpose of SERVQUAL is to accurately and dependably measure certain functions [28]. One of its metrics, assurance, measures employee knowledge, courtesy, trust, and the ability to communicate convictions [29]. Tangibles include measuring physical facilities, equipment, personnel, and communication data [30]. Empathy means caring for and providing personalized attention to customers [31]. Responsiveness refers to providing customer support and prompt service [32].

Among the five measures of SERVQUAL, [2] included only assurance, empathy, and responsiveness in their updated information system success model. This is only a small selection of possible factors that are appropriate for the measurement of service quality that reflects the characteristics of e-commerce. To measure the quality of service provided by artificial intelligence speakers, preinclusion of the model and redefinition of assurance, empathy, and responsiveness are needed. For the measurement of assurance in relation to the artificial intelligence speaker, we focus

on whether the manufacturer or vendor has performed the appropriate technical support activities when users experience a problem related to the use of the device. Furthermore, if users experience problems, the sales company determines whether to empathize. Responsiveness is crucial for successful e-commerce. The AI speaker's good quality would mean immediate answers to any question. Artificial intelligence speakers must respond immediately to sensitivity. For example, responsiveness is an essential factor when the device is locking a door at a remote location or a gas valve during a home service visit.

2.2.3. System Quality. In DeLone and McLean's updated information system success model of 2003, system quality is measured in terms of adaptability, availability, reliability, response time, and usability. Adaptability refers to working well in the surrounding environment [33]. For example, in a living environment in which artificial intelligence speakers are situated in a noisy area, the volume may be automatically adjusted to suit the circumstances. Availability refers to the ability of the system to operate normally and consistently without failure [34]. Reliability refers to the probability that a machine, device, or component performs its required function adequately during the intended period under given conditions [35]. Response time refers to the rate at which the user responds to the system and vice versa. Usability refers to the availability of information such as weather reports, notifications, and smart home services [36].

2.2.4. Use. The construct of use in e-commerce encompasses the nature of use, navigation patterns, number of site visits, and number of transactions executed [37–40]. In the context of artificial intelligence speakers, use is characterized by speech-enabled functions [41, 42]. In particular, the user does not need to input data for the device to operate; the speaker analyzes patterns, monitors the time, and intelligently accesses the user's characteristics. The navigation pattern is not a direct input search such as one might conduct on a PC, a notebook, or a mobile phone, but a feature that informs the user when it is raining or snowing, or when there is a traffic situation or an accident. The number of site visits can be measured by determining the number of artificial intelligence speakers. Like regular e-commerce, the number of site visits not only increases the frequency of use but also increases the ability of the intelligence speaker to provide you with the necessary information.

In addition, the frequency of use of artificial intelligence speakers increases proportionally with the variety of functions implemented, including smart and personalized services [43, 44]. The volume of transactions in e-commerce depends on the actual purchase of the goods. For example, artificial intelligence speakers can be used to order food or shop, just as in e-commerce when defining the number of transactions [45]. Moreover, financial transactions can be included in the number of transactions. Unfortunately, application of the concept of use to the artificial intelligence speaker cannot be applied directly due to the usage characteristics of the original model. Several factors, such as search pattern, site revision, and transaction number originally proposed by [45] are particular to the e-commerce domain.

2.2.5. User Satisfaction. In e-commerce, user satisfaction can be measured by determining the number of repeated purchases and return visits and by conducting user surveys. User satisfaction is an important construct for measuring customer feedback on information and product searches, purchases, payments, and product receipts [36, 46–48]. Through improvements resulting from analyses of user satisfaction, artificial intelligence speakers will continue to evolve, and new products will be released. User satisfaction can be measured by monitoring product returns to the purchase site or the time of day the product is used. For users of artificial intelligence speakers who do not feel satisfied with the product, it is necessary to examine the reasons for dissatisfaction. Future modifications to artificial intelligence speakers can then be made considering the results of this analysis on the use and user satisfaction.

2.2.6. Net Benefits. In DeLone and McLean's updated information systems success model of 2003, net benefits are a construct encompassing cost savings, expanded markets, incremental additional sales, reduced search costs, and time savings in the e-commerce context [49]. Cost and time savings measure whether individual consumers save time and money through internet purchases. An expanded market is a measure of whether a positive net advantage is provided to an organization through the benefits of market size, supply chain efficiency, and customer responsiveness. Incremental additional sales refer to whether e-commerce has contributed to the net growth rate of the gross national product. Net benefits for artificial intelligence speakers can be measured by examining users' smart and intelligent searching efforts to save on costs and time. Using an artificial speaker can not only save time but also increase work efficiency. The artificial intelligence speaker may be interconnected with other smart home services and as part of the Internet of Things for convenience [50–52]. Among the main functions of AI speakers, alarms can help in the scheduling of daily life [2].

An updated version of the model verifies whether net benefits have a positive impact on the use and user satisfaction. The authors suggest that both independent and dependent variables have the same effect even if they change. However, we intend to reaffirm the 2003 model as it is.

2.2.7. Perceived Playfulness. In this study, we analyze the relationship between use and user satisfaction and the net benefits provided by artificial intelligence speakers. We measure perceived playfulness, which is a feature of entertainment emphasized in PR marketing by artificial intelligence speakers, as a causal variable in the same dimension as many quality attributes. In previous studies, the concept of perceived playfulness is defined as follows. [53] describe this characteristic as satisfying the intrinsic motivation of the user while interacting with the web portal [53]. With this form of satisfaction, that is, perceived playfulness, the user is unaware of several things: how much time has elapsed

while using the web portal, any background noise, or many other things that he or she would normally care about. Some scholars suggest that perceived playfulness induces voluntary use [54]. In another study, hedonic use (i.e., use for pleasure or to induce positive emotions) increased usability even in technologically complex mobile devices [55]. [56] argued that the perceived playfulness of new technologies in hedonic situations had a significant effect on use and use behavior. In this study, perceived playfulness in the context of artificial intelligence speakers is considered an entertainment function involved in playing games or listening to music. In addition to the entertainment features of the AI speaker, there is a certain pleasure in receiving constant answers to questions. During leisure time, these devices provide users with weather and other information; they can perform searches, order food, and do shopping, all through voice cognition. This daily interaction may result in a degree of perceived playfulness and improved quality of leisure time.

2.2.8. Relevance between Existing Studies and This Study. Before examining existing studies, we first want to define artificial intelligence speakers. The name of the product released on the market is called artificial intelligence speaker or smart speaker. Here, the various functions of market launch products can be limited to conversation function, voice recognition, and noncontact interaction. The purpose of this study is to find implications for the research results on the construct concept of DeLone and McLean's research model through the analysis of existing studies. First, the relevance of existing studies on information quality, system quality, perceived enjoyment, use, user satisfaction, and pure benefit is summarized as follows.

In previous studies on quality, research was conducted when performing the role of a personal voice assistant of an artificial intelligence speaker or non-face-to-face/noncontact interaction through an agent of an artificial intelligence speaker. In addition, it is related to the study of the dependent variables for pleasure, user satisfaction, and net benefits.

3. Methodology

3.1. Participants and Measures. Data collected in this study are from users who have purchased and used artificial intelligence speakers. The questionnaire was translated into the languages of the USA, Korea, and China. The first questionnaire was a Google online questionnaire, to which 100 users responded by answering the question, contacting telecommunication companies, and taking on artificial intelligence speakers' vendors. However, this number did not reach the limit of new product penetration. The primary statistics collected were as follows: 80 users had experience using artificial intelligence speakers; out of the 80 respondents, several provided no responses to some of the items on the questionnaire. Therefore, only 1 out of 5 responses was selected for all items, and 20 responses were excluded due to unreliability. So, the total analysis target is 60 people. This indicates that although artificial intelligence speakers were launched within three years, from 2019 to the end of 2021. Considering this fact, the survey was conducted from November 2021 to January 2022. The demographic and usage characteristics of the respondents are as follows. SKT NUGU (Korea) (16.8%) and Google Home (USA) (11.2%) were the most popular brands among artificial intelligence speakers. The purpose of use was music streaming (26.6%), weather report (17.5%), and general questions (9.1%). The acquisition of knowledge provided by artificial intelligence for learning is only 7%. The period of use was less than 3 months (27.3%) and 3.5% of users had used the device over 1 year. Most users were students (28.0%). Artificial intelligence speakers were mainly used in the morning (26.6%). In the living room (27.3%), the main user age group was 20-30 years old, accounting for 27.3% of the sample. In terms of usage of the artificial intelligence speakers, 1.4% of respondents used them to order food, while only 0.7% used them to order goods and services. Finally, music playback was the most popular use at 26.6%. In the 2017 report from the platform company Statista, 60% asked their speakers general questions, 57% of respondents used them to determine about the weather, and 54% of respondents used them for music playback. There are many cases in which music is used for reproducing music. Table 3 analyzes the characteristics of respondents regarding artificial intelligence speakers.

In this study, it is necessary to analyze whether the functions such as music reproduction will act as perceived playfulness. Overall, we have analyzed the characteristics of AI speakers and found that many features are on the market, but their use is on one side. The place to use is most often used in a living room. This means that application development according to various spaces is required. The percentage of households living in the house corresponds to 27.3%. In this study, 28.0% of the respondents were students. Most of the students who responded showed that they use artificial intelligence speakers to listen to music rather than to learn. This is because the AI speaker is not at the level that can provide the answers needed for students' learning. As mentioned earlier, in this study, people in their 20s and 30s had the most experience using artificial intelligence speakers, with 27.3%. In addition, people in their 30s to 60s accounted for 10.5%. As important as AI speakers are to seniors, the most important things for people in their 20s and 30s are as follows. Artificial intelligence speakers currently on the market mainly provide some learning functions to students or young workers, or through complex reasoning or calculation.

It is not enough to provide information. However, looking at the status of usage, most of the functions that inform you of what you have set for simple listening to music or weather, alarm, and schedule management are used. Young people who use artificial intelligence speakers recognize that it is important to use the alarm function for what to do, rather than using it as a function to relieve the inconvenience experienced by seniors due to restrictions on their actions. In this study, it was difficult to obtain detailed information through the questionnaire, so additional interviews were conducted with seniors about the main purpose of using artificial intelligence speakers after this study. Most

Table 3: Artificial intelligent speaker user characteristics.

Items and categories	Frequency	%
1. What products do you use? (a)		
Amazon Echo	5	3.5
Amazon Echo dot (2nd generation)	2	1.4
Amazon tap	3	2.1
Google home	16	11.2
Kakao mini	2	1.4
KT GIGA GINI	4	2.8
LG ThinkQ	1	.7
Naver friends	6	4.2
SKT NUGU	24	16.8
2. For what purpose do you use it? (b)		
Calendar	7	4.9
General questions	23	16.1
Home automation	5	3.5
Music stream	38	26.6
Order food/services	1	.7
Order products	2	1.4
Playing games	1	.7
Reminders/to do	13	9.1
Stream news	6	4.2
Timers/alarms	22	15.4
Weather	25	17.5
3. How many months did you use the above products?		
1 month ~3 months	39	27.3
4 months ~6 months	8	5.6
7 months ~9 months	4	2.8
10 months ~12 months	4	2.8
Over 1 year	5	3.5
4. What is your occupation?		
Employee	16	11.2
Profession*	3	2.1
Public servants	1	0.7
Student	40	28.0
5. What time do you usually use?		
Afternoon (PM)	38	26.6
All day	8	5.6
Morning (AM)	14	9.8
6. What place do you usually use? (c)		
Home (kitchen)	5	3.5
Home (living room)	39	27.3
Home (my room)	13	9.1
Home (toilet)	2	1.4
Workplace (specific place)	2	1.4
Workplace (my desk)	13	9.1
7. What is your age?		
More than 10 ~ less than 20	6	4.2
More than 20 ~ less than 30	39	27.3
More than 30 ~ less than 40	8	5.6
More than 40 ~ less than 50	5	3.5
More than 50 ~ less than 60	1	0.7
More than 60	1	0.7
8. What is your gender?		
Male	25	41.7
Female	35	58.3

The total statistic is $n = 60$. (a), (b), and (c) are multiple-choice items that can exceed the total statistics. *Profession: (doctors, lawyers, judges, etc.).

of the seniors were found to be using voice recognition to order food, call service for transportation, or deal with uncomfortable behaviors of phone calls. Among the total of 60 respondents, 41.7% were male and 58.3% female. As a result of reanalyzing the purpose of use targeting only women, the home automation function was the largest at 20.7%, followed by order food/services at 10.2% and order products at 16.8%. It was found that most of the women use the function to give heating and lighting, and pet food (part of KT and LG U+ services) using the app connected to the artificial intelligence speaker. In addition, it can be seen that COVID-19 and working women mostly use it as a function to order food.

On the other hand, among males, playing games accounted for 21.8%, stream news 12.3%, ordering food/services 11.3%, and ordering products 8.6%.

The questionnaire consists of information quality, service quality, system quality, perceived playfulness, use, user's satisfaction, and net benefits. All questionnaires were set to 1 = strongly disagree, 3 = neutral, and 5 = strongly agree on a 5-point scale. Tables 4 and 5 summarizes the measurement variables, questionnaire items, and constitutional concepts for each construct. In this study, we propose an improvement plan for artificial intelligence speakers. To derive improvement measures, UTAUT (Unified Theory of Acceptance and Use of Technology, [57]) and TAM (Technology Acceptance Model) were considered, but DeLone and McLean's model was adopted for the following reasons. First, the independent variables of UTAUT are set as performance expectancy, efficiency expectancy, social influence, and facilitating conditions. Behavior intentions and use behavior are set as dependent variables. The antecedent variable of UTAUT is to measure the expectation matching of performance and effort and to determine whether there is a motivation to use the social impact and use the environment. However, in this study, it is to determine whether artificial intelligence speakers are being used rather than intended to be used, not only with performance but also with user experience for information system, service quality, and perceived enjoyment. As suggested in previous studies, most of them measure the functions and value of artificial intelligence speakers. However, UTAUT analyzes whether the user experience matches the expectations and the antecedent factors of the environment, and it is difficult to clearly determine what needs to be improved for the primary function of an artificial intelligence speaker. In addition, in TAM,

Table 4: Exogenous variable-rotated component matrix[a].

Constructs	Measurement Variable	Component 1	2	3	4	Cronbach's α
Information quality	InfoQ1	-.009	.180	.232	.855	.648
	InfoQ3	.423	.442	.153	.463	
	InfoQ5	.362	-.040	.436	.533	
System quality	SysQ2	.185	.264	.847	.172	.881
	SysQ3	.349	.243	.823	.202	
	SysQ4	.182	.324	.687	.268	
Service quality	SerQ1	.211	.869	.203	.133	.922
	SerQ2	.186	.852	.303	.096	
	SerQ3	.281	.850	.185	.092	
Perceived playfulness	Hedonic2	.850	.206	.149	.106	.866
	Hedonic3	.688	.290	.346	.049	
	Hedonic4	.812	.205	.291	-.068	
	Hedonic5	.754	.166	.089	.256	
Rotation sums of squared loadings	Eigen value	3.081	2.862	2.536	1.491	
	% of variance	23.699	22.013	19.511	11.466	
	Cumulative %	23.699	45.712	65.223	76.690	

Kaiser-Meyer-Olkin measure of sampling adequacy = .838, approx. chi-square = 500.147, Bartlett's test of sphericity, degree of freedom = 78, Sig = 0.000, extraction method: principal component analysis. Rotation method: varimax with Kaiser's normalization. [a]Rotation converged in 5 iterations.

Table 5: Endogenous variable-rotated component matrix[b].

Constructs	Measurement variable	Component 1	2	3	Cronbach's α
Use	Use1	.159	.800	.247	.687
	Use2	.002	.646	.385	
	Use3	.308	.807	-.006	
User's satisfaction	UserSatis1	.920	.162	.229	.932
	UserSatis2	.926	.201	.144	
Net profits	Benefit3	.339	.164	.783	.726
	Benefit4	.093	.218	.861	
Rotation sums of squared loadings	Eigen value	1.948	1.852	1.638	
	% of variance	27.824	26.451	23.396	
	Cumulative %	27.824	54.275	77.671	

Kaiser-Meyer-Olkin measure of sampling adequacy = .705, approx. chi-square = 177.824, Bartlett's test of sphericity degree of freedom = 21, Sig = 0.000. Extraction method: principal component analysis. Rotation method: varimax with Kaiser's normalization. [b]Rotation converged in 5 iterations.

subject norm, image, job relevance, output quality, and result demonstrability are set as the preceding variables that affect perceived usefulness. Like UTAUT, this also sets dependent variables for the intention to use and the act of using. In TAM, the concept of output quality is correct. However, in detail, there is no specific subconstruction concept whether the output quality is information quality, system quality, or service quality. Moreover, due to the nature of artificial intelligence, there is no question about playfulness, and the focus is on usefulness and convenience. Therefore, to derive improvements for artificial intelligence speakers in this study, a model capable of measuring quality attributes was needed, so DeLone and McLean's information system success model was adopted and applied. In Table 4, the independent variables of information quality, system quality, and service quality of the measured variables are the reconstitution of DeLone and McLean's independent variables presented in 2003 according to the characteristics of artificial intelligence. Perceived playfulness is not a causal variable of DeLone and McLean, but it is included in the preliminary variables in that it emphasizes the characteristics of artificial intelligence and promotes and markets it.

Although there are many measurement variables in each construct, we want to reaffirm the validity of the concept

through factor analysis. Therefore, the measurement variables corresponding to each configuration concept will be removed. In other words, we want to leave only measurement variables that are appropriate for the concept of construction.

3.2. Statistical Analyses

3.2.1. Analysis Procedure. This study is to test the causal relationship by setting the quality attribute and perceived enjoyment of artificial intelligence as antecedent variables, and setting usage, user satisfaction, and perceived net benefits as dependent variables. First, in 3.2.2, an exploratory factor analysis was performed to test the validity of the construct, and a correlation analysis was performed to check whether there was a problem with multicollinearity. Finally, the model fit of the causal relationship analysis was evaluated, and the acceptance of the hypothesis was tested to suggest implications.

3.2.2. Analytical Validity Test

(1) Exploratory Factor Analysis. The data were analyzed by SPSS version 20.0 for Windows. The probability of significance was confirmed at the level of $p < 0.05$, $p < 0.01$, and $p < 0.001$. In this study, the construct validity and the reliability of the response of the measurement variables constructed in the questionnaire are measured with SPSS version 20. To determine whether the factor analysis can be carried out, first, we would like to confirm whether the Kaiser-Meyer-Olkin measure of adequacy, which measures the correlation between data items, is 0.5 or more. Bartlett's sphericity test is used to determine whether there is a correlation between variables at the level of $p < 0.001$ [58]. To simplify the measurement variables of the constructs, varimax and principal component analysis were used. The reliability of the response will confirm that a value of Cronbach's alpha value of 0.7 or more is obtained. The factor loadings of the measurement variables in the component are all 0.5 or more.

The value of the eigenvalue must be greater than 1 for the factor to qualify [59]. As a result of the analysis, all four exogenous variables are more than 1.491~3.081, and the endogenous variable is also in the range of 1.638~1.948. The varimax rotation values for the four factors of exogenous variables performed by principal analysis are as follows. In Table 4, the information quality (eigenvalue = 3.08 , 23.70% of the variance), service quality (eigenvalue = 2.86, 22.01% of the variance), system quality (eigenvalue = 2.54, 19.51% of the variance), and perceived playfulness (eigenvalue = 1.49, % of the variance). The endogenous variables are used (eigenvalue = 1.95, 27.84% of the variance), user's satisfaction (eigenvalue = 1.85, 26.45% of the variance), and net profits (eigenvalue = 1.64, 23.40% of the variance). Moreover, in Table 4, the cumulative variance value shows the explanatory power of the questionnaire composition, with 76.90% for exogenous variables and 77.67% for endogenous variables. Cronbach's alpha value measures the reliability of the response. A value of 0.7 or more may be considered reliable [60]. Cronbach's alpha values of the exogenous variables are as follows: information quality (Cronbach's alpha = 0.65), service quality (Cronbach's alpha = 0.92), system quality (Cronbach's alpha = 0.88), and perceived playfulness (Cronbach's alpha = 0.87).

In Table 5, endogenous variables (Cronbach's alpha = 0.69), user's satisfaction (Cronbach's alpha = 0.93), and net profits (Cronbach's alpha = 0.73) are used. Kaiser-Meyer-Olkin measure of adequacy is 0.838 for exogenous variables and 0.705 for endogenous variables, which is greater than 0.5, so it is eligible for factor analysis [61]. In the Bartlett's sphericity test [58], p (probability) = 0.000 at the $p < 0.001$ level qualifies the factor analysis for both exogenous and endogenous variables.

(2) Correlation Analysis. In Table 6, we will check whether there is a problem with the construct multicollinearity through the correlation analysis. If the correlation coefficient is 0.9 or more, it is judged that there is a problem in multicollinearity. This means that there is no plausibility between constructs. Constructs that do not have this discriminant validity should be deleted before performing a causal analysis.

The correlation between constructs is in the range of 0.388 to 0.708. This means that there is no problem of multicollinearity between each construct. All constructs were significant with $p < 0.001$ based on the two-tailed test.

3.2.3. Results of Causality Analysis

(1) Model Fitness Evaluation. To evaluate the fitness of the regression model, we will check whether the significance value for the F value is $p < 0.05$. The variation inflation factor (VIF), which grasps the multicollinearity problem between the constructs, is judged to be nonproblematic if the VIF is less than 10 [62–64]. The adjusted R square value from H1 to H14 is not larger than R square value. R square indicates how independent variables explain the dependent variables. We also present the adjusted R square value. R square describes how independent variables explain the dependent variables. However, the R square value increases unconditionally as the number of variables to be measured increases. To correct this, we use the adjusted R square value [65, 66]. Durbin-Watson, which evaluates the independence of residuals, is in the range of 1 to 3 from 1.594 to 2.240, so there is no problem with the independence of the residuals [67, 68]. To evaluate the fitness of the regression model, Sig (p) value is in the range of 0.000~0.001 because of confirming that the significance value for the F value is $p <$ 0.05. That is, you can see that the model is suitable. The variation inflation factor (VIF), which grasps the problem of multicollinearity between constructs, is between 1.000 and 2.195, which is less than 10, so there is no problem in multicollinearity.

(2) Key Findings Summary. As a result of the causal analysis in Figure 1, it is only H1 that information quality has a positive effect on use. In H6 and H7, only service quality and

Table 6: The result of correlation analysis.

Constructs	1	2	3	4	5	6	7
Information quality	1						
System quality	.654**	1					
Service quality	.496**	.580**	1				
Perceived playfulness	.529**	.575**	.533**	1			
Use	.537**	.483**	.480**	.388**	1		
User's satisfaction	.448**	.708**	.600**	.579**	.429**	1	
Net profits	.546**	.501**	.576**	.533**	.467**	.431**	1
Mean	2.828	3.233	3.133	3.379	3.478	2.991	3.267
Standard deviation	0.758	0.858	0.868	0.811	0.656	1.027	0.904

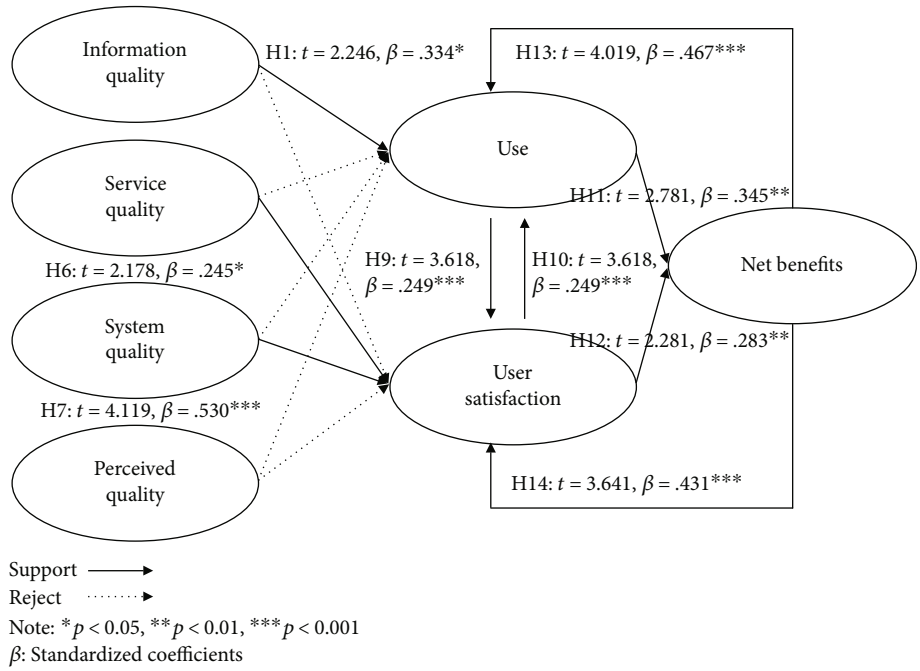

Figure 1: Causality analysis results.

system quality have a positive effect on independent variables that have a positive effect on user satisfaction. In H9 and H10, causal relationships between use and user satisfaction were statistically significant. H11 and H12 also showed significant differences in net benefits. Particularly, H13 and H14 show that the net benefits are again positive for use and user satisfaction. The causality analysis of this study is summarized as follows.

The net benefits of an artificial intelligence speaker have a positive impact on use through information quality and a positive impact on user satisfaction. In addition, use and user satisfaction have a positive effect on net benefits. However, service quality, system quality, and perceived playfulness did not have a positive effect on use. Service quality and system quality are used after user satisfaction. Taken together, information quality responds first to use, and service quality and system quality respond first to user satisfaction.

To summarize the information quality again, the answer to the question is about completeness, easy understanding, personalized information that is needed only for me, and relevant answers. Use can be measured by factors such as immediate information availability, ease of use without connecting other digital devices, frequent frequency of use in daily life, financial transactions, and ordering of food products and services. Information quality is a direct influencing factor during use.

However, the quality of the system does not mean that it will not be used immediately due to a short interruption or a poor response to the surrounding environment, or a slow response rate. The results of this study are as follows. There was no relationship between use and user satisfaction. If H9 is supported and H10 is rejected, it can be interpreted that use affects user satisfaction. On the other hand, if H10 is supported and 9 is rejected, it can be said that it affects use. However, in this study, both H9 and 10 are supported, and there is no relationship between them.

However, information quality responded to use first, and service quality and system quality first responded to user satisfaction. Perceived playfulness emphasized the advertising and marketing of the artificial intelligent speakers on the market recently and tried to verify that this was true. Of course, there is a function to playing music and games, but it is questionable whether it can bring pleasure to the level of utilizing leisure. This is because artificial intelligence has only recently been launched on the market in just three years in 2017. We use advertising and lectures that are all about everything, from artificial intelligence speakers to mass media. However, this is not true. Therefore, in this study, we want to determine what parts can be implemented in detail considering this realistic level of technology. A variety of artificial intelligence speakers are not trying to find out what is true or false about the features they are promoting, nor are they trying to determine if they are performing well. Any artificial intelligent speaker would be the main task of this research to find the overall level of current.

4. Discussion

4.1. Theoretical Contributions. About DeLone and McLean's model in 2008, Petter et al. reviewed all 180 papers from 1992 to 2007 and synthesized the results of the causality test at the individual level [69]. As a result, system quality has a positive effect on use.

It was difficult to assure that information quality and service quality were not enough to supply positive effects. In this study, only information quality has a positive effect on use. In the previous research, general information systems were investigated. However, in this study, we analyzed the characteristics of artificial intelligence speakers, which are different from general information systems. In the previous studies, the quality factors that have a positive effect on user satisfaction were information quality and service quality.

In this study, system quality and service quality have a positive effect on user satisfaction. This is the same result as previous studies. The following conclusions were obtained from the analysis of the causal relationship between information quality, system quality, and service quality in use and user's satisfaction. The three quality factors of the information system are user satisfaction and use. However, in this study, information quality was found to reach user satisfaction through use. In addition, system quality and service quality have positive effects on use and net benefits through user satisfaction. Table 7 presents the results of testing whether the quality of information, system, and service provided by artificial intelligence speakers affect satisfaction and whether user satisfaction delivers usage and value.

In previous studies on perceived playfulness, Moon and Kim proved the hypothesis with the extended technology acceptance model. Perceived playfulness has a positive effect on attitudes toward using and behavioral intention to use. All have a meaningful relationship. Moon and Kim demonstrated the perceived playfulness in the context of the World Wide Web [53]. However, this study does not analyze general information systems. It is aimed at a new product called artificial intelligent speaker.

As a result, perceived playfulness did not have a positive effect on both use and user satisfaction. Even though the ability to play music and play games and emotional conversation according to mood was provided, there were no significant results. Gelderman, who studies the relationship between use and user satisfaction, suggests that it does not have a positive impact [70]. Moreover, there is no study on whether user satisfaction affects use. In this study, we tried to grasp the context of use and user satisfaction differently from previous studies. As a result, both user and user satisfaction are in a mutually positive relationship. Only information quality has a positive effect on user satisfaction through use.

In a study by Petter et al. in 2008 on use, user satisfaction, and net benefits, a study of user satisfaction was conducted by 14 researchers between 1992 and 2007, suggesting that all of them have positive effects. 5 out of 6 researchers conclude that use has a positive effect on net benefits. In addition, studies that affect net benefits and use suggest that three out of four researchers have a positive impact. Gefen, Gill, and Belcher and Watson have suggested that the positive impacts are positive [71–73]. Premkumar et al. did not predict this [74]. None of the studies that had net benefits affecting user satisfaction suggested that no one had a positive impact. In this study, use and user satisfaction had a positive effect on net benefit, and net benefit had a positive effect on use and user satisfaction again.

4.2. Practical Implications. The practical implications of this study are presented as follows. First, information quality is the only factor that positively affects user satisfaction through user behavior in the quality attributes of artificial intelligence speakers. However, service quality and system quality directly affect user satisfaction positively (+), not through user behavior. This is not a satisfaction obtained by an artificial intelligence speaker, but a factor that must be provided by default. What is unique is that artificial intelligence does not have a positive (+) effect on perceived playfulness at all on the act of use or satisfaction. As a result, users are only used to obtain simple information and do not enjoy entertainment. Of course, it was mentioned earlier that it is mainly used for listening to music, but this is also not for pleasure but is used like white noise in a cafe. To create user behavior and use the satisfaction of artificial intelligence, it is necessary to develop and install various contents of entertainment provided by artificial intelligence.

4.3. Social Implications. Artificial intelligence speakers are used by various age groups, and they perform alarm functions, call functions, life information, ordering food or products, and controlling smart home services. Since the elderly often have restrictions on their actions, they order food or products and use the call function. If information quality is provided, the psychological loneliness caused by the increase in the number of elderly people living alone can be utilized as a function of conversation, and various convenience functions can be used.

Table 7: Results of hypothesis testing.

Hypothesis	Unstandardized coefficients		Standardized coefficients	t	Result	Sig.	Collinearity statistics	
	B	Std. error	Beta				Tolerance	VIF
(constant)	1.712	.342	—	5.007	—	.000	—	—
H1: INFQLT ➔ USE	.289	.129	.334	2.246	S	.029	.529	1.890
H2: SERQLT ➔ USE	.179	.106	.238	1.695	N	.096	.595	1.680
H3: SYSQLT ➔ USE	.089	.122	.116	.723	N	.473	.455	2.195
H4: PERPN ➔ USE	.015	.114	.019	.133	N	.895	.584	1.711
Fvalue = 7.627, degree of freedom = 4, p = 0.01, Rsquare = 0.357, adjusted Rsquare = 0.310, Durbin-Watson = 2.209								
(constant)	-.373	.430	—	-.867	—	.390	—	—
H5: INFQLT ➔ USERSAT	-.180	.162	-.133	-1.112	N	.271	.529	1.890
H6: SERQLT ➔ USERSAT	.290	.133	.245	2.178	S	.034	.595	1.680
H7: SYSQLT ➔ USERSAT	.634	.154	.530	4.119	S	.000	.455	2.195
H8: PERPN ➔ USERSAT	.271	.144	.214	1.882	N	.065	.584	1.711
Fvalue = 19.454, degree of freedom = 4, p = 0.01, Rsquare = 0.586, adjusted Rsquare = 0.556, Durbin-Watson = 1.594								
(constant)	.687	.648	—	1.059	—	.294	—	—
H9: USE ➔ USERSAT	.672	.186	.429	3.618	S	.001	1.000	1.000
Fvalue = 11.462, degree of freedom = 1, p = 0.01, Rsquare = 0.184, adjusted Rsquare = 0.170, Durbin-Watson = 1.804								
(constant)	2.608	.239	—	10.904	—	.000	—	—
H10: USERSAT ➔ USE	.274	.076	.429	3.618	S	.001	1.000	1.000
Fvalue = 13.091, degree of freedom = 1, p = 0.01, Rsquare = 0.184, adjusted Rsquare = 0.170, Durbin-Watson = 2.369								
(constant)	.889	.545	—	1.631	—	.108	—	—
H11: USE ➔ NETBEN	.476	.171	.345	2.781	S	.007	.816	1.226
H12: USERSAT ➔ NETBEN	.249	.109	.283	2.281	S	.026	.816	1.226
Fvalue = 11.264, degree of freedom = 2, p = 0.01, Rsquare = 0.283, adjusted Rsquare = 0.258, Durbin-Watson = 1.968								
(constant)	2.322	.285	—	8.143	S	.000	—	—
H13: NETBEN ➔ USE	.338	.084	.467	4.019	S	.000	1.000	1.000
Fvalue = 16.155, degree of freedom = 1, p = 0.01, Rsquare = 0.218, adjusted Rsquare = 0.204, Durbin-Watson = 2.240								
(constant)	1.391	.456	—	3.051	S	.003	—	—
H14: NETBEN ➔ USERSAT	.490	.135	.431	3.641	S	.001	1.000	1.000
Fvalue = 13.256, degree of freedom = 1, p = 0.01, Rsquare = 0.186, adjusted Rsquare = 0.172, Durbin-Watson = 1.793								

S: support; N: reject; INFQLT: information quality; SYSQLT: system quality; SERQLT: service quality; PERPN: perceived playfulness; USE: use; USERSAT: user satisfaction; NETBEN: net benefits.

However, it still needs further development to get to the level of enjoyment. It seems that the younger generation also expects to solve psychological loneliness as the number of people living alone increases. The reason artificial intelligence speakers are mainly used in this study is to use the alarm function, order food, or use the function of conversation through voice recognition. Artificial intelligence speakers have many functions that can be provided to the socially underprivileged.

However, to demonstrate social value, not only the quality of information, systems, and services but also the technological progress of the product and the user's requirements must be accurately reflected so that it can give usefulness and pleasure.

4.4. Managerial Implications. The practical implications of this study are as follows. First, technology development is urgently needed for net benefits that positively affect user behavior or satisfaction with the use of artificial intelligence speakers and can be recognized as such. This is because the artificial intelligence speakers currently on the market are at the level of delivering information by simply searching for stored functions through the Internet. Second, the artificial intelligence characteristics of artificial intelligence speakers should be reflected. It is necessary to provide services based on learned data, convergence data, and more evolved data that can deliver decision-making information when people request it, rather than simply delivering information. For example, it is necessary to provide the most reasonable decision-making information based on prelearned data so that ordinary people can easily recognize it as an answer to a question related to expertise. In addition, it should be possible to provide the most suitable service to the user by converging data on weather, age, region, environment, ordered products, the purpose of use, economic level, and level of payment ability. Evolved data should deliver mature data reflecting data accumulation, filtering,

Table 8: Definition of questionnaire items and variable abbreviations.

Constructs		Item
Information Quality (INFQLT) [24]	InfoQ1	1. When I asked the AI speaker what information, AI speaker gave the most complete answer.
	InfoQ2	2. When I asked the AI speaker what information, AI speaker gave it an easy answer.
	InfoQ3	3. When I asked the AI speaker what information, AI speaker gave the answer that I needed.
	InfoQ4	4. When I asked the AI speaker what information, AI speaker provided relevant information.
	InfoQ5	5. When I asked the AI speaker what information, AI speaker provided information in a secure state. (for example, if you use a financial inquiry, you are dealing with security-related procedures)
System Quality (SYSQLT) [33]	SysQ1	1. I use artificial intelligent speakers because it is useful. (for example, weather, living information, smart home services, etc.)
	SysQ2	2. While I use artificial intelligent speakers, most of them are operating normally without any problems.
	SysQ3	3. While I use artificial intelligent speakers, the machine or device performs the proper function under given conditions.
	SysQ4	4. I use artificial intelligent speakers to adapt to the surrounding environment and react well. (for example, when the volume is automatically raised in a noisy area)
	SysQ5	5. The system response rate is right while I use artificial intelligent speakers. (ex. if you do not have to wait more than 3 seconds)
Service Quality (SERQLT) [28]	SerQ1	1. If I use artificial intelligent speakers and there is a problem in use, the manufacturer provides the appropriate technical support.
	SerQ2	2. If I use artificial intelligent speakers and there is a problem in use, the manufacturer agrees and has an appropriate processing process.
	SerQ3	3. If I have problems using my artificial intelligent speakers, the manufacturer will react immediately.
Perceived Playfulness (PERPN) [53]	Hedonic1	1. There is reason why I use artificial intelligent speakers. It provides entertainment services.
	Hedonic2	2. There is reason why I use artificial intelligent speakers. It gives me pleasure.
	Hedonic3	3. There is reason why I use artificial intelligent speakers. It is good for leisure time.
	Hedonic4	4. There is reason why I use artificial intelligent speakers. It is interesting.
	Hedonic5	5. It is pleasant to use artificial intelligent speakers.
Use (USE) [37–40]	Use1	1. I use artificial intelligent speakers because I can get my voice and get the information I want in a variety of ways.
	Use2	2. The reason I use artificial intelligent speakers is because I can search for information by voice that I do not have to input directly like PC, notebook, mobile phone.
	Use3	3. The number of times I use artificial intelligent speakers is very often used in daily life.
	Use4	4. The reason I use artificial intelligent speakers is because there are transaction processing such as financial settlement and ordering.
User Satisfaction (USERSAT) [36, 46–48]	UserSatis1	1. I will buy another new AI speaker product.
	UserSatis2	2. I will revisit the site to get information about the new AI speaker product.
	UserSatis3	3. I am generally satisfied with artificial intelligent speakers, so I would recommend to repurchase and use it for others even if the price rises.
Net Benefits (NETBEN) [49]	Benefit1	1. I use artificial intelligent speakers because smart and intelligent search can reduce search costs.
	Benefit2	2. The reason I use artificial intelligent speakers is because it saves time about what to do after searching.
	Benefit3	3. I use artificial intelligent speakers because there is a smart home management service.
	Benefit4	4. The reason I use AI is because there are time management, scheduling and alarm functions.

convergence, and environmental variables to artificial intelligence speakers.

4.5. Market Penetration Implications. Not only artificial intelligence speakers but also any product or service has the property that once it is launched on the market, users can recognize and not throw away what they experienced for the first time. For this reason, providing users with good quality is the most existing starting point. The 4Ps, commonly called the marketing mix, consist of products, prices, places (distribution channels), and promotions to form a strategy.

However, in this study, the price, distribution channels, and promotions are disclosed faster than the quality level of the product, forming an imbalance. To put it simply, the artificial intelligence speakers released on the market are at the level of automated response machines, not products that provide artificial intelligence characteristics expected by users. To have a competitive edge in products, first, it is necessary to develop technical and planning (content development) for the quality and perceived enjoyment of information, systems, and services. In fact, a system called an artificial intelligence speaker distributed in the market can be a smart speaker. As mentioned earlier, artificial intelligence speakers should be able to simply present rational decision-making to people through complex processes of converging certain data, extracting, filtering, learning, and refining. In previous studies, this is called anthropomorphism.

That is, a level of technology capable of thinking like that of a human being must be provided so as not to be inconsistent with users' expectations. In addition, it is a reality that users cannot hide their great disappointment in user reviews for not only artificial intelligence speakers but also products and services that have recently been released to the market as the latest technology. Therefore, advances in new state-of-the-art technologies will have to precede market launch.

5. Conclusion

Artificial intelligence speakers need to go beyond simply being able to use voice recognition technology to retrieve information, use alarms, order food services/products, or manage smart home services efficiently. Furthermore, in this study, it was found that artificial intelligence speakers do not provide perceived pleasure. As mentioned earlier, most of the respondents were in their 20s and 30s, accounting for 27.3%. The main purpose of the use is to listen to music, use the alarm function, or use functions such as food ordering. In addition, it was found that women mainly use home automation more than men and use it for food ordering and shopping. AI speakers should also provide customized services with enhanced functions according to the user's characteristics. It is also possible to differentiate the price according to the provision of services accordingly. However, it is still necessary to develop advanced technology that reflects the characteristics of artificial intelligence, as it still provides only simple functions installed in advance in terms of technology level. In addition, it is necessary to connect to IoT, shopping platforms, transportation platforms, and safety and emergency contact platforms that can provide convenience in life as well as simple information for people in their 30s to 60s. With so many improvements, the current artificial intelligence speaker is a prototype that has been released to the market and cannot be called a smart speaker. Technically, artificial intelligence is not applied, but it can be a highly advanced automation function. Artificial intelligence has a range that needs to be overcome, from weak artificial intelligence to strong artificial intelligence. Through this study, it seems that artificial intelligence speakers are not trying to think like human beings with weak artificial intelligence but are trying to implement functions such as perception, reasoning, and behavior through computational models. Future artificial intelligence speakers may want to act and think like humans. However, artificial intelligence speakers currently on the market seem to be making various attempts to realize the image of a human being. We would like to realize that soon, artificial intelligence speakers will be able to grasp a human emotional state during a conversation with humans or analyze human intelligence algorithms rather than simple information according to age, to deliver information suitable for decision-making.

In this study, information quality has a positive effect on users only, and service quality and system quality have a positive effect only on user satisfaction. The priorities may not be as important as whether the quality attributes of artificial intelligence let us choose first. However, it is difficult to guarantee continuous use in the future if it is used only and does not satisfy the user. In addition, it means that if you do not use it, you are just good and do not feel the value you need to use it. Perceived playfulness is one of the most emphasized aspects of advertisements for artificial intelligence speakers currently on the market. However, all of them were not significant in this study. The service to be developed for the perceived playfulness here should not be at the level of simply playing music. That is, in order to provide perceived playfulness, it is necessary to develop and provide playful content. Here, playful content refers to a conversation, telling interesting stories, playing music suitable for age, environment, weather, and events, or implementing a conversation method that speaks like an anthropomorphic person, an artificial intelligence element. In addition, as the number of elderly and young people living alone increases due to demographic characteristics, it is necessary to develop playful contents that can relieve psychological anxiety caused by loneliness and solitude. Women need specific content that provides entertainment, such as implementing artificial intelligence, counseling functions that can overcome psychological conditions such as parenting depression while raising children and providing music that can be sung by children. In the existing research, it is suggested that enjoyment plays an important role in the continuous use of the information system and the use and user satisfaction. However, in this study, perceived playfulness is not working. Rather than being implemented as a pleasure level, the concept of everyday life management is strong in that it retrieves information at the level of receiving voice, processing natural language, providing an alarm function, and interworking with other objects on the Internet. Most importantly, using artificial intelligence can give you net benefits that tell you whether you can save time or money in information retrieval or decision-making or whether you can streamline your lifestyle. In this study, we find that both use and user satisfaction give net benefits, and net benefits have a positive effect on both use and user satisfaction again. In artificial intelligent speaker research in the future, it is necessary to select and compare the most popular products of the United States, Korea, China, and other producing countries. In the future, it will be necessary to exchange mutual information about the advanced technology of the artificial intelligent speaker to develop the technology worldwide.

Appendix

Questionnaire

The four quality attributes, information, service, system quality, and perceived playfulness, used in the causal relationship analysis were measured as the preceding variables, composed of the following measurement subitems.

Refer to the following table and reconstruct and use constructs and measurement variables for new technologies. As a dependent variable, the use, user satisfaction, and net benefits corresponding to the use value of artificial intelligence speakers were set as submeasurements. In addition to the constructive concept of playfulness, additional variables and control variables can be changed according to the subject of the thesis. Table 8 is a compilation of survey questions based on the constructs of DeLone and McLean's IS success model, which can evaluate user satisfaction, usage, and user value of artificial intelligence speakers. The survey questions are designed using information quality, system quality, service quality, and perceived enjoyment as the independent variables.

Data Availability

"Access to data is restricted" for data sharing. Because the information of KT user members in Korea is included, it should not be disclosed. For purposes other than research purposes, information about KT user members and personal information among items are included and cannot be disclosed.

Conflicts of Interest

The author declares that they have no conflict of interest.

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