# Factors Affecting Intention to Accept Artificial Intelligence-based Smart Aquaculture System

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## Abstract

Currently, in the fishery industry, production of traditional fisheries is decreasing due to ① limitations in fish resources, ② pollution of the marine environment, ③ illegal overfishing, and ④ weakening of the foundation due to hollowing out and aging of fishing villages. As a result, aquaculture has been proposed as an alternative to traditional fishing methods.

In this paper, by identifying the factors that people interested in existing conventional fish farming, new fishermen who want to enter aquaculture, and fishermen who want to retire in a fishing village to spend their old age accepting AI-based smart aquaculture systems, It was intended to derive the direction of advancement and contribute to the development of the aquaculture industry.

To this end, the following three research questions were set. First, a research model was established to identify the acceptance intention of the artificial intelligence-based smart aquaculture system. Second, factors that directly or indirectly affect the acceptance intention of the AI-based smart farm system were set as independent variables and parameters, and measurement items were derived. Third, in order to find out the effect of demographic characteristics such as education, career, and age on acceptance intention, the study was conducted focusing on the relationship between independent and dependent variables.

The study was conducted in 5 stages. In the first stage, the overall direction of the thesis, such as the purpose of the study and the procedure for the factors affecting the acceptance intention of the AI-based smart farm system, was presented.

In the second step, previous studies were divided into three areas and analyzed. ① Analysis of preceding studies on the definition, configuration and theoretical background of AI-based smart aquaculture systems, environmental characteristics in terms of policy, economy, society, and technology through PEST technique, and future development direction, ② Acceptance intention of preceding studies related to artificial intelligence services Analysis ③ Prior to constructing the research model, previous research models such as TAM, UTAUT, IS Success Model, and ServQual were analyzed to derive measurement items such as independent variables, parameters, and dependent variables.

In the third step, the research model construction step, a model was constructed to conduct this study, hypotheses were established, and operational definitions and measurement items for direct, indirect, and moderating effects were derived.

In the 4th stage of empirical analysis, a questionnaire was constructed based on the measurement items derived in advance, and a total of 457 people were surveyed from December 2020 to February 2021. Using SPSS 26 and AMOS 26, the influence of parameters and the moderating effect of demographic characteristics were analyzed as follows.

Checked the result. ① Reliability, expertise, and availability were analyzed to have a positive (+) effect on perceived ease. Along with this, responsiveness and security had a positive effect on usability. Investment value and social influence had a positive (+) effect on acceptance intention. ② Reliability-perceived ease-acceptance-intention path, expertise-perceived ease-acceptance-intention path, and usability-perceived ease-perceived usefulness path had a complete mediating effect, and the perceived ease-acceptance-intention path It was analyzed that there was a partial

mediating effect. mediating effect. ③ Regarding the moderating effect according to demographic characteristics, it was analyzed that gender, age, and service experience had a moderating effect.
Lastly, by analyzing the implications of this study, quality improvement through standardization of services and systems in terms of policy, contribution to the preparation of related legal and institutional measures, and academically analyzed the intention to accept artificial intelligence smart systems in other primary industries. It can provide value as a reference case for related studies such as smart farm and smart livestock farming.

## Keywords
Artificial Intelligence, Limitation of fish resources, pollution of the marine environment, illegal overfishing and deterioration of fishing villages

## 1. Introduction
### 1.1. Research method
This thesis established a research plan in 7 steps and proceeded step by step. ① In the investigation of the current status and problems, the background and current status of the current smart aquaculture industry, and countermeasures for problems were investigated. ② In the review of preceding studies, various preceding studies were analyzed, such as an overview and macroscopic environment analysis of smart food and artificial intelligence services, and a case study of technology acceptance models related to artificial intelligence services. ③ In the derivation of factor variables, independent variables, parameters, dependent variables, and moderating variables that fit the research model were derived based on the factors derived from the previous research review and analysis. ④ A research model was developed and hypotheses were established for each pathway. In addition, operational definitions and questionnaires were constructed based on the measured variables. ⑤ In the survey, a survey was conducted targeting those involved in maritime affairs and the general public who are interested in returning to the village. From December 2020 to February 2021, an online survey was conducted on a total of 457 people, and 42 invalid questionnaires were eliminated, resulting in valid results for a total of 415 people. ⑥ In the result analysis and hypothesis verification, the validity and reliability were verified based on SPSS 26 and AMOS26, and the hypothesis verification for the structural model was conducted to derive the results of the hypothesis. ⑦ In conclusion and implication, policy and theoretical considerations were conducted based on the results. In addition, the study was completed after explaining the implications and limitations of this study, and explaining the future direction.

### 1.2 Prior research analysis
PEST analysis of smart aquaculture system, core technology of future smart aquaculture system, acceptance intention of artificial intelligence service, and previous studies related to technology acceptance model were analyzed.
Looking at this, first, the core technology of the future smart aquaculture system derived from the PEST analysis results for the smart aquaculture industry was analyzed, and among the technology acceptance models, the service quality characteristics of the information system success model, the 5-dimensional characteristics of the service quality model, and artificial intelligence As a result of studying 7 characteristics of quality characteristics, independent variables of reliability, responsiveness, and expertise were derived.
Second, the service quality characteristics of the information system success model among the key technology analysis and technology acceptance models of the future smart farming system were studied, and independent variables of availability and security were derived as system quality characteristics.
Third, analyze the macroscopic environmental characteristics of policy, economy, society, and technology, examine related preceding studies, and integrated technology acceptance theory to derive independent variables of investment value, policy support, industrial standardization, and social impact, and direct paths to dependent variables. set up
According to a report by the Rural Research Institute (2018), it was found that social influences such as national policies and support systems, homecoming village centers, and fishing villages directly affect the intention to accept returning home villagers. In addition, in a number of previous studies related to the acceptance intention of smart farms in the same primary industry, agriculture, it was confirmed that independent variables such as social impact, promotion conditions, and price effectiveness directly affect dependent variables.
Fourth, and finally, through the smart food PEST analysis, technology acceptance model (TAM), and previous studies of the integrated technology acceptance model 2, the mediating and dependent variables of perceived ease, perceived usefulness, and acceptance intention were derived.

### 1.3 Sample subject and size review

In this study, a survey was conducted with the general public who are interested in the return village and those who are thinking about introducing an artificial intelligence-based smart aquaculture system among stakeholders in existing maritime and fisheries related projects. According to Kim (2020), a standard for an appropriate sample size for structural models is proposed, and the minimum appropriate sample size for a survey is 200.

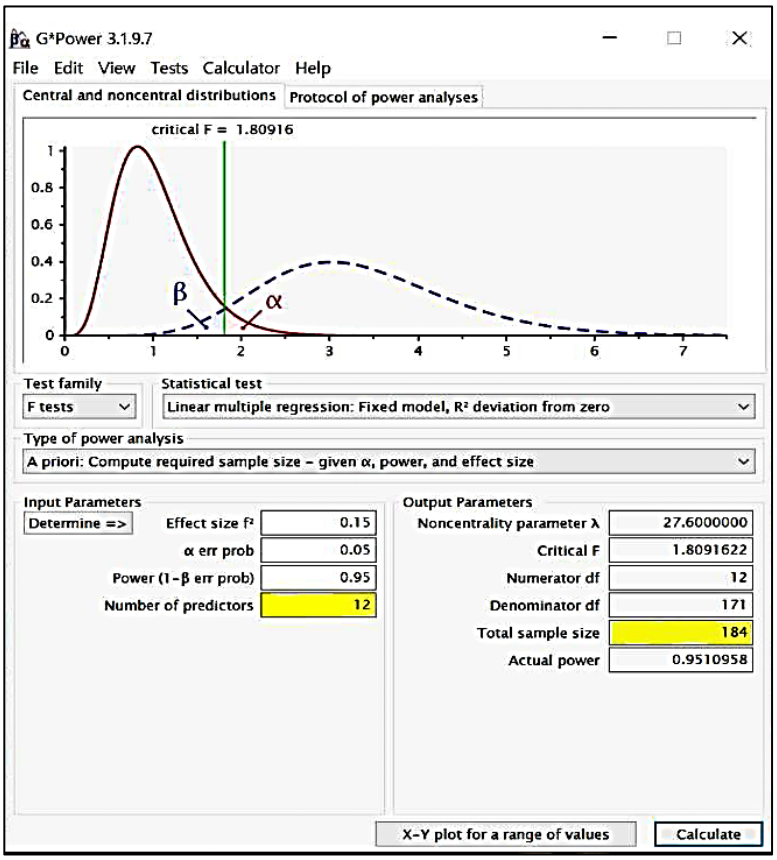


Figure 1. Derivation of appropriate survey sample size using G*Power

This paper consists of 12 variables, so a total of 234 are proposed. In another related study, Faul et al. (2007) suggest an appropriate sample size using the G*Power tool. G*Power is freeware that provides the ability to calculate power for various statistical tests, including t-tests, F-tests and chi-square (x^2) tests. In addition, it includes a function to suggest an appropriate sample size according to the number of variables. As shown in Figure 1, after executing the program and entering the set values for the variables of this research model, the result of the appropriate sample size was confirmed, and the appropriate number of samples for 12 variables was derived as a total of 18. Combining the results of previous studies and G*Power, the minimum sample size is judged to be significant from 184 to 400. research was conducted.

## 2. Body

### 2.1 Research model

After reviewing previous studies and theoretical backgrounds, IS Success model, ServQual model, and UTAUT2 model were established as research models for factor analysis on the effect on acceptance intention of artificial intelligence-based smart farming system.

Service reliability, service responsiveness, service expertise, system availability, and system security, which are independent variables, use perceived ease and perceived usefulness as parameters, and environmental characteristics such as investment value, policy support, industry standardization, and social impact are evaluated through direct channels. It was built to analyze the effect on acceptance intention. The AI service experience was set as a moderating variable, and differences in effects between groups according to demographic characteristics were analyzed.

## 2.2 Research hypothesis

For the purpose of this study, 17 direct effects and hypotheses were established, and hypothesis verification and mediating effect analysis were performed accordingly.

## 2.3 Direct effect settings

Analyzing the direct path between a total of 12 independent variables, parameters, and dependent variables proposed in the research model, the first path leads to the perceived value of ease, which is an independent variable such as reliability, responsiveness, expertise, availability, and security. is the path The second path is the path leading to usefulness, which is the perceived value, with antecedent variables such as reliability, responsiveness, expertise, availability, and security, which are independent variables, and perceived ease, which is a parameter. The third is the path leading to the intention to accept the dependent variables, such as the preceding variables such as investment value, policy support, industrial standardization, and social influence, and the parameters such as perceived ease and perceived usefulness.

## 2.4 Relationship between AI service quality and perceived ease of use

According to Han (2019) study on factors influencing pedestrian satisfaction with IoT-based smart crosswalk systems, Parasuraman et al. (1988) found that reliability and responsiveness among the five dimensions of service quality were perceived usefulness as a parameter of the technology acceptance model TAM. was found to have a significant effect on Jang and Noh (2010) studied that service quality has a significant effect on the perceived usefulness based on the technology acceptance model among information system success models through previous research on IPTV service. According to Baek (2019), reliability, real-time (responsiveness), and professionalism were derived as indicators used to evaluate service satisfaction in seven characteristics of AI service characteristics analysis and quality evaluation attributes. The hypotheses derived from analyzing these preceding studies are as follows.

H1: Reliability will have a positive (+) effect on perceived ease.
H3: Responsiveness will have a positive (+) effect on perceived ease.
H5: Expertise will have a positive (+) effect on perceived ease.

## 2.5 Relationship between smart aquaculture system quality and perceived ease

According to a preceding study by Kwon (2020), security and availability, which are key variables of system quality among information system success models, have a significant effect on the UTAUT model. According to Jung (2019), the relationship between the independent variables security and stability and the technology acceptance model was analyzed. The hypotheses derived by analyzing these preceding studies are as follows.

H7: Availability will have a positive (+) effect on perceived ease.
H9: Security will have a positive (+) effect on perceived ease.

## 2.6 Relationship between AI service quality and perceived usefulness

According to Lee and Kwon (2020)'s previous research on the impact of artificial intelligence on decision-making, he said that the expertise and reliability of artificial intelligence have a significant effect on perceived usefulness, which is a key parameter of the technology acceptance model. Baek (2020) said that reliability, real-time, and professionalism are key evaluation indicators that can pursue beneficial and convenient benefits for users who use services in the age of artificial intelligence in a study on service quality evaluation in the age of artificial intelligence. The hypotheses derived from analyzing these preceding studies are as follows.

H2: Reliability will have a positive (+) effect on perceived usefulness.
H4: Responsiveness will have a positive (+) effect on perceived usefulness.
H6: Expertise will have a positive (+) effect on perceived usefulness.

## 2.7 Relationship between smart aquaculture system quality and perceived usefulness

Kim (2017), in a study on factors affecting the intention to use biometric authentication in payment services, said that perceived security, a system characteristic, has a significant impact on the integrated technology acceptance theory. The hypotheses derived from analyzing these preceding studies are as follows.

H8: Availability will have a positive (+) effect on perceived usefulness.
H10: Security will have a positive (+) effect on perceived usefulness.

## 2.8 Empirical Analysis

### 2.8.1 Data collection

In order to verify the hypothesis of this study, measurement items were derived based on a total of 12 variables, a questionnaire was constructed as shown in the appendix, and the survey was conducted. Prior to the main survey, a preliminary survey was conducted on 50 people, including those who wish to return to the village and those involved in maritime and fisheries, and then the main survey was conducted by checking and improving errors. The survey period was online for about 3 months from December 2020 to February 2021. A survey was conducted through the total number of respondents was 457, and 42 invalid questionnaires that answered insincerely were eliminated, and 415 valid results were obtained.

**2.8.2 Sample Characteristics**

Among the 415 people surveyed, 269 males (64.8%) and 146 females (35.2%) were found in terms of gender. According to the statistics of the Homecoming Village Comprehensive Center, as of 2017, out of 1,359 households, 819 (60.3%) were male and 540 (39.7%) were female. In this survey, the gender ratio of participants, which is similar to the gender ratio of statistics (within 5%), can be confirmed, and the ratio of male and female interest in homecoming villages can be confirmed. By age, 12 people under the age of 20 (2.9%), 70 people between the ages of 21 and 30 (16.9%), 98 people between the ages of 31 and 40 (23.6%), 120 people between the ages of 41 and 50 (28.9%), 106 (25.5%) were under the age of 60, and 9 (22%) were over the age of 61. Referring to the Rural Research Institute (2018) report and statistics on returning home, it was found that people in their 40s and 50s showed the highest interest in returning home. You can check the parts that are in line with the research. In terms of education, there were no elementary school or middle school graduates, 25 high school graduates or less (6.0%), bachelor's (including professional) graduates or less 179 (43.1%), master's graduate or less 163 (39.3%), doctoral degree or higher 48 (11.6%). In the case of artificial intelligence service experience, 'no experience' was 37 (8.9%), 1 to 5 times or less 84 people (20.2%), 6 to 10 times or less 75 people (18.1%), 11 to 50 times or less 132 people ( 31.8%), 36 people (8.7%) between 51 and 100 times, and 51 people (12.3%) over 101 times. Gender can be directly classified into two groups according to men and women, and the remaining age, educational background, and artificial intelligence service experience are classified into six groups. Using a methodology that compares effects by reducing the dimensions into two groups by referring to previous studies did

**2.8.3 Exploratory factor analysis**

Even if the validity and reliability of the research model are secured and the analysis is performed with an appropriate tool, if there is an error in the collected information, the validity and reliability are not verified and the wrong conclusion is reached (Bang 2019). Accordingly, it is necessary to check whether the survey data has validity and reliability. To this end, exploratory factor analysis and reliability analysis of grouped factors (Cronbach's alpha test) were performed. First, exploratory factor analysis is defined as a step to confirm whether observed variables such as independent variables, parameters, and dependent variables are objectively measurable and correlated with each other, according to Yang (2018), Lee (2018) . For this purpose, factor analysis is performed through the Varimax rotation method, KMO is 0.5 or more, Bartlett is less than 0.05, and factorial wit is 0.5 or more to judge adequacy, and all Eigen Values must be 1 or more (Jo 2016). According to Hair (1998), the reliability test analyzes that the measurement of each variable has internal consistency if the Cronbach's alpha coefficient value of the grouped factor is 0.7 or higher. In the exploratory factor analysis process, RE5, AV1, AV5, SP6, IV1, IV2, IV6, PS1, PS2, PS6, SI5, PU1, PU2, AI5, which are measurement variables with factor loadings less than 0.5, were removed for a total of 49 measurement items. Exploratory factor analysis was performed. As a result, the Kaiser-Meyer-Olkin measure of sample adequacy is 0.944, and the significance probability is 0.000, lower than 0.05. In the case of commonality, the range of 0.587 to 0.787 was all secured over 0.4. The factor loadings were validated by deleting all items less than 0.5 and loading them with values greater than 0.5, and the eigenvalues were values between 4.219 and 1.885, all greater than 1, and one factor explained more than one variable. It was confirmed that it was possible (Cho 2016).

The cumulative value was confirmed to be 70.463% overall, and in this study, it can be seen that 12 components with an eigenvalue of 1 or more account for 70% of the total data variation (Bang 2019). In addition, Cronbach's alpha coefficient was derived to perform reliability analysis along with exploratory factor analysis. The Cronbach's alpha coefficient of each factor showed a value of 0.743 to 0.896, and all satisfied the value of 0.7 or higher, confirming the reliability test for internal consistency of each variable.

**2.8.4 Confirmatory factor analysis**

Prior to hypothesis testing, the discriminant validity and conceptual reliability of the measurement model were analyzed through confirmatory factor analysis. Confirmatory Factor Analysis is an analysis method that verifies whether measured variables correspond well to latent variables in order to model the variables to be analyzed from existing theories or empirical research results (Kim 2018). Depending on how to do this, it can be divided into two

main categories. First, conceptual reliability analysis is a method for verifying synthetic reliability and variance extraction index for measurement items, and second, discriminant validity analysis is a method for verifying low correlations between latent variables (Lee 2018).

**2.8.5 Concept Reliability Analysis**

In the concept reliability analysis, the criteria for composite reliability (CR: Composite Reliability) value of 0.7 or more and AVE (Average Variance Extracted) value of 0.5 or more are judged to be suitable. The formula for obtaining synthetic reliability and mean variance extraction index is shown in Figure 2.

$$C.R = \frac{(\sum \text{Standardization } \lambda)^2}{(\sum \text{Standardization } \lambda)^2 + \sum \text{Error coefficient}} \geq 0.7$$

$$AVE = \frac{\sum \text{Standardization } \lambda^2}{(\sum \text{Standardization } \lambda^2 + \sum \text{Error coefficient})} \geq 0.5$$

Figure 2. Synthetic Reliability and Average Variance Extraction Index Formula

The synthetic reliability of this study model was all over 0.7 with a minimum value of 0.751, and the average variance extraction index was all over 0.5 with a minimum value of 0.503, confirming convergent validity. Looking at the details of the synthetic reliability analysis results, the RE synthetic reliability was 0.811, the RT synthetic reliability was 0.862, the SP synthetic reliability was 0.896, the AV synthetic reliability was 0.751, the SE synthetic reliability was 0.888, the ST synthetic reliability was 0.885, and the IV synthetic reliability was 0.885. was 0.766, PS synthesis reliability was 0.753, SI synthesis reliability was 0.846, PE synthesis reliability was 0.872, PU synthesis reliability was 0.836, and IA synthesis reliability was 0.874. , RE AVE is 0.519, RT AVE is 0.556, SP AVE is 0.634, AV AVE is 0.503, SE AVE is 0.616, ST AVE is 0.608, IV AVE is 0.523, PS AVE is 0.505, SI AVE is 0.580, and PE AVE is 0.580. 0.579, PU AVE was 0.631, and AI AVE was 0.636.

**2.8.6 Discriminant validity analysis**

The discriminant validity test is a method of comparing whether the square of the maximum value of the correlation coefficient of all factors is smaller than the minimum value of the AVE (Lee 2018). In this model, the correlation coefficient of 0.581 between RE ↔ SP is the highest, and the value of 0.337, which is the square of 0.581, is smaller than the lowest value of AVE, 0.503, thus securing discriminant validity.

**2.8.7 Structural Model Path Analysis**

According to Cho (2015) and Bang (2019), the structural model is a research model constructed in this study that shows the relationship between independent variables and dependent variables, which are regarded as causes and consequences of phenomena, and the method of analyzing them is the path analysis. Regression analysis can be repeatedly applied to confirm the overall effect, direct effect, and mediating effect of variables that have causal relationships between multiple exogenous and endogenous variables (Lee 2018). Accordingly, direct effect analysis and mediating effect analysis were performed by performing exploratory factor analysis > factor analysis model fit verification > confirmatory factor analysis > structural model suitability verification > structural model path analysis.

**2.8.8 Direct effect hypothesis testing**

First, the effect between direct pathways was analyzed. According to Kim (2020), the hypothesis is adopted when the CR (Critical Ratio) value is ±1.96 or more and $p < 0.05$. First, confirming the hypotheses and paths adopted, H1's RE ⟶ PE path, H4's RT ⟶ PU path, H5's SP ⟶ PE path in AI service quality, H7's AV ⟶ PE path in smart aquaculture system quality, SE ⟶ PU pathway in H10, IV ⟶ AI pathway in H11, SI ⟶ PE pathway in H14, PE ⟶ PU pathway in H15, PE ⟶ AI pathway in H16, PE ⟶ AI pathway in H16, PU ⟶ AI in H10 between parameters and dependent variables path was identified. Second, confirming the rejected hypotheses and pathways, H2's RE⟶PU path, H3's

RT⟶PE path, H6's SP ⟶ PU path in AI service quality, H8's AV ⟶ PU path, H9 in smart aquaculture system quality The SE⟶PE pathway of H12, the PS⟶AI pathway of H12, and the ST⟶AI pathway of H13 were confirmed.

**2.8.9 Mediating Effect Hypothesis Test**

According to Heo (2016) and Kim (2020), the mediating effect (indirect effect) means that an independent variable affects the dependent variable by one or more parameters, and measures the magnitude of the mediating effect using AMOS. Significance test was performed for detailed analysis of the results.

For significance verification, bootstrap was performed by applying the BC (Bias Correct Percentile) technique of AMOS, the verification result was derived that there was significance for a total of 8 intermediate pathways. . Looking at this, it was confirmed that reliability, expertise, and availability have a significant effect on acceptance intention through perceived usefulness as a medium. It was confirmed that security has a significant effect on acceptance intention through perceived ease of use, and perceived ease also has a significant effect on acceptance intention through perceived usefulness as a medium. Finally, in order to confirm the details of the mediating effect, the BC (Bias Correct Percentile) technique of AMOS was applied and bootstrap was performed to compare and analyze the overall effect, direct effect, and indirect effect, as shown in Table 1. The analysis results were derived. According to Heo (2016) and Kim (2020), mediating effects and direct effects are adopted when p is less than 0.05 significant probability. In addition, when only the significance probability of the mediating effect is less than 0.05 and the significance probability of the direct effect is 0.05 or more, the complete mediation effect is determined.

Table 1. Total effect, direct effect, indirect effect analysis (BC method)

| Association Hypothesis Code | Route | Total Effect | | | Direct Effect | | | Indirect Effect | | | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Effect | p value | Result | Effect | p value | Result | Effect | p value | Result | |
| H15 | RE-PE-PU | 0.256 | 0.007 | Adopt | 0.064 | 0350 | Reject | 0.192 | 0.012 | Adopt | Complete mediation |
| | RT-PE-PU | 0.180 | 0.021 | Adopt | 0.145 | 0.061 | Reject | 0.035 | 0.343 | Reject | |
| | SP-PE-PU | 0.283 | 0.005 | Adopt | 0.112 | 0.099 | Reject | 0.171 | 0.008 | Adopt | Complete mediation |
| | AV-PE-PU | 0.131 | 0.049 | Adopt | 0.020 | 0.640 | Reject | 0.112 | 0.012 | Adopt | Complete mediation |
| | SE-PE-PU | 0.250 | 0.007 | Adopt | 0.206 | 0.004 | Adopt | 0.044 | 0.115 | Reject | |
| H16 H17 | RE-PE-AI RE-PU-AI RE-PE-PU-AI | 0.161 | 0.018 | Adopt | - | - | - | 0.161 | 0.018 | Adopt | Indirect Effect |
| | RT-PE-AI RT-PU-AI RT-PE-PU-AI | 0.064 | 0.119 | Reject | - | - | - | 0.064 | 0.119 | Reject | |
| | SP-PE-AI SP-PU-AI SP-PE-PU-AI | 0.158 | 0.014 | Adopt | - | - | - | 0.158 | 0.014 | Adopt | Indirect Effect |
| | AV-PE-AI AV-PU-AI AV-PE-PU-AI | 0.089 | 0.018 | Adopt | - | - | - | 0.089 | 0.018 | Adopt | Indirect Effect |
| | SE-PE-AI SE-PU-AI SE-PE-PU-AI | 0.087 | 0.013 | Adopt | - | - | - | 0.087 | 0.013 | Adopt | Indirect Effect |
| H17 | PE-PU-IA | 0.396 | 0.011 | Adopt | 0.259 | 0.016 | Adopt | 0.138 | 0.031 | Adopt | Partial mediation |

Looking at the details, it was confirmed that the RE⟶PE⟶PU indirect effect pathway, SP⟶PE⟶PU indirect effect pathway, and AV⟶PE⟶PU indirect effect pathway showed fully mediated effects, and PE⟶PU⟶AI partially mediated effects. . In addition, it was confirmed that there was an indirect effect in the interval leading to RE⟶AI, the interval leading to SP⟶AI, the interval leading to AV⟶AI, and the interval leading to SE⟶AI, for which direct effects could not be confirmed.

**2.8.10 Hypothesis verification by AI service experience**

It is the artificial intelligence service most commonly used by the general public, and explains the user recognition and motivation of using the artificial intelligence speaker system, and suggested the research result that the main age group of the artificial intelligence speaker service is in their 30s. However, as the age increases, the experience rate of artificial intelligence service drops rapidly, and in the case of those in their 50s, it was found that the experience of artificial intelligence was low. According to Kim (2020), in a previous study on the experience of using AI service-

based administrative services, 58% experienced simple information utilization and 28% experienced information inquiry and civil petition handling. However, the actual frequency of use per week is 0.9 times, and by analyzing this, it can be seen that there are many people who have experienced a small number of times, but those who use it continuously are few. Based on this, the analysis by experience of recognition technology was divided into a group that used artificial intelligence services as a test experience and a group that consistently experienced services, and those who used AI services less than 10 times (196 people) and those who used AI services more than 11 times (219 people) After grouping, comparative analysis was conducted. As a result of analysis by age for each hypothetical path, as shown in Table 2, the SP ⟶ PE path of H5 and the IV ⟶ AI path of H11 were adopted between groups with less than 10 AI service experiences and 11 or more AI service experiences, respectively. Contrary to this, it is judged that there is a significant difference between the two groups.

Table 2. Results of hypothesis verification based on AI service experience

| Hypothesis | Route | less than 10 times | | | | More than 11 times | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Route coefficient | CR (t) | P | Adopted or not | Route coefficient | CR (t) | P | Adopted or not |
| H1 | RE>PE | 0.362 | 2.894 | 0.004 | Adopt | 0.587 | 4.243 | *** | Adopt |
| H2 | RE>PU | 0.179 | 1.604 | 0.109 | Reject | 0.011 | 0.081 | 0.935 | Reject |
| H3 | RT>PE | -0.157 | -1.187 | 0.235 | Reject | -0.112 | -0.759 | 0.448 | Reject |
| H4 | **RT>PU** | 0.159 | 1.383 | 0.167 | Reject | 0.060 | 0.444 | 0.657 | Reject |
| **H5** | **SP>PE** | **0.500** | **3.965** | *** | Adopt | **0.043** | **0.372** | **0.710** | Reject |
| H6 | **SP>PU** | 0.057 | 0.510 | 0.167 | Reject | 0.128 | 1.204 | 0.229 | Reject |
| H7 | AV>PE | 0.454 | 2.256 | 0.024 | Adopt | 0.221 | 2.483 | 0.013 | Adopt |
| H8 | AV>PU | 0.023 | 0.131 | 0.896 | Reject | 0.098 | 1.189 | 0.234 | Reject |
| H9 | **SE>PE** | -0.122 | -1.122 | 0.262 | Reject | 0.065 | 0.741 | 0.459 | Reject |
| H10 | SE>PU | 0.188 | 1.991 | 0.047 | Adopt | 0.182 | 2.223 | 0.026 | Adopt |
| **H11** | **IV>AI** | **0.094** | **0.610** | **0.542** | Reject | **0.470** | **3.054** | **0.002** | Adopt |
| H12 | PS>AI | 0.087 | 0.425 | 0.671 | Reject | -0.069 | -0.513 | 0.608 | Reject |
| H13 | ST>AI | -0.143 | -1.245 | 0.213 | Reject | -0.356 | -1.760 | 0.078 | Reject |
| H14 | SI>AI | 0.406 | 2.819 | 0.005 | Adopt | 0.579 | 3.786 | *** | Adopt |
| H15 | PE>PU | 0.532 | 4.874 | *** | Adopt | 0.472 | 4.231 | *** | Adopt |
| H16 | PE>AI | 0.141 | 0.827 | 0.408 | Reject | 0.184 | 1.740 | 0.082 | Reject |
| H17 | PU>AI | 0.343 | 1.744 | 0.081 | Reject | 0.178 | 1.579 | 0.114 | Reject |

*** : $p<0.001$

On the other hand, for the H1, H2, H3, H4, H6, H7, H8, H9, H10, H12, H13, H14, H15, H16, H17 routes, there was no difference in adoption results between groups with less than 10 AI service experiences and 11 or more AI service experiences. It is not visible and is judged to be of no significance.

## 3. Conclusion

In the 2000s, the fast-growing consumption of fishery products, global warming, marine pollution, illegal overfishing, and other traditional methods of producing fishery products, such as fishing, showed limitations. It became. As a result, the production method of aquatic products is being transformed from the existing fishing industry to the aquaculture industry. In particular, the 4th industrial revolution technology, which has recently been spreading across all industries, has promoted convergence in the aquaculture industry, and accordingly, the smart aquaculture system has emerged and entered the diffusion phase. However, there are matters to be considered in terms of policy, economy, society, and technology for the full-fledged spread and development of smart aquaculture systems.

First, in terms of policy, it is necessary to improve the relevant legal system surrounding the aquaculture industry. Accordingly, the Ministry of Maritime Affairs and Fisheries enacted the negative-based Aquaculture Industry Development Act in 2019 to overcome the limitations of the positive-based Fisheries Act, and accordingly, individuals or companies that have promoted the aquaculture industry so far can do business in a realistic and non-restrictive legal system environment. The basis for the full-fledged development of the aquaculture industry was formed. In particular, for special aquaculture species that require large-scale capital, it is possible to restrict the participation of large companies, making it possible to scale and commercialize the smart aquaculture industry.

Second, in terms of economy, 40% of total seafood consumption is imported from abroad according to the annual per capita consumption of seafood in Korea, which is currently ranked first in the world. Accordingly, a public-private joint project to create a large-scale smart aquaculture cluster complex of 20,000 pyeong is being promoted in three

locations, including Busan City, Gyeongnam Goseong, and Jeonnam Shinan. It is expected to be used as a leading example for the development of the domestic aquaculture industry, as it includes a processing plant, distribution system, and related R&D research center along with a factory-type smart aquaculture system.

Third, it is a consideration from the social aspect. The Ministry of Maritime Affairs and Fisheries is activating the 6th industrialization of fishing villages and return-to-earth policy in order to actively respond to the hollowing out and aging of fishing villages, which are increasingly intensifying. The 6th industrialization of fishing villages is a national project that converges the tangible and intangible assets of fishing villages and promotes linkage with secondary manufacturing and tertiary tourism by moving away from the primary industry-based fishing industry. The smart aquaculture system is in line with the 6th industrialization of fishing villages as it moves away from the fishing industry, which is the existing primary industry, and embraces the tertiary industry, which includes distribution as well as orientation toward the secondary industry. In addition, at the present time when the number of returnees is increasing, various related educations are being conducted, especially considering that the area of greatest interest to returnees is the aquaculture industry. However, the existing aquaculture is a heuristic-based business where experience is very important, and for this reason, it is quite difficult for early fishermen to directly promote the aquaculture industry and produce results. Accordingly, the latest smart aquaculture system is a trend in which user demands for ease and usefulness are increasing.

Finally, considerations in terms of technology are the direction of establishing an optimal architecture by utilizing artificial intelligence technology, digital twin technology, big data and edge computing technology, security technology, etc. to synthesize these user needs and derive a future standard model. is a derivation In order to easily and efficiently carry out aquaculture, which requires considerable experience and technology, by converging with artificial intelligence services and applying the latest technologies such as digital twins, anyone can easily make aquaculture by self-determining and operating the system that is most suitable for the environment and situation. It should be possible to perform, and industrial standardization for optimal system configuration should be promoted.

Against this background, research was conducted to establish the development direction of the smart aquaculture system by identifying the exact acceptance intention of the users for the general public who are interested in returning to the village as well as the existing aquaculture producers. To this end, an online survey was conducted from December 2020 to February 2021 to set 12 variables, set 17 direct effects, hypotheses, and analyze the effects of 11 mediating effects for AI service quality, smart aquaculture system quality, and environmental characteristics. An investigation was conducted. For each variable, a total of 67 items were measured, and among them, 63 factor analysis questionnaires using a 7-point Likert scale and 4 demographic questionnaires were used. The total number of respondents was 457, and 42 invalid questionnaires that answered insincerely were eliminated, and 415 valid results were obtained. Through hypothesis verification, the following results were derived.

First, looking at the hypothesis verification of the direct effect, reliability, expertise, and availability, which are independent variables of artificial intelligence service quality, and reliability, expertise, and availability among the quality availability and security of smart aquaculture systems have a significant effect on perceived ease, which is a parameter. The result was derived, and the result was derived that responsiveness and security have a significant effect on perceived usefulness. Looking at the results of previous studies, it was found that all independent variables affect perceived ease and perceived usefulness, respectively, but there are differences in the presence or absence of influence on the parameters of each independent variable in the acceptance intention of the AI-based smart farming system. As a result, it is necessary to consider and refer to the results in the policy project promotion of the smart aquaculture system or academic research. In terms of the influence of investment value, policy support, industrial standardization, and social influence, which are independent variables of smart farming environment characteristics, on the dependent variable, intention to accept, it was analyzed that investment value and social impact had a significant effect, while policy support and industrial standardization had a significant effect. The result was obtained as having no effect. Relevant results can be used when promoting tasks related to the revision of related laws and systems in the country.

Second, the effect of perceived ease, a parameter, on perceived usefulness was analyzed to be significant, and the effect of perceived ease and perceived usefulness on acceptance intention, a dependent variable, was also analyzed to be significant. This is consistent with the results of previous studies, and the perceived ease and perceived usefulness, which are parameters for the acceptance intention of the artificial intelligence-based smart aquaculture system, are significant, and both the returnees and existing aquaculture farmers accept the parameters as important. It can be inferred that it is considered intentional.

Third, when analyzing the effect of AI service experience on the research model, it was found that it was in the AI service experience as a result of analyzing the influence by classifying into two groups. Through this, when conducting policy and academic research on AI-based smart aquaculture systems, it is necessary to consider the differences of each group and establish each direction to approach. Based on these research results, the implications of the academic and policy aspects are analyzed and utilized in research and industrial fields, so that it can be used for the proposal of

the legal system direction of the smart aquaculture industry, standardization, and technology development. In addition, considering the limitations of this study centered on the acceptance intention from the user side, a new study considering the future trend-based technology research related to smart forms such as digital twins and underwater robots or continuous use intentions for experts in the future Research activities and R&D projects should be pursued to derive a direction and continue to develop the AI-based smart aquaculture industry.

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