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Platform Adoption Factors in the Internet Industry

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Abstract: This study examines the factors influencing the choices of Internet platform services by applying the technology acceptance model. For this purpose, the analysis is conducted with 222 people who use different types of Internet platforms by utilizing structural equation modeling. The results show that perceived usefulness had positive effects on the intention to use, perceived ease of use, diversity, and security risks affected by the perceived usefulness, and the indirect influences on the intention to use. In addition, satisfaction (in relation to service quality) was found to affect both perceived ease of use and perceived usefulness. This research is significant because it will make it possible to predict users' perceptions of Internet platforms, which is important for establishing relevant strategies.

Keywords: platform; technology acceptance model; perceived diversity; perceived security; perceived satisfaction

1. Introduction

The business of Internet platforms has made a huge difference in today's online society. One commonality has been identified during comparison of the business models of today's top companies, such as Facebook, Google, Apple, Alibaba, Airbnb, and Uber: All of these companies are implementing the platform business model. In this business model, a platform does not offer products or services directly to consumers but to producers or user groups who are in need [1,2]. Operators generate value and, ultimately, revenue by allowing producer and user groups to generate active transactions within the platform. Hence, if one looks at the growth strategies of companies within the Internet industry, it is easy to determine that most companies are aiming to become platform companies [3]. The platform business model has attracted the fastest business proliferation as a growth model for almost all types of companies, regardless of the field [4]. Therefore, there is a lot of competition in the industry to preoccupy a platform that can be considered an "Internet revolution," and many companies are investing costs and effort to achieve this. In addition, one cannot deny that a platform is a remarkable strategic model in terms of the national-social-personal aspects, because even in the academic world, research and development is very active worldwide. A platform business model is appealing because it provides a place where producers (or content providers) can create value, and consumers (or content users) can use that value to meet and connect freely.

The platform business has a business model that creates value by connection; it also has a structure where producers and users are complicatedly connected, called the "two-sided market." In this context, research on platform strategy to build a two-sided market [5,6] should be conducted to ensure a successful platform business, as no influential studies have been conducted since the study on cross-subsidy strategy [7]. Especially, in the two-sided market research, many studies focus on the content provider and supply side, and very little research has been conducted in the last 20 years on construction of the end-user using the actual platform and consuming the content (e.g., References [8,9]). On the platform, end-users play an important role in promoting the consumption of content, which is a

key factor in building a platform ecosystem. In this respect, this study seeks to differentiate the factors influencing platform adoption from the demand side. It intends to investigate the effect users have on choice intention by applying the technology acceptance model (TAM) [10,11] to successfully build a platform business model. For this purpose, the current research applies the TAM theory based on previous research on the TAM, which plays a major role in the adoption of new technology and sets up research models and hypotheses. This study tried to identify the platform adoption factors using structural equations for platform service users. Thus, this study determines the effect of "diversity", online "security risk", and service quality "satisfaction" on the independent variables of the two-sided market, based on the characteristics of online platform services and their influence on perceived usefulness and ease of use. Finally, the purpose of this study is to analyze the relationships amongst perceived usefulness, usability, and intention to use. Therefore, this study is expected to be a very useful for predicting the influence of the relationship between platform propensity and platform intention. As a result, all three factors, perceived diversity, security risk, and perceived satisfaction, have statistically significant effects. In particular, the intention to use online platform services is affected by the variable of perceived usefulness, and perceived ease of use, perceived diversity, security risk, and perceived satisfaction have significant effects on perceived usefulness. Satisfaction has also a positive effect on ease of use.

2. Theoretical Background

The term "platform" is used by industrial managers and researchers in various industries. The reason for this is that platform innovation and strategy create value mainly through direct interactions [4] between two or more distinct types of affiliated participants, which is known as a two- or multi-sided platform [12,13]. The platform provides an essential or "core" function to an encompassing system of users. This system is a set of components and rules used in most user transactions [12,14]. These components consist of hardware, software, and service modules, along with the structure of how they fit together [15]. Rules are employed to manage platform participants' activities [16]. Furthermore, a platform needs a "network effect" that tends to radically strengthen the advantages for the platform itself, as well as for participants and stakeholders [2]. Hence why the platform has become an important element of corporate sustainability—because it can meet the needs of a firm's stakeholders such as users, providers, and all participants [17,18]. In addition, a platform typically emerges in the context of modular industries [16] or industry ecosystems [19] in order to generate revenue and continued growth. Therefore, platforms have emerged as a new, potent organizational strategy for open innovation and business transactions in a number of industries [20,21].

2.1. Technology Acceptance Model

The TAM [9,22] is based on the theory of reasoned action of Fishbein and Ajzen [23], which is a methodology for identifying the factors affecting the relationships between the attitude toward technology and the intention to use the technology. This means that the concept of cognitive constructs such as beliefs, intentions, and behaviors are shown when certain attitudes refer to the totally integrated implementation of concepts. In other words, the TAM explains the relationship between the attitude toward behavior and behavioral intentions presented in the theory of rational behavior [22]. This model explains the adoption behavior of new information, technologies, services, and products using the theory of rational behavior and basic variables proposed by previous studies [24]. This theory suggests that perceived usefulness and perceived ease of use are determinants of attitude and intentions to use. In the TAM, perceived usefulness and perceived ease of use, as shown in Figure 1, are affected by external variables, and perceived usefulness is directly affected by the usage attitude and intention to use.

As new technology becomes easier to use, according to the core of TAM [10], a more positive perception of usefulness results in a positive attitude toward use, an increased intention to use, and, eventually, an increase in behavior. The TAM is simple, but because it demonstrates powerful

explanatory ability, it has been used to describe the adoption of and persistent intent of using new technologies, products, or services in their early stages. In particular, Karahanna et al. [25] describe the process of accepting the Windows computer operating system; Chiu et al. [26] apply the TAM to a new technology called "online shopping", revealing external factors that influence consumers to shop online; and Park et al. [27] present a model explaining consumers' adoption of wireless Internet. Thus, research on the determinants of service adoption on either mobile devices or the Internet using the TAM has been steadily progressing in various fields. Previous studies on TAM suggest that perceived ease of use and perceived usefulness will affect the intention to use online platform services.

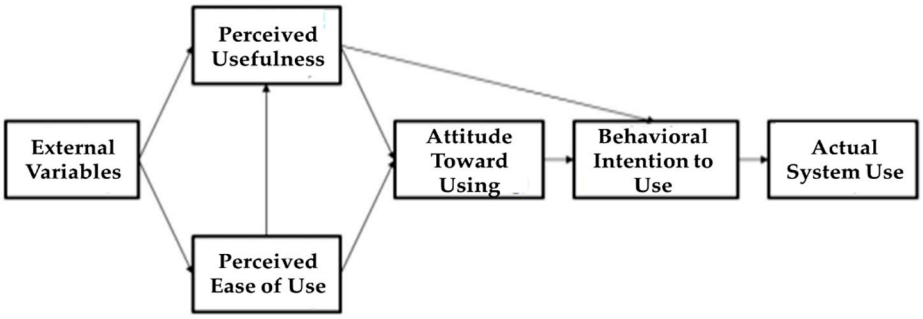

Figure 1. The technology acceptance model. Source: Davis et al. [10].

2.2. Systematic Structure of the Online Platform Service

Platform business is composed of three theoretical concepts—two-sided market, network effect, and business ecosystem (see Figure 2)—which are the keys to its systematic nature. A platform business model is likely to involve a transaction occurring in a two-sided market [28], in which various stakeholders can join the platform as part of the supply or demand side [9,29,30]. A two-sided market is an environment established to allow multiple groups such as suppliers and consumers to participate and exchange values that each group desires to obtain through fair "transactions." The network effect emerges from these transactions, because transactions in two-sided markets create value by facilitating interactions between different sides [7,31]. The best feature of network effects in the platform business is that either direct or indirect network effects (which are also called same-sided and cross-sided network effects) emerge. Recently, studies have been conducted on value co-creation in the service platform business [32] and platform revenue structures [2]. Finally, a platform business model is appealing because it provides a place where producers can create value, and consumers can use that value to meet and connect freely. Once again, a platform business model, which is characterized as bi-directional, allows producers and consumers to be variously connected, and it has a structure wherein producers and users are connected at a very random level, called a two-sided market.

It is difficult to find empirical studies on the attitude of individual users using the TAM for online platform services. However, looking beyond the limited research on the use of online platform services, several studies have been conducted on the adoption of various types of information technology services. For instance, Pikkarainen et al. [33] develop a model for online banking adoption among private banking customers in the online banking industry. They find that the relative advantages of mobile banking, personal beliefs, and structural guarantees affect the initial trust in mobile banking, the initial trust in mobile banking affects the intention to actually use mobile banking, and the relative advantages also affect the intention to use mobile banking. Wu and Wang [34] develop a model indicating online banking adoption among private banking customers in mobile commerce. In particular, they find that innovativeness of individuals, mobility of mobile devices, convenience, and connectivity are variables that affect the intention of using the mobile payment system. Ha and Stoel [35] try to reveal that e-shopping quality determines the perceptions of usefulness, trust, and enjoyment, which in turn influence consumers' attitudes toward e-shopping. The authors conceptualize the ubiquitous connectivity that combines ubiquity and mobility amongst

the characteristics of mobile devices through a study of intention to accept mobile commerce. As a result of applying these factors to the TAM, they confirmed that perceived usefulness, ubiquitous connectivity, and provision of context-based services have a significant influence on the intention to accept. In addition, Park and Kim [36] identify and investigate a number of cognitive factors that contribute to shaping user perceptions and attitudes toward mobile cloud computing services by integrating these factors with the TAM. The abovementioned studies show that TAM is used as an important analytical model when studying the adoption of online services. Therefore, this study concludes that analysis of the TAM model will be significant in the same context for online platform services.

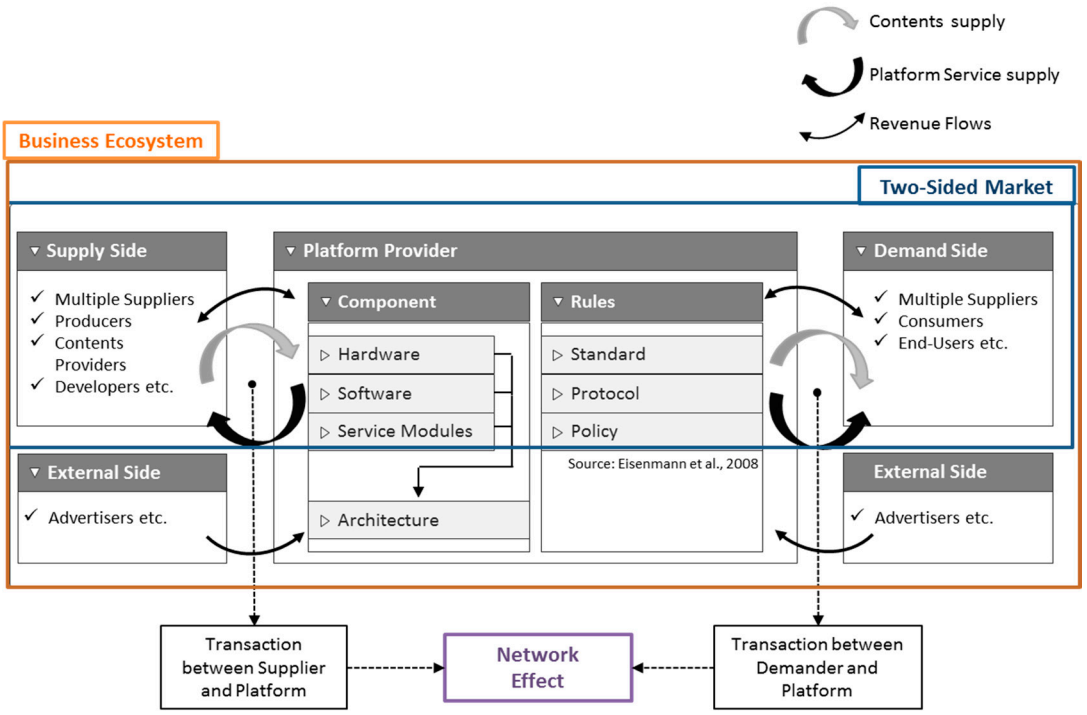

Figure 2. The platform business comprising a two-sided market, network effect, and business ecosystem. Source: Author's elaboration, based on References [2,13].

3. Research Design and Method

3.1. Research Hypothesis

The theoretical model provides insights into the aspects of platform business usability and design, as well as offers the whole picture for empirical research [37,38]. This study applies a process to confirm whether it is appropriate to apply the "online platform service adoption strategy" to the TAM, as presented in previous studies. According to the TAM theory, consumers perceive the ease of use and usefulness of accepting new technologies, and therefore have the intent to use (purchase) them (Davis et al. [10]). TAM was introduced to analyze the adoption factors of the platform. Hypotheses 1–3 are derived based on the above discussions. To construct the "user adoption model" of online platform services, influential external factors affecting the TAM are derived. Research has been conducted on the influence of external variables on the TAM, depending on the type of technology. Several studies verify that the diversity of the two-sided market has a positive effect on the use of a platform (e.g., References [39,40]). Due to the network effect, the platform can acquire different content exponentially when it reaches critical mass, and much of the content satisfies various needs of the consumers. Therefore, a more diverse set of complementary content can increase the rate of platform adoption by users. These studies show that the platform can expand its contents and services beyond the existing value chain through the two-sided market, which has a positive and significant effect on the use of the platform by users. Moreover, security risk is an external variable

that affects consumers' behavior on the Internet [33,41,42]. For example, perceived security was used as a significant variable in the online situations of various consumers, such as online shopping, wireless Internet usage, and online banking service usage.

It is anticipated that this study will identify a significant external factor because of the existence of various platform participants. Such varied platform participants exist, due to the characteristics of the two-sided market of the online platform, and therefore security issues such as information leakage and personal information leakage are important—thus, it is expected to act as a significant external variable. Finally, it is hypothesized that consumers' perceived satisfaction with a service affects its usefulness and ease of use. Research on platforms shows that platform providers continue to have a direct impact on users' satisfaction through cross-subsidy, and it suggests a model to serve as a parameter to encourage users to participate in the platform [43–45]. The value in using new services can be conceptualized as perceived usefulness and ease of use, and so users' satisfaction levels are expected to have an impact on perceived usefulness and ease of use. Hypotheses 4–8 are designed based on the findings of these previous studies.

Hypothesis 1 (H1). *Perceived ease of use will have a positive impact on perceived usefulness.*

Hypothesis 2 (H2). *Perceived usefulness will have a positive impact on intention to use.*

Hypothesis 3 (H3). *Perceived ease of use will have a positive impact on intention to use.*

Hypothesis 4 (H4). *Perceived diversity will have a positive impact on perceived usefulness.*

Hypothesis 5 (H5). *Perceived diversity will have a positive impact on perceived ease of use.*

Hypothesis 6 (H6). *Perceived security risk will have a positive impact on perceived usefulness.*

Hypothesis 7 (H7). *Perceived satisfaction will affect perceived usefulness.*

Hypothesis 8 (H8). *Perceived satisfaction will have a positive impact on perceived ease of use.*

3.2. Research Design and Data Collection

In this study, the following six variables have been measured: Perceived usefulness, perceived ease of use, perceived diversity, security risk, perceived satisfaction, and intention to use. For this purpose, a questionnaire survey was conducted after excluding some questions with low reliability and validity. The questions were asked on a seven-point Likert scale, from strongly disagree to strongly agree. To collect the data, users of RecordFarm participated in this survey between the 15 and 22 March 2017. RecordFarm is a free social audio platform service for uploading, listening, and sharing music and audio tracks. When individual artists upload music on RecordFarm, their fans listen and buy the music and leave comments. Fans and listeners also share the content and use it to create albums. More listeners use the platform as new and diverse music that is difficult to find on other music streaming services is uploaded on RecordFarm. Consequently, more artists use the RecordFarm service to find these listeners and continue to create a variety of content. This behavior creates positive cross-side network externalities. The main revenue models of the platform are advertisements and commission fees.

Through the convenience sampling method, 222 individual users (non-corporate users) of over 15 years of age were surveyed. Perceived usefulness is defined as the degree to which it is efficient and beneficial to use the Internet platform service, and perceived ease of use is the degree to which the user feels that the method of using the online platform service is easy. Of the 222 respondents, the ratio of men to women is 1.2 to 1, and the age cohort showed the highest percentage of 15~24-year old. This is consistent with the general age of the core online users, 15 to 30 years (See Table 1).

Four items were constructed to measure the intention to use. These include the desire to use the online platform service, willingness to use the service continuously, willingness to use the service actively, and surrounding publicity about the service. The following four questions were used to measure these items: (1) I plan to use this platform service consistently; (2) I hope that the platform services will continue to evolve; (3) I will use this platform every week, and will use it variously, and (4) I will recommend this platform service to other users.

Davis [11] defined perceived usefulness as the perception that it is better to accept technology than not. This study adopts this definition and establishes the concept as one of the values to be obtained by using the online platform service. Three items were constructed to measure the usefulness, that is, the value of using platform services: Time saving, quality content, and financial benefits. Specifically, the following three questions were used to measure these items: (1) Using platform services will help search for content faster; (2) I will find better content through platform services; and (3) financial benefits and savings will be possible using platform services. This study defined perceived ease of use as the degree to which one believes physical and mental endeavor will not be required to use a specific technology. To measure the ease of use of platform services, three items were constructed that cover both ease of information search and ease of use. The following questions were thus used: (1) It is easy to get the desired information through platform services; (2) it is easy to learn how to use platform services; and (3) it is easy to explain how to use platform services.

Three items were also constructed to measure perceived diversity. This is a measure of user perception of the diversity, newness, and accuracy of the content provided to users. Therefore, the following three questions were used to measure the perceived efficiency: (1) There is a wider variety of content than other services; (2) platform services provide new content faster; and (3) platform services provide accurate content. Security risk is defined as the level of a user's perception regarding the security level of online service providers [46] and the degree of concern platform service users have about privacy or privacy infringement [47]. Three questionnaires were constructed as tools to measure perceived security, which cover the possibility of leakage of personal information, leakage of information about service use, and possibility of infiltration of viruses or hacking programs. Therefore, the following three questions were used to measure perceived security: (1) Platform services may leak personal information; (2) transaction information can be leaked; and (3) viruses and hacking programs may penetrate through platform services. In this study, three items were constructed to measure the concept of perceived satisfaction [48–51], which was found to cover satisfaction with the content provided by the service and satisfaction with the usage method while continuously using the platform service. These were measured, using the following questions: (1) I am satisfied with the overall service of the platform; (2) I am satisfied with the content on the platform; and (3) I am satisfied with the way of using the platform.

To classify the quality properties of the platform service, an exploratory factor analysis was conducted using IBM AMOS 18. The six variables of perceived usefulness, perceived ease of use, perceived diversity, security risk, perceived satisfaction, and intention to use are presented in the study, because this enables a combination of personality analysis, regression analysis, and path analysis to examine the structural relationship. A principal component analysis was executed and a varimax rotation was used to simplify the expression of a particular sub-space in terms of a few major qualities. According to the data analysis, men and women each showed different perceptions of the quality. In addition, to classify the quality properties of the platform service, an exploratory factor analysis was conducted using AMOS 18. The six variables of perceived usefulness, perceived ease of use, perceived diversity, security risk, perceived satisfaction, and intention to use are presented in the study, because this enables a combination of personality analysis, regression analysis, and path analysis to examine the structural relationship. A principal component analysis was executed and a varimax rotation was used to simplify the expression of a particular sub-space in terms of a few major qualities. According to the data analysis, men and women each showed different perceptions of the quality.

Table 1. Survey of demographic characteristics (n = 222).

Demographic Characteristics		n	%
Gender	Male	98	44.14
	Female	124	55.86
Age (years)	15–24	82	36.94
	25–34	78	35.13
	35–44	48	21.62
	Over 45	14	6.31
Occupation	Student	124	55.86
	Worker	98	44.14
	- Office worker	68	30.63
	- Professional	10	4.51
	- Self-employed	20	9.11

4. Data Analysis

To verify the validity of each construct, we conducted a confirmatory factor analysis on the items. The results showed that all Critical Ratio (C.R.) values were over 1.965, and p values were less than 0.05 (see Table 2). As a result of the factor analysis, the fit index of the measurement model was at a good level: Chi-square = 245.8 (df = 165, $p < 0.001$), GFI = 0.91, CFI = 0.97, RMR = 0.041, RMSEA = 0.062, and Q (χ^2/df) = 1.490.

Table 2. Verification of reliability and validity.

Variable	Item	Estimate	S.E.	C.R.	p	AVE	α	Construct Reliability
Intention to use	IU1	1.000				0.86	0.901	0.94
	IU2	1.680	0.084	20.111	***			
	IU3	1.083	0.096	11.321	***			
	IU4	0.99	0.051	19.29	***			
Perceived usefulness	PU1	1.294	0.084	15.413	***	0.82	0.889	0.93
	PU2	0.95	0.049	19.27	***			
	PU3	0.94	0.046	20.48	***			
Perceived ease of use	PE1	1.246	0.088	14.211	***	0.88	0.927	0.96
	PE2	1.16	0.058	20.11	***			
	PE3	1			***			
Perceived diversity	PD1	1				0.88	0.911	0.94
	PD2	0.98	0.039	25.08	***			
	PD3	1.12	0.073	15.43	***			
Security risk	SR1	1				0.72	0.835	0.87
	SR2	0.98	0.051	19.24	***			
	SR3	0.88	0.057	15.32	***			
Perceived satisfaction	PS1	1.09	0.062	17.68	***	0.82	0.912	0.93
	PS2	1						
	PS3	1.12	0.052	21.42	***			

*** $p < 0.001$.

The results of the structural equation model analysis showed that the fit of the six variables was adequate: Chi-square = 268.7 (df = 170, $p < 0.001$), GFI = 0.92, CFI = 0.97, RMR = 0.043, RMSEA = 0.066, and Q (χ^2/df) = 1.580. As shown in Figure 3, all paths except for the perceived ease of use to intention to use and perceived diversity to perceived ease of use were analysed as meaningful.

The results showed that perceived usefulness ($\beta = 0.351$, $p < 0.001$) had a statistically significant effect on intention to use. It is interpreted that the higher is the perceived usefulness of online platform services, the more positive are the perceptions of platform services. The perceived ease of use, another factor in the TAM, did not have a statistically significant effect on the intent of use. That is, perceived ease of use has no direct effect on purchase intentions but has an indirect effect by affecting

perceived usefulness (β = 0.419, $p < 0.001$). Therefore, research Hypotheses 1 and 3 were adopted, but Hypothesis 2 was rejected.

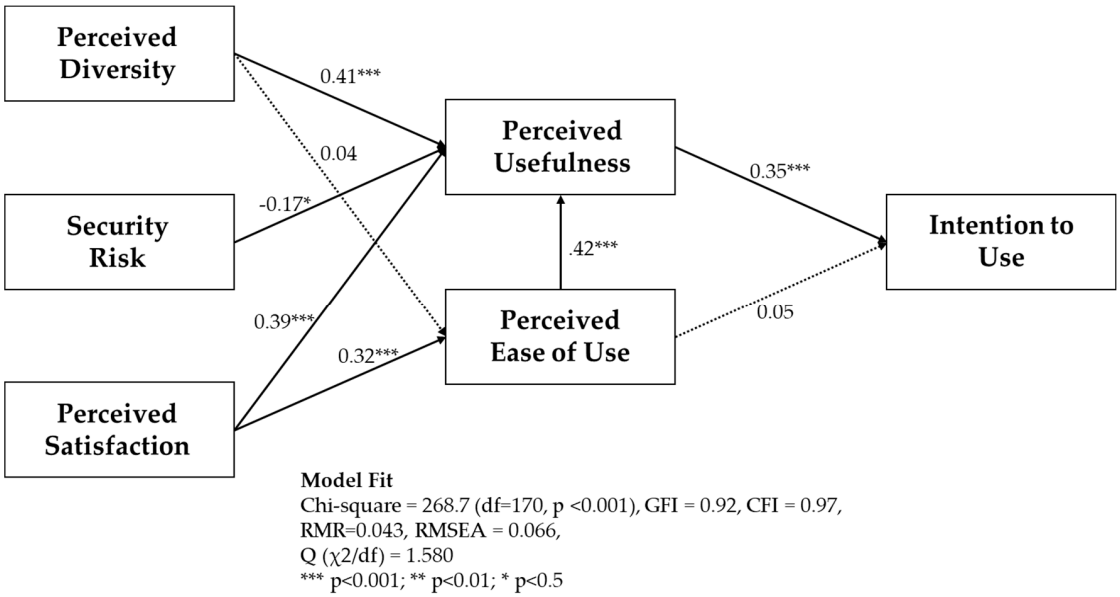

Figure 3. Empirical results of this study.

From the perceived usefulness perspective, perceived diversity (β = 0.398, $p < 0.001$), which is a characteristic of the two-sided market, security risk (β = −0.171, $p < 0.001$), and perceived satisfaction (β = 0.387, $p < 0.001$) also had a statistically significant effect on attitude. This implies that the higher are the diversity of the platform and satisfaction with the service impact, the more positive are the perceived usefulness and ease of use of the platform service. More satisfaction also has a positive effect on the perceived ease of use. On the contrary, security risk has a statistically significant value but has a negative effect. This is interpreted to mean that the more unsafe are the online platform services, the more negative is the attitude toward online platform service demands. Moreover, the perceived diversity did not affect the ease of use, but perceived satisfaction was found to have a significant effect on ease of use (β = 0.322, $p < 0.001$). Therefore, research Hypotheses 4–8 were adopted, and Hypothesis 5 was rejected.

This means that the more useful is the online platform service, the more useful it becomes. In other words, it is important to make the platform more useful. Therefore, it is necessary for the service company to increase the platform users, as well as use diversity, security, and service satisfaction to increase the platform's usefulness. The path coefficients and verification results for each path are shown in Table 3.

Table 3. Hypothesis results.

Hypothesis and Path	Path Coefficient	C.R.	*p*	Result
H1: Perceived ease of use → Perceived usefulness	0.351	5.212	***	Adopted
H2: Perceived usefulness → Intention to use	0.048	0.581	0.584	Rejected
H3: Perceived ease of use → Intention to use	0.419	8.574	***	Adopted
H4: Perceived diversity → Perceived usefulness	0.412	8.246	***	Adopted
H5: Perceived diversity → Perceived ease of use	0.042	0.528	0.598	Rejected
H6: Perceived security risk → Perceived usefulness	−0.171	−2.886	*	Adopted
H7: Perceived satisfaction → Perceived usefulness	0.387	6.015	***	Adopted
H8: Perceived satisfaction → Perceived ease of use	0.322	4.988	***	Adopted

Note: *** $p < 0.001$, * $p < 0.05$.

5. Discussion and Conclusions

The results show that the variable of perceived usefulness has a statistically significant effect on the intention to use online platform services, and the variables affecting perceived usefulness are perceived ease of use, perceived diversity, security risk, and perceived satisfaction. In particular, satisfaction was found to have a positive effect on ease of use as well. The research shows that, unlike the model proposed by Davis et al. [11], only perceived usefulness has an effect on the intention to use. The result of the study shows that the perception that online platform services will be useful various ways will lead to a positive perception and attitude toward actual platform service use. On the other hand, perceived ease of use does not affect the intention to use, which means that it does not have a positive effect on the actual use decision, even though people perceive that the service, such as regarding online platform usage or subscription methods, is easy to use. This analysis shows that the results obtained for users of social media and mobile commerce are similar to those for people not affected directly through the intention to use but indirectly through perceived usefulness [34,52]. In other words, it can be inferred that perceived ease of use of the online platform service does not have a significant effect on the intent to use, since users who use the platform already have a lot of experience with the Internet and are very familiar with the usage of information technology devices.

As a result of the analysis, all three factors, perceived diversity, security risk, and perceived satisfaction, show statistically significant effects. This indicates that higher content diversity on the platform impacts perceived usefulness more but does not affect the perceived ease of use. The result demonstrates that the platform's content diversity based on the two-sided market has no effect on the perceived ease of use, due to its complexity, but it is still an important factor for the intention to use because it affects the perceived usefulness strongly. Security risk has a negative effect on the attitude of adoption, which means that the greater is the concern about protection of personal information when using the online platform service, the more negative is the attitude. However, it can be confirmed that the explanatory power is the lowest among the exogenous factors. Perceived satisfaction, which indicates the extent to which the users' expectations and desires are satisfied, has an effect on perceived usefulness and ease of use. The results of this analysis can be interpreted to show the greater explanatory power of other factors besides satisfaction. This suggests that anxiety about privacy and online hacking can lead to a negative attitude toward platform services. In summary, just like the TAM of Davis et al. [10], perceived ease of use has been shown to affect perceived usefulness, and perceived usefulness has a direct impact on the intent to use. This implies that the ease of use also indirectly affects the intention to use, since ease of use affects usability and usability affects usage intention. Diversity has the greatest impact on perceived usefulness. The result of this analysis suggests that users need to emphasize various contents and services in order to increase their intention of using online platform services. It also shows that anxiety regarding online services needs to be actively addressed through information security. In addition, the platform provider must recognize that satisfaction with high service quality is an important factor directly affecting both perceived ease of use and perceived usefulness, due to the nature of the service industry.

This study was conducted to address the limitations of existing research on platform services. Existing platform studies are focused on content providers based on the two-sided market, and there is very little research over the past 20 years on the construction of end-users who use the actual platform and consume the content. In this study, the factors affecting platform adoption are explored, and it is meaningful to study the possibility of predicting users' perception of Internet platforms and establishing strategies. The purpose of this study is to identify the factors that affect the adoption of users' platform services by applying the TAM, which has been used to predict new technologies, innovative products, and service utilization intentions. However, this study still has the following limitations. Firstly, we did not study the type and tendency of the platforms. Therefore, if we were to perform a comparative analysis according to the type of platform, we will be able to derive results with more implications. Secondly, the variables that affect the attitude of online platform service adoption are set as the perceived usefulness, perceived ease of use, diversity, security risk, and satisfaction.

However, various other influential variables may exist. The fact that these variables have not been covered can be pointed out as a limitation of this study. Therefore, in future follow-up studies, various types of platforms and variables should also be examined.

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