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Why would the users of Google's cloud services intend to switch to alternative services?^a

Chulmin Lim^b, Seongcheol Kim^{c*}

Abstract

As the amount of data collected by individuals increases and working and education environments are digitalized, the demand for personal cloud storage services (PCSS) has been expanded as well. Users can upload their data to the storage in the cloud service and use or share the data seamlessly through multiple devices. Global service providers such as Google and Microsoft have led this market based on their high cloud computing technology and extensive user network, providing free basic service to all users. Google, however, has changed its Google Photos from free to paid service according to the new cloud service policy. Considering diverse opinions and evaluations on the change, this study aims to analyze the users' response to Google's PCSS and service charging policy. This study examines the factors affecting cloud service users' intention to switch to alternative services based on the push-pull-mooring (PPM) framework in the context of South Korea. The result of this study provides some practical and policy implications for cloud service providers, IT-related institutions, and government.

Keywords: Google cloud service, Personal cloud storage service (PCCS), Switching intention, Push-Pull-Mooring (PPM) framework

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1. INTRODUCTION

As new technology has been developed and applied to diverse types of service, it has many effects on and brought many changes to our daily life. From the cloud computing technology, for instance, users can now borrow and use IT resources such as software, storage, server, and network anytime and anywhere (Ghaffari & Lagzian, 2018). Cloud computing refers to a technology or related service that provides an application or hardware and software system that helps users utilize computing resources as much as they want through the network (Lin & Chen, 2012). The original purpose of cloud computing was to improve efficiency and reduce costs by utilizing unused resources of computer servers, and now cloud services have become the essential infrastructure of the ICT industry. Securing a higher capability of storing and managing the data has become more important for companies providing the artificial intelligence (AI) and big data-related services or institutions that retain important or confidential data with safety. For these users, it is much more efficient and cost-saving to use cloud computing-related services since it might be costly to purchase their own extra IT resources or devices.

Not only the demand of companies or institutions, personal users' demand for this cloud computing has also expanded as well. As the types of data that personal users hold become more diverse and their amount increases, they need to store and use them more efficiently and safely. To respond to this demand from users, many service providers have provided diverse types of personal cloud storage service (PCSS) based on their strengths and characteristics. Individuals who need larger space to store their diverse types of data, including documents, photos, and videos, can upload all of these on the storage in the cloud service and use and share them seamlessly through multiple devices such as smartphones, laptops, and PC through this service. Accordingly, users can choose the most preferred service considering several attributes such as price, function, interface, and design. Currently, PCSS market is led by global companies such as Google, Microsoft, Dropbox, and Apple. They have provided services to personal users with a strategy to secure users with free service up to a certain amount of storage and require non-free subscriptions for extra space for storage.

Based on this strategy, global PCSS providers have expanded their market share and impacted local markets in many countries. In South Korea, for example, major telecom service providers such as SKT, KT, and LGU+ failed to differentiate their PCSS from those of global PCSS providers and withdrew their services (Sun & Kin, 2021). At this point, Google recently

changed its Google Photos, the free PCSS focusing on photos and video, to a non-free service (Hunter, 2021). Users of Google Photos could unlimitedly upload photos of less than 16 million pixels and videos less than 1080p (FHD). However, due to the new service fee-charging policy, Google Photos is now provided with no fee, only up to 15 gigabytes (GB) of storage, which is shared with Google Drive and Gmail data storage. It means that users should subscribe to paid services to use the additional storage of Google's PCSS, including Gmail, Google Drive, and Google Photos.

In terms of PCSS providers, maintaining free service could be considered a burden when the number of free service users and the amount of data uploaded to the cloud increases. In this sense, retaining free service users as well as generating stable fixed sales would help maintain their business with sustainability. In terms of current users, however, they would negatively perceive this new policy and feel less enough for basic storage provided with no charge. Therefore, users are more likely to decide whether stay with their current service by subscribing to paid PCSS or switching to alternatives. Service providers need to find the crucial factors affecting users' switching intention when users need to decide whether stay on their current PCSS or switch to another service (Cheng et al., 2019). Even though there are diverse opinions and evaluations on the new policy of Google's PCSS, few studies have examined its strategic implication and users' responses to it. In this sense, this study aims to analyze the local (South Korean) users' response to Google's change of PCSS charging policy and provide the corresponding practical and policy implications for several stakeholders. In particular, this study examines the factors affecting cloud service users' intention to switch to alternative services.

2. LITERATURE REVIEW AND RESEARCH QUESTION

2.1 Overview of cloud service market in South Korea and Google's cloud service

Cloud services are divided by the range of service that is offered, infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS) (Lin & Chen, 2012). IaaS provides hardware resources for the most basic computing, such as networks, storage, and servers. Through IaaS, users can flexibly operate their systems without constructing a data center. Amazon's AWS (Amazon Web Service), Microsoft's Azure, and Google's Google Cloud Platform (GCP) are representative IaaS services. PaaS provides a

platform for the development of the operating system (OS) and software or data analysis and various application programming interfaces (API) for developers for a better developing environment. SaaS refers to a cloud service that provides hardware and OS and application software through the network. Since installation and upgrade are not required to use this service, it is efficient in terms of cost and time for system deployment. Google's cloud services, such as Gmail, Google Cloud, Google Photos, Microsoft's OneDrive, and Dropbox, are included in SaaS. The total market size of global public cloud computing is \$410.9 billion; by service, SaaS is \$152.1 billion, IaaS is \$91.6 billion, PaaS were \$86.9 billion in 2021, and the market is expected to grow to \$599.8 billion in 2023 (Gartner, 2022). South Korea's total market size for cloud computing has rapidly increased from \$217 million in 2018 to \$3.13 billion in 2019 and reached \$3.21 billion in 2020. Sales by business type were \$1.52 billion for IaaS, \$1.15 billion for SaaS, and \$217 million for PaaS in 2020 (NIPA, 2022).

Although the cloud computing market is expanded based on the service for companies or institutions, cloud computing is also becoming an essential element in an individual's daily life. As the amount of data people have to store increases, the demand for PCSS, which allows users to store and manage data efficiently, has also increased. In addition to storing and sharing data, users can work and collaborate with other users through this PCSS. Therefore, the market size of the global PCSS market reached \$20.8 billion in 2022 and is estimated to grow to \$50.8 billion by 2027 (Markets and Markets, 2022). In South Korea, PCSS has started to diffuse widely since 2012. Accordingly, the rate of people using PCSS remained low at 5% in 2012 but reached 20% in 2020 (KISDI, 2021). Regarding the monthly active users of PCSS providers, Google Drive (12.2 million) was the dominant player in Korea, followed by Naver My box (4.9 million) and MS One Drive (3 million) in April 2021 (Lee, 2021). On the other hand, Other local PCSSs such as Samsung's Samsung Cloud, SKT's Cloudberry, LG Uplus's Uplus storage, and Uplus box all closed in 2021, while KT's M storage also closed in 2020 (Sun & Kim, 2021).

While local telecommunication service providers and Samsung terminated their PCSSs, Google, the dominant player in the global market, stopped providing unlimited free use of Google Photos from June 1st of, 2021, in the worldwide market. In other words, cloud storage of Google's Gmail, Google Drive, and Google Photos are integrated, so only 15 gigabytes of cloud storage are available for these services for each user without charge (Abramson, 2021). It is estimated that Google's new cloud service policy compensates for the lowered profitability in the online advertising business, which accounts for an essential portion

of sales. Or, as the number of free service users and data uploaded to cloud servers increase, maintaining this free PCSS might be considered a burden to Google. In this sense, it is also assumed that Google would want to secure more subscribers and generate more fixed revenues from PCSS by lock-in current users.

On the other hand, if too many users are dissatisfied with the current service and try to use another service, reversely, the new policy could negatively impact its business. It implies that the effect or result of Google's new policy on PCSS depends on the current users' perception of the service, and it is crucial to estimate and manage the factors affecting users' switching intention to alternative services. On the other hand, there was insufficient research to examine the users' perception of dominant PCSS after the new service policy was activated. Therefore, this study aims to estimate the PCSS users' response in the context of the South Korean cloud service industry, where global and local service providers are fiercely competing.

2.2 Related studies on cloud service

As cloud computing technology has been diffused widely, studies on individual perception or behavior toward this technology have been actively conducted. In this sense, empirical research has been conducted to understand the users' adoption of and experience with PCSS in diverse ways. For instance, Park & Kim (2014) explored the factors affecting users' cloud service acceptance by applying an extension of the technology acceptance model (TAM). They verified that satisfaction, quality of service and system, perceived mobility, security, and connectedness impact users' adoption of mobile cloud service. Chen et al. (2021) conducted an empirical study to find the determinants of users' intention to use PCSS with a unified theory of acceptance and use of technology 2 (UTAUT2). This research proved the effect of social influence, price value, expectancy, habit, and hedonic motivation on users' intention to use PCSS, and considering personal characteristics such as gender, age, and experience of PCSS as a moderator would help to understand users' perception more precisely. To comprehensively understand the relationship between users and PCSS, Ghaffari and Lagzian (2018) conducted a phenomenological study in the context of a developing country. By conducting qualitative research, they emphasized demand-, supply-, and institutional factors in predicting users' intention to adopt PCSS. Furthermore, Park et al. (2016) verified that security risk factors, including information leakage risk, compliance risk, fault risk, and

service interruption risk, has a negative impact on users' intention to adopt PCSS and found the different tendency between South Korean and Chinese users.

As users are available to choose and use more diverse cloud services than before, competition among service providers became even fiercer. However, few studies have been focused on competitive dynamics or strategies among service providers within the cloud market (Kshetri, 2016; Li & Kumar, 2018). By considering the importance of understanding this technology from the perspective of service providers and industry, some studies have been conducted to find the meaning and estimate the effect or outcome of switching cloud services. For example, several studies examined the effects of both benefits and costs of switching at the organization level. In the context of the organization using traditional enterprise resource planning (ERP), Chang (2020) found that system quality, financial advantage, and industry pressure have significant impact on switching cost and switching cost positively impact on top managers' switching intention to cloud ERP. On the other hand, this study also verified that perceived risk, satisfaction, and breadth of use significantly influence on switching cost and switching cost negatively impact on switching intention. In a similar context, Chang and Hsu (2019) verified that perceived usefulness and ease of use positively impact switching intention to cloud ERP, while privacy concern negatively impacts on it.

As diverse types of PCSS have emerged in the market, users are more likely to find and choose a more appropriate service by comparing and evaluating incumbent services or alternatives. In this regard, some studies have tried to understand the meaning of this market environment and focused on switching from cloud service to alternative PCSS. For instance, Wu et al. (2017) conducted empirical research with the push-pull-mooring (PPM) framework. They verified that risk, trust, critical mass, switching cost, and social norms influence users' switching intention. With the same framework, Cheng et al. (2019) suggested the complex model explore the switching intention and found that privacy risk and security risk, referent network size, complementarity, usefulness, technical compatibility, lifestyle compatibility, and enjoyment, habit and switching cost influence intention to switch significantly. From these previous studies, it was shown that analyzing PCSS users' switching intention has both academic and practical implications, and the PPM framework is a valid approach to understanding users' switching intention. Even though several studies found some general implications of switching intention, few studies focused on specific services such as Google's PCSS, which is a dominant service in the global market. When the dominant service provider

introduces a new services policy related to the cloud service, examining the switching intention of its users is expected to offer practical and specific implications for business strategies and policies. Therefore, this study examines the switching intention of Google's PCSS users by applying the PPM framework, which has been frequently adopted in previous studies.

2.3 Migration theory and Push-Pull-Mooring (PPM) framework

Migration reflects “the movement of a person (a migrant) between two places for a certain period of time” (Boyle et al., 1998). Some studies have distinguished this concept of migration based on a different point of view to understand it. Migration can be seen either as a temporary movement or a permanent movement according to how much time is involved (Cohen, 1996). It means that a person can decide whether to move back to the previous place or not, and it is the standard of dividing migration into temporary or permanent. In addition, migration can be divided based on its characteristics into voluntary migration or involuntary migration (Lee, 1966). Involuntary migration is that a person has no choice but to move on to another place involuntary due to environmental or contextual change or effect while voluntary migration is decided by a person’s preference or wish. In the field of users’ or consumers’ behavior research, switching is more likely to refer the voluntary migration rather than involuntary migration. Based on this understanding of migration, diverse studies have been conducted to explore the users’ switching intentions and behavior. These studies commonly argue that push-pull-mooring (PPM) framework is proper tool to understand and estimate the relationship between users’ perception of certain services, products, or organizations and switching (Bansal et al., 2005).

PPM is most widely used frameworks to explore the possible variables and explain the phenomena that users decide to move from a current service to another (Bansal et al., 2005). This framework consists of push, pull, and mooring factors that determine the users’ switching intention (Bansal et al., 2005; Moon, 1995). The push factor is related to the component or characteristic of the current service or product that leads the user or consumer to move on to another one. The pull factor is associated with the alternative of the incumbent service or product and its attractive attribute that drag users out of the current service or product. Unlike these two factors, the mooring factor is more related to the personal, environmental, and situational elements that the user or consumer is exposed to (Moon, 1995). This mooring factor

can have either a positive or negative effect on their switching intention. By adopting this framework, some studies have been conducted to understand the users' intention to switch from current PCSS to alternatives (Cheng et al., 2019; Wu et al., 2017). Therefore, this study adopts the PPM framework to understand switching intention and explore the factors affecting it in the context of Google's PCSS and its South Korean users. Furthermore, this study investigates the relationship between users' switching intention and intention to subscribe to paid PCSS, Google One, to estimate the effect and role of switching intention. From these attempts to understand the meaning of users switching intentions comprehensively, the result of this study can provide academic, practical, and policy implications related to the cloud service industry and users. Accordingly, this study presents the research question as follows:

RQ: What factors would impact Google's personal cloud storage service users' intention to switch to alternatives?

3. RESEARCH HYPOTHESIS AND RESEARCH MODEL

3.1 Push factor

Privacy is defined as the right to be alone and the right to be free from unfair intrusion and infringement by others (Brandeis, 1890). As various personal information and data can be used and stored online, users of information services or systems are exposed to risky environments. If these data are not effectively managed in an online or mobile environment, users will have privacy issues. In this regard, Theoharidou et al. (2010) argued that it is necessary to diagnose risks that can occur when data is stored in a cloud environment has some traits such as data duplication, proliferation, and accessibility from multiple locations. It implies that cloud service providers need to manage users' privacy-related issues, which could be highly related to users' adoption or intention to use. In this sense, Cheng et al. (2019) verified that privacy risk increases mobile PCSS users' switching intention. In this regard, It is expected that users who perceive a high privacy risk of current PCSS are likely to perceive their relationship with the service negatively. Therefore, it is assumed that perceived privacy risk would induce users to switch to alternative PCSS. Therefore, this study hypothesized:

H1. Perceived privacy risk with Google's PCSS positively impacts users' intention to switch to an alternative.

Some studies have tried to understand the role and effect of security risk in the context of the internet or information services (Shin, 201). For instance, Johnson et al. (2018) proved that perceived security positively impacts the intention to use information system services. In addition, security risk has been considered a crucial factor related in adopting cloud computing services (Kantarcioglu et al., 2011; Mishra & Pandey, 2016). These findings show that protecting cloud systems from security issues such as invasion of someone who is not allowed to use or access stored data or data breach is one of the critical roles of service providers (Kshetri, 2013). If cloud service users have experienced a security-related issue directly or perceive a particular service has a high-security risk from prior problems within the service. In this sense, the security risk is one of the essential components in the context of PCSS and its users and verified that perceived security risk could increase users' voluntary switching intention of mobile PCSS (Cheng et al., 2019). Therefore, this study hypothesized:

H2. Perceived security risk with Google's PCSS positively impacts users' intention to switch to an alternative.

System quality refers to the general performance of the service system (DeLone & McLean, 2003). System quality in information systems and services has been considered an essential factor that influences user satisfaction or adoption (DeLone & McLean, 1992). In addition, Lee and Chung (2009) verified that system quality of service positively impacts both users' trust and satisfaction with mobile banking service with the model of DeLone and McLean (DeLone & McLean, 1992). These findings commonly argue that system quality is one of the fundamental components of information service, and service providers should improve service systems' performance consistently. In the context of PCSS, users would want service to have high system quality by providing cloud service with fewer errors and high stability. It is assumed that if PCSS is provided to users with low system performance, users would have dissatisfaction with the current service and try to switch to an alternative. Therefore, this study hypothesized:

H3. Low system quality with Google's PCSS positively impacts users' intention to switch to an alternative.

Interface design quality refers to whether navigation or application is designed well in terms of service users. Some studies have been done to understand the role and effect of interface design quality (Bharati & Chaudhury, 2004). Bharati and Chaudhury (2004) found that user interface design factor has significant effects on emotions, and Fung and Lee (1999)

verified that the quality of interface designs which is related to ease to navigation, quickly to download, and reliability, can increase users' initial trust on electronic commerce web service. Even though several studies examining PCSS users' switching intention have not considered interface design quality as a determinant of it (Cheng et al., 2019; We et al., 2017), how much the PCSS is user-friendly in interface designs, including the layout, menu, and color could impact on users' perception and evaluation on current service. If users do not have enough satisfaction with this component of service, they are more likely to switch to alternative services. Therefore, this study hypothesized:

H4. Low interface design quality with Google's PCSS positively impacts users' intention to switch to an alternative.

3.2 Mooring factor

In the field of management studies, switching cost is generally defined as the cost which is generated by changing the current service or service provider (Dick & Basu, 1994) or the composite burden of users from switching (Jones et al., 2000). The switching cost has been widely known as a basic determinant of switching in studies on migration (Park & Koo, 2016). In terms of users, switching takes time, money, and effort, and if users perceive these are taken too much for their switching, they will want to stay on the current service. In the context of PCSS, switching cost has been considered a constraint or barrier to switching to an alternative service (Cheng et al., 2019; Park & Ryoo, 2013). If users upload too much data on the current PCSS and it might not be easy to transfer this to other services, and they need to learn how to use the new PCSS and get used to this. When users perceive these economic, physical, and psychological costs to be high for switching PCSS to an alternative, they would not switch their service and maintain the relationship with the current service. Therefore, this study hypothesized:

H5. Perceived switching cost with Google's PCSS negatively impacts users' intention to switch to an alternative.

Trust has been considered a crucial determinant of users' perception or behavior (Chai & Pavlou, 2002). In the context of information technology, trust is known to help service providers to have a long-term relationship with customers (Jarvenpaa et al., 2000) and increase intention to purchase through mobile commerce (Siau & Shen, 2003). In the context of PCSS,

it is assumed that users perceive service providers as non-trustable. They would not want to maintain the current relationship based on PCSS and are more likely to switch to an alternative service that is provided by a more trustable and honest provider. In the situation that Google recently changed its policy of PCSS, users' perception of the service provider might have a significant impact on evaluation or opinion on its service, PCSS. This study assumes that if users have low trust in Google, the PCSS provider, they will want to switch to an alternative PCSS. Therefore, we hypothesized:

H6. Low trust in service provider (Google) positively impacts users' intention to switch to an alternative.

3.3 Pull factor

Alternative attractiveness is defined by the outstanding characteristics of an alternative (Bansal et al., 2005). In this sense, Moon (1995) verified that the compelling trait of alternative pulls the customer (user) from the current service to others. It means that attractive characteristics of alternative induce users to want to switch to it (Moon, 1995). On the other hand, if the option is not considered as compelling as the incumbent service, users would not want to switch. In this regard, alternative attractiveness has been considered a switching enabler in diverse contexts of customer services such as online games (Hou et al., 2011), auto-repair services and hairstyling services (Bansal et al., 2005), and PCSS (Cheng et al., 2019; Park & Ryoo, 2013). Even though users are unsatisfied with incumbent PCSS, they might maintain the relationship with incumbent service when they don't recognize the compelling alternative to switch to. If users want and find attractive alternative PCSS, they are likely to switch to other services with better system quality or interface design. Therefore, this study hypothesized:

H7. Alternative attractiveness positively impacts users' intention to switch to an alternative.

3.4 Intention to subscribe to paid service (Google One)

As Google changes its cloud service fee policy (Google Photos), users have to decide whether to continue using the service (subscribe) or use other services. As users consider the estimated value, cost, and even risk of subscription-based service (Rudolph et al., 2017), they can decide whether subscribe to the Google One service and use Google's PCSS consistently

or switch to an alternative service. Users with free services may feel burdened to pay for services in the form of subscriptions that did not previously cost money. In this case, users are expected to find other free services or subscribe to more suitable alternative services. On the other hand, if users want to continue using it, they can start a subscription after payment. Currently, Google provides a paid PCSS called Google one. The service integrates the storage of Google Mail, Google Drive, and Google Photos. Even though acceptance of a service or technology is mainly based on users' perceived value or benefit from it (Turel, Serenko, & Bontis, 2007), this study tries to find the relationship between users' switching intention of current free service and subscription intention of paid service. The goal of cloud (subscription) service providers is to lead existing users to paid subscriptions, that is, to maintain at least their free service usage without leaving to other services. In this sense, even though the perceived benefit or value of paid service could be the most crucial factor influencing users' decision on subscription, this study assumes that users' low intention to switch can increase intention to subscribe to paid PCSS. Therefore, this study hypothesized:

H8. Users' intention to switch negatively impacts users' intention to subscribe to paid service.

The complete research design with the related hypotheses is presented in Fig 1.

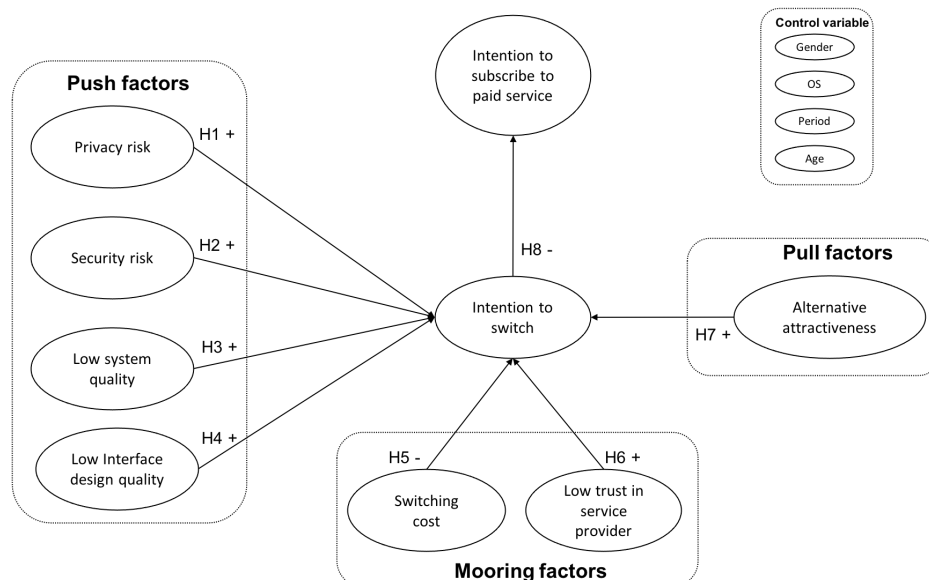


Fig 1. Research model

4. METHODOLOGY

4.1 Data collection and analysis

To collect the data for verifying the proposed hypotheses, this research conducted an online survey for current users of Google's PCSSs including Google Photos, Google Drive, and Gmail. The questionnaires of survey were mainly based on previous literatures related to cloud computing service and PPM framework. All measurement used the seven-point Likert-scale, ranging from '1 – strongly disagree', to '7 – strongly agree'. The participants were recruited from 3 universities-based online communities and 2 IT/device-related communities in South Korea from 25th of May 2022 to 4th of June 2022. These 3 universities have provided affiliated Google's PCSS to their students, staffs, and faculties so they are more likely to have chances to use Google's service. During the same period, the survey was conducted through 168 participants and 144 responses were included in the analysis after deleting 24 inappropriate answers from the collected data set.

Table 1 shows 144 survey respondents' profiles including gender, age, smart phone OS, and the period of using Google cloud services. Regarding the respondents' gender and age, among 144 respondents 42% were male and 58% were female and 56% were 20s, 36% were 30s, 3% were 40s and 4% were 50s or over. Regarding the respondents' smart phone OS, 33% used iOS based smart phone (iPhone) and 67% used android based smart phone. In addition, 20% of respondents used Google cloud service for less than 12 months, 25% used for 12~23 months, 22% used for 24~47 months and 33% used for 48 months or more.

Partial least squares structural equation modeling (PLS-SEM) is widely known to reduce the latent variable's error term while increasing the explanatory power of path coefficient. Moreover, there are several advantages of PLS-SEM to overcome some limited research condition. For instance, Gefen et al. (2000) insisted that this methodology is specialized in testing multi-staged causal relationships at once and it is also known to be applied properly when the sample size is not large enough, analyzing complex research model, or research data is not assumed that it follows normal distribution (Hair et al., 2011). Since this study tries to explain users' intention to switch in the context of PCSS which is rarely examined in diverse ways, PLS-SEM, focusing on theory development rather than extracting the structural characteristics of research model, would be helpful to examine the proposed research model with 8 hypotheses. To test the measurement and structural model and estimate the path coefficient with the collected data, this study used SPSS 27.0 and SmartPLS 3.3.9 software.

5. RESEARCH RESULTS

5.1 Test of measurement model

To evaluate the reliability of measurement model, this study verified major indicators including Cronbach's alpha and composite reliability (CR) and each value is shown in table 3. Cronbach's alpha and CR of all factors what this study adopted are over 0.7 and it follows the standard what Blalock (2017) suggested as a reasonable threshold.

To test the convergent validity of each factor, this study checked the average variance extracted (AVE) of it and found that all the values are over 0.5. It implies that research model of this study has reasonable convergent validity based on the standard from Gefen et al. (2000). To verify the discriminant validity which is depend on whether each measurement is included in right factor or not, this study adopted Fornell–Larcker criterion and checked whether each factor's squared root of the AVE is over is correlation with others. Table 5 shows that each diagonal value, which is each factor's squared root of the AVE, is larger than the values in same column and it implies that research model of this study confirmed discriminant validity as following the guideline of Henseler et al. (2016). These findings from several testing measurement model, it was found that this study has reasonable reliability and validity in adopting measurement.

Table 1. Sample characteristics

Demographic variable / Item	Frequency	Percentage (%)
Gender		
Male	61	42
Female	83	58
Age		
The 20s	81	56
The 30s	52	36
The 40s	5	3
The 50s or over	6	4
Smart phone OS		
iOS (iPhone)	48	33
Android	96	67
The period of using Google cloud services		
Less than 12 months	29	20
12 ~ 23 months	36	25
24 ~ 35 months	10	7
36 ~ 47 months	22	15

48 ~ 59 months	13	9
60 ~ 71 months	18	13
72 months or more	16	11
Total	144	100%

5.2 Test of structural model

As a result of assessing explanatory power of research model presented in Fig. 2, proposed model can explain 57.4% of the variance in users' intention to switch, 6.3% of the variance in intention to subscribe to paid service. As following the standard (Hair et al. 2011), all the endogenous latent variables in the proposed structural model has moderate level of R square value and it implies that this model reflects the users' perception on Google cloud service while limits on explaining intention to subscribe to paid service. The results of bootstrapping analysis for testing proposed hypothesis are shown in Table 4 and Fig. 2 and 5 hypotheses were supported among 8 hypotheses.

Table 2. Descriptive statistics

Factor type	Factor	Code	M	SD
Push factor	Privacy risk	PR	3.36	1.74
	Security risk	SR	3.51	1.69
	Low system quality	SQ	3.11	1.54
	Low Interface design quality	IDQ	3.81	1.71
Pull factor	Switching cost	SC	2.78	1.44
	Low trust in service provider	TSP	3.24	1.57
Mooring factor	Alternative attractiveness	AA	3.73	1.57
	Intention to switch	SW	3.90	1.66
	Intention to subscribe to paid service	SUB	4.32	1.80

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As a result of assessing explanatory power of research model presented in Fig. 2, proposed model can explain 57.4% of the variance in users' intention to switch, 6.3% of the variance in intention to subscribe to paid service. As following the standard (Hair et al. 2011), all the endogenous latent variables in the proposed structural model has moderate level of R square value and it implies that this model reflects the users' perception on Google cloud service while limits on explaining intention to subscribe to paid service. The results of bootstrapping analysis for testing proposed hypothesis are shown in Table 5 and Fig. 2 and 5 hypotheses were supported among 8 hypotheses.

Table 3. Reliability and convergent validity

Factor	Cronbach's Alpha	CR	AVE
Privacy risk	0.92	0.949	0.862
Security risk	0.917	0.96	0.923
Low system quality	0.914	0.946	0.853
Low Interface design quality	0.914	0.945	0.852
Switching cost	0.87	0.91	0.718
Low trust in service provider	0.912	0.938	0.791
Alternative attractiveness	0.836	0.75	0.521
Intention to switch	0.933	0.967	0.937
Intention to subscribe to paid service	0.953	0.977	0.955

From this analysis, it was verified that push factors such as privacy risk, security risk, and low interface design quality have positively impact on Google cloud service users' intention to switch to alternative, with coefficients of 0.157 ($P < 0.05$), 0.295 ($P < 0.001$), and 0.299 ($P < 0.001$) supporting H1, H2, and H4. Regarding the mooring factors, it was shown that only low trust in service provider positively influence on intention to switch with coefficients of 0.211 ($P < 0.0$), supporting H6. Lastly, this study found that PCSS users' intention to switch

have negative effects on users' intention to subscribe to paid service with coefficients of -0.256 ($P < 0.05$).

Table 4. Result of path analysis

Hypothesis	Relations	β	t-value	Result
H1	Privacy risk \rightarrow Intention to switch	0.157	2.007*	Supported
H2	Security risk \rightarrow Intention to switch	0.295	3.808***	Supported
H3	Low system quality \rightarrow Intention to switch	0.098	1.561	Not supported
H4	Low Interface design quality \rightarrow Intention to switch	0.299	4.261***	Supported
H5	Switching cost \rightarrow Intention to switch	0.098	1.174	Not supported
H6	Low trust in service provider \rightarrow Intention to switch	0.211	3.026**	Supported
H7	Alternative attractiveness \rightarrow Intention to switch	0.135	1.331	Not supported
H8	Intention to switch \rightarrow Intention to subscribe to paid service	-0.256	2.924**	Supported

Note: *: $p < .05$, **: $p < .01$, ***: $p < .001$

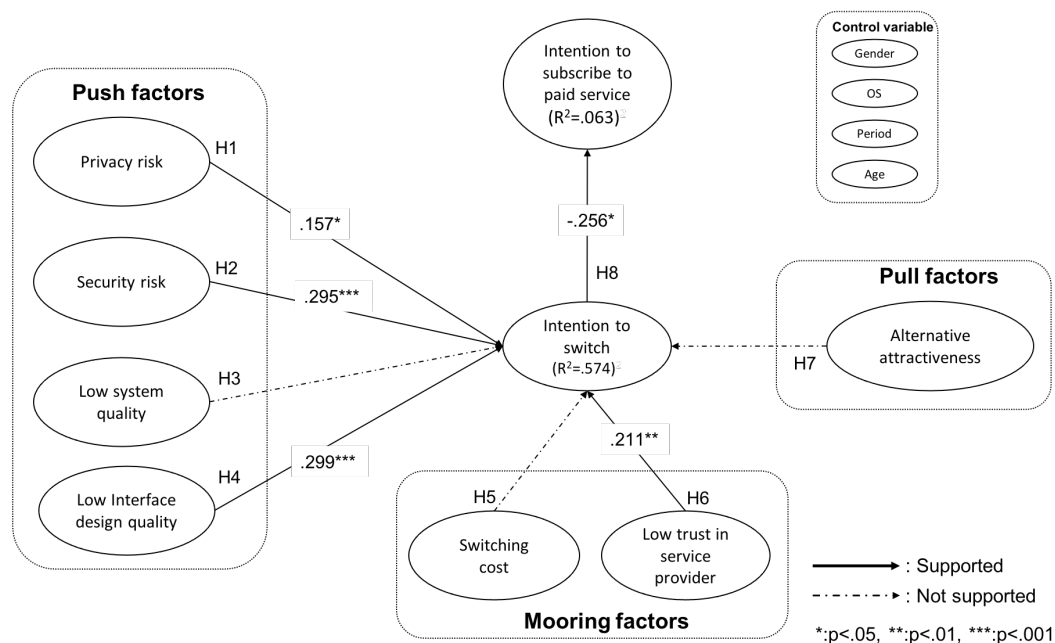


Fig 2. Results of the research model

Table 5. Fornell-lacker criterion

	Alternative attractiveness	Switching cost	Intention to subscribe to paid service	Intention to switch	Low Interface design quality	Low system quality	Low trust in service provider	Privacy risk	Security risk
Alternative attractiveness	0.722								
Switching cost	-0.195	0.847							
Intention to subscribe to paid service	0.228	-0.179	0.977						
Intention to switch	0.223	0.219	-0.252	0.968					
Low Interface design quality	0.214	0.148	-0.083	0.517	0.923				
Low system quality	-0.198	0.208	-0.067	0.216	0.189	0.924			
Low trust in service provider	0.028	0.17	-0.253	0.503	0.227	0.077	0.889		
Privacy risk	0.023	0.129	-0.196	0.549	0.267	0.155	0.542	0.928	
Security risk	0.117	0.158	-0.15	0.573	0.235	0.142	0.364	0.565	0.961

6. Conclusion and Discussion

Although services to companies or public institutions account for a large portion of the cloud market, individual demand for data storage is expected to increase consistently. Accordingly, PCSS will become more common for users, and users' dependence on them is also expected to grow consistently. Major PCSSs are currently provided through a freemium-type business model that requires subscribing to paid services for further use after using a basic (free) service. In this regard, recently, Google changed Google Photos, an unlimited and free service with the largest number of users in the PCSS market, into a non-free service and has an impact on the cloud service industry and users. Due to this service policy change, some users had to decide whether stay on the current Google cloud service and subscribe to paid service or switch to an alternative.

At a time when diverse responses or perceptions from users and industry are expected, this study explored the factors that can affect the Google cloud service users' intention to switch to an alternative. Furthermore, this study attempted to verify the relationship between the users' intention to switch and their intention to subscribe paid PCSS service, Google One. As a result, this study found that privacy risk, security risk, low interface design quality, and low trust in service providers have positive effects on users' switching intention to an alternative after using all storage offered with basic free service. In addition, it was found that this switching intention negatively impacts users' intention to subscribe to paid service, Google One. Based on these findings, this study can give academic, practical, and policy implications for each stakeholder in the ICT industry.

The results of this study provide several academic implications in the context of cloud service and industry. First, this study tried to explain the users' intention to switch in the context of PCSS of a dominant service provider, Google. By adopting the PPM model, this study found that well-known variables such as risk, service quality, and switching costs were crucial factors influencing the users' intention to switch in the context of PCSS. In addition, it is an important contribution that this study confirmed that not only service-related factors but also non-service-related factors such as low trust in service providers significantly impact users' switching intention. It implies that considering diverse components related to the cloud service environment is helpful to understanding users' perceptions precisely and estimating their behavior accurately. Lastly, this study found a significant relationship between switching intention and intention to subscribe to paid service. This finding shows that estimating the

effect and result of switching is crucial to understanding the diverse dimension of switching intention or behavior.

The results of this study also provide practical implications for cloud service providers and developers, including Google. First among suggested factors in this study, low interface design quality influenced users' intention to switch with the most significant effects. In contrast, the low system quality does not significantly affect it. It means that users can switch to other services if the cloud service's menu composition and usage environment are not perceived as user-friendly. Accordingly, service providers must continuously improve the data usage environment and interface (upload, download, search, etc.), and it is necessary to provide a consistent service environment no matter their device. Even though the systematic aspect of PCSS can play an essential role in allowing users to use the service stably with less systematic errors, it did not directly affect the users' intention to switch. It could mean that users recognize that systematic errors or defects in PCSS are caused not only by defects in the PCSS but also by each device's network instability. On the other hand, this result may reflect users' overall low or high perception of system quality regardless of their intention to switch.

Second, low trust in service providers significantly affects PCSS users' intention to switch to alternatives. It implies that the more cloud service users perceive that the service provider is dishonest or not reliable, the more they want to switch the current PCSS to another service. Regarding service providers, it is necessary to recognize that managing the company's reputation can be crucial in preventing cloud service users from leaving or switching. Accordingly, internet portals such as Google and NAVER, which provide various services and clouds, must respond to socially controversial issues effectively. When Google Photos, which was previously provided free of charge, changed to paid service, many users in South Korea complained, and some users left the service. In this regard, cloud service users can react more sensitively to issues directly related to cloud services, so it is necessary to predict the various effect or results of policy changes (price, service content, etc.) from a user's perspective.

Third, both privacy and security risks significantly affect the switching intention of cloud service users. While more and more diverse data are available to be stored and shared from high compatibility of PCSS in devices and provide increased convenience, it might lead users to perceive more privacy and security-related risk issues. In particular, PCSS users who synchronize data like smartphones or PCs may be more aware of such risks. In this sense, service providers should try to prevent privacy and security-related issues for users by

developing technologies related to data security. In addition, they also should try to reduce the risk that users can perceive by continuously leading users to recognize how data is stored and managed through its cloud service or system.

This study has several managerial implications for cloud service providers and diverse information system-related markets or service providers adopting freemium or subscription business models for their strategy. First, providing service without charge could help service providers retain many users in their service and maintain the market shares. For some service providers with this strategy, however, the transition of business model to non-free (subscription) could be needed to sustain their business with stable profitability. In this regard, maintaining current free users and leading them to subscribe to paid services smoothly could be one of the crucial goals for service providers such as Google facing this type of situation. In this sense, managing critical factors found to be important might lead current free users to stay with the current service.

Second, it was confirmed that the user's intention to switch has a negative effect on the intention to subscribe to the paid service. Major PCSSs are provided through a freemium (free and premium) business model that requires users to pay for additional use after using a basic (free) service with a subscription. In this sense, service providers would want current free service users to continue to stay on their services (after signing up for a paid service) without exiting to other services. In this sense, this study emphasized the importance of managing switching intention by confirming that it can also negatively affect the intention to subscribe to paid service. It implies that service providers need to recognize the importance of managing users' switching intentions which could help users subscribe to paid services.

One of the dominant global cloud service providers, Google, has changed its cloud service policy and significantly affected users and the industry. By analyzing users' responses and perceptions of this service and policy, this study may provide policy implications for ICT-related public institutions and government. As cloud computing technology has been widely diffused, related services, including PCSS, have been considered a necessary and important tool for daily life (Ozu et al., 2020). Many components of our daily life, such as education, work, health, and entertainment, are being digitalized, and related services are provided with data and network-based on cloud computing. It means that people are more likely to depend on cloud-related services, and this dependence will be more serious consistently. In this regard, cloud service providers need to be more cautious about changing their service policy that might

impact people's daily life. In addition, if a policy related to personal data is changed, the change notification must be preemptively and effectively made so that users can have enough time to find an alternative. Therefore, there is a need for a kind of self-regulation of service providers or government guidelines to protect users from policy changes of cloud services. The government may need to monitor such a change in advance to protect users.

While Samsung and telecommunication service providers in South Korea, including SKT, KT, and LG Uplus, terminated their PCSS, a dominant local internet portal service provider, NAVER, still offers My box, which is its PCSS, to users. In particular, unlike Google, which offers 15 gigabytes for free, NAVER provides 30 gigabytes to users for free. Accordingly, some users moved to NAVER, a local service, after Google's policy change. On the other hand, users in countries where local services' quality or competitiveness are insufficient have difficulties in finding local alternatives to cope with Google's policy changes. In this sense, not only South Korean government but also other countries' government need to develop some policy programs to help local service providers to have a competitive edge in the cloud services industry.

This study is not without its limitations. First, since the sample data of this study is only based on users in South Korea, it may be difficult to generalize the results and implications of this study. If future research could be conducted in different contexts, finding the common implications could be possible. Second, the explanatory power of the users' intention to subscribe to paid service (Google One) was weak. From this study, users' intention to switch to an alternative PCSS service was the only determinant to explain the intention to subscribe to paid service. However, it is expected that the perceived benefit or value of paid service could be the most crucial factor that leads users to subscribe to paid service. Nevertheless, this study is more focused on explaining the intention to switch by adopting potential factors directly related to it rather than finding other factors affecting the intention to subscribe to paid service. It might lead to the low explanatory power of intention to subscribe to paid service. Therefore, if a further study adds some important factors that influence users' perception or behavior (adoption, use, willingness to pay, and subscribe), it would be better understand users' experience or assessment of PCSS. Third, as shown in Table 1, the age group of participants is focused on the 20~30s. Even though these age groups would be more friendly with IT-related devices and have a higher intention to use innovative services such as PCSS than other age

groups, the generalizability of this study might be limited. Thus, future research could be extended by including more diverse demographic or personal characteristics.

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