Association for Information Systems
AIS Electronic Library (AISeL)

PACIS 2018 Proceedings

Pacific Asia Conference on Information Systems (PACIS)

6-26-2018

Influencing Factors on Knowledge Adoption of Mobile Game Developers in Online Communities

Jong-Won Park
Kyung Hee University, jwp90@khu.ac.kr

Changsok Yoo
Kyung Hee University, csyoo@khu.ac.kr

Sung-Byung Yang
Kyung Hee University, sbyang@khu.ac.kr

Influencing Factors on Knowledge Adoption of Mobile Game Developers in Online Communities

Completed Research Paper

Jong-Won Park
Department of Business Administration,
Graduate School, Kyung Hee University,
Republic of Korea
jwp90@khu.ac.kr

Chansok Yoo
College of Hotel & Tourism Management,
Kyung Hee University,
Republic of Korea
csyoo@khu.ac.kr

Sung-Byung Yang
School of Management, Kyung Hee University,
Republic of Korea
sbyang@khu.ac.kr

Abstract

Recently, with the advance of wireless Internet access via mobile devices, a myriad of game development companies has forayed into the mobile game market, leading to intense competition. To survive in this fierce competition, mobile game developers often try to get a grasp of the rapidly changing needs of their customers by operating their own official communities where game users freely leave their requests, suggestions, and ideas relevant to focal games. Based on the heuristic-systematic model (HSM) and data quality (DQ) framework, this study derives key content, non-content, and hybrid cues that can be utilized when game developers accept suggested postings in these online communities. The results of the hierarchical multiple regression analysis show relevancy, timeliness, amount of writing, and the number of comments are positively associated with mobile game developers' knowledge adoption. In addition, title attractiveness mitigates the relationship between amount of writing/the number of comments and knowledge adoption.

Keywords: Knowledge adoption, mobile game developer, online community, heuristic-systematic model (HSM), data quality (DQ) framework

Introduction

For the first time in the year of 2016, the sales of the mobile game market (US$ 36.9 billion, 37%) have surpassed those of the PC game market (US$ 31.8 billion, 32%) in the entire game market (US$99.6 billion) (Newzoo 2016). This is thanks to the improved performance of mobile devices and the advancement of wireless Internet technologies enabling the high-quality games to be played in mobile environments (Nakatsu et al. 2017). Furthermore, as new technologies such as virtual reality (VR) and augmented reality (AR) are going to fuse into mobile devices, it is predicted that the sales and the number of users of mobile games will occupy more than half of the entire game market (Newzoo 2016).

Likewise, as restrictions in the mobile environment disappear and the mobile game market expands, the game development companies who specialized in producing personal computer (PC) or console games have also massively entered the mobile game market (Eric and Takashi 2015). This has triggered the intense competition in which the average life cycle of mobile games is below six months, and 70% of

mobile games cannot reach the break-even point (IGAWorks 2015). To survive in this competitive environment, mobile game development companies directly operate their own online communities called 'official communities' where game users can express their opinions freely.[1] By virtue of this, mobile game developers are accurately grasping the rapidly changing needs of users, and fulfilling their needs in the form of improvement of existing contents and development of new contents.

However, when we look into these official communities in detail, simple postings regarding complaints, rather than quality suggested postings constitute the mainstream. This may be deemed as an act of users' expression about their interest towards mobile games; but, the real problem is that the interest of mobile game developers towards such official communities diminishes, and therefore even some existing quality suggested postings are not being used properly. This is partially due to the fault of users who have failed to adequately understand the objectives of the official community which aims to gain the competitive edge by securing quality suggested postings; however, we deem that mobile game development companies are more to be blamed since they have not offered any clear explanations or guidelines about how to write suggested postings properly in which mobile game developers can adopt some knowledge embedded.

Therefore, this study identifies the influencing factors on knowledge adoption of mobile game developers embedded in suggested postings of online communities and classifies them into content, non-content, and hybrid cues based on the heuristic-systematic model (HSM). In addition, drawing on the data quality (DQ) framework, this study materializes the criteria expected to be employed when measuring the quality of content cues. Furthermore, it conducts an empirical analysis on both direct and interaction effects of derived cues on knowledge adoption of mobile game developers. The findings of this study could provide mobile game development companies who find themselves in intense competition with criteria and guidelines for managing suggested postings in their official communities in more effective and strategic ways.

Theoretical Background

Literature on Mobile Games

In a broad sense, mobile games are defined as all games that run on mobile devices such as calculators, feature phones, smartphones, and so forth (Wikipedia 2018). Recently, it has been used in a limited sense as the game that can be downloaded from an application store of a mobile operating system used in a smartphone. This is because mobile games before and after the appearance of smartphones show a big difference (Nakatsu et al. 2017). Therefore, we only review the studies published after launching of the iPhone in 2007, which led to the popularization of using the smartphone. Theses extant studies can be classified into 'mobile game design,' 'mobile game user behavior,' and 'mobile game policy and trend' (see Table 1).

First, prior studies on 'mobile game design' have mainly focused on strategies and methods relevant to improvement of mobile game components, such as characters (De and Formico 2011), sounds (Engström et al. 2015), background (Kim et al. 2014), and story (Wilhelmsson et al. 2017) in order to increase the engagement and satisfaction of users. In addition, most studies used the experimental method to confirm the effectiveness of the newly proposed strategies. Second, extant studies on 'mobile game users behavior' have mainly focused on factors affecting the adoption of mobile games (Chen et al. 2016; Hamari and Keronen 2017; Jeon et al. 2016; Lin and Lu 2015; Wei and Lu 2014) and the purchase of products in mobile games (Hamari et al. 2017; Hsiao and Chen 2016). Such studies conducted empirical studies using questionnaires. Finally, previous studies regarding 'mobile game policy and trend' have included the changes in policies and mobile technologies which can affect an

[1] In fact, in the second week of February 2018, the results of the survey from the top 10 mobile games in terms of sales of Google Play Store in South Korea indicated that 90% of mobile games were communicating with users through their own official communities.

overall mobile game industry (Feijoo et al. 2012; Fung 2017; Gavalas and Economou 2011; Marchand and Hennig 2013).

Table 1. Literature on Mobile Games

Category	Description	References
Mobile Game Design	The component of mobile games affecting the engagement and satisfaction of users	De and Formico (2011); Engström et al. (2015); Kim et al. (2014); Wilhelmsson et al. 2017
Mobile Game User Behavior	The factors affecting the adoption and play of mobile games	Chen et al. (2016); Hamari and Keronen (2017); Jeon et al. (2016); Lin and Lu (2015); Wei and Lu (2014)
	The factors affecting the purchase of products in mobile games	Hamari et al. (2017); Hsiao and Chen (2016)
Mobile Game Policy and Trend	Policies and technologies that can affect the mobile game industry	Feijoo et al. (2012); Fung (2017); Gavalas and Economou (2011); Marchand and Hennig (2013)

To sum up, most prior literature on mobile games has been conducted only from the viewpoint of users. However, the successful operation of mobile games, however, is followed by better understanding of mobile game developers, one group of primary players in the mobile game industry. Therefore, this study focuses on mobile game developers, rather than users, and attempts to investigate influencing factors on knowledge adoption of them, drawing on the HSM and DQ framework.

Heuristic-Systematic Model (HSM)

The heuristic-systematic model (HSM) is a theory explaining two information processing strategies that occur when an individual evaluates the validity of information and then adopts it. It can be divided into (1) systematic processing which acquires step-by-step information regarding content cues and (2) heuristic processing, acquiring immediate information such as non-content cues (Chaiken 1980). Although content cues (e.g., value-added, relevancy, timeliness, completeness, and etc.) have the demerit of requiring immense time and endeavors because they have to be obtained only after reading through the information given to the individual, it bears the merit that facilitates the evaluation of validity of information since the reliability of information rises when reading. On the contrary, as for non-content cues (e.g., amount of writing, the number of images, the number of comments, and etc.), which may be acquired on the spot, individuals harness the exterior factors of the information. Thus, on one hand, they have the advantage of requiring less time and endeavors; however, on the other hand, the disadvantage that it is hard to size up the validity of information also exists. The person who processes given information may have to solely select out one strategy, taking account of the situation she/he is in; however, both strategies can be used to spend an appropriate level of time and efforts. In this case, the validity of the information is processed through the interaction between content and non-content cues (Ratneshwar and Chaiken 1991).

Meanwhile, Lee and Yang (2015) suggested attractiveness of title as a hybrid cue that retains all the features of both the content and non-content cues. It is also interpreted that the hybrid cue has both (1) the characteristics of content cues which necessitates a certain degree of time and efforts (less than content cues but more than non-content cues) in examining and interpreting the title, and (2) the

characteristics of non-content cues, which is hard to assess properly the validity of information by the reliability of information which may be acquired just by reading the title. Moreover, they claimed that since the more the attractiveness of the title, the more the recipients of knowledge take interest in the content of the given information, and the possibilities of utilizing heuristic processing strategy would decline, while those of utilizing systematic cues rise.

Figure 1 shows an exemplar posting suggested by a mobile game user found in the official community of D mobile game of S mobile game development company, which is the focus of this study. Grounded on the HSM, these can be classified into content, non-content, and hybrid cues.

Figure 1. The Illustration of Content, Non-Content, and Hybrid Cues in an Online Community

The cues (e.g., value-added, relevancy, timeliness, and completeness), which may be acquired only when mobile game developers read the content of suggested postings, may fall under the category of a content cue. In addition, the cues (e.g., amount of writing, the number of images, and the number of comment), which may be acquired without even reading suggested postings, may fall under the category of a non-content cue. Finally, the attractiveness of title, which is a cue that can be obtained only if mobile game developers go over (the characteristics of a content cue), even if it is not the content of suggested postings (the characteristics of a non-content cue), may fall under the category of a hybrid cue.

Heuristic-Systematic Model (HSM)

Wang and Strong (1996) conducted a two-stage survey to draw the data quality (DQ) which the actual data consumers deem important, pointing out that the previous studies related to data quality have been progressed not in the viewpoint of data consumers, but in that of database developers and custodians. As a result (see Table 2), they revealed that the data consumer judges data quality based on the four categories and fifteen dimensions that constitute categories.

Based on the data quality framework, the categories and dimensions that are important to data consumers in a variety of fields such as online review (Filieri and McLeay 2014), social media

(Emamjome et al. 2013), website (Katerattanakul and Siau 1999) and World Wide Web (WWW) (Klein 2002) have been demonstrated. These subsequent studies have used a contingency approach to select, add, or remove the categories and dimensions taking into account the characteristics of the field and data consumers. Thus, this study also derives categories and dimensions considering the characteristics of official mobile game communities and mobile game developers.

Table 2. Data Quality Framework (Adapted from Wang and Strong 1996)

	Category	Description	Dimensions
Data Quality (DQ)	Intrinsic DQ	The data consumers judge data quality by taking into consideration the characteristic inherent to the data.	Believability; Accuracy; Objectivity; Reputation
	Contextual DQ	The data consumers judge data quality by taking into consideration the context of the current work.	Value-Added; Relevancy; Timeliness; Completeness; Amount of data
	Representational DQ	The data consumers judge data quality by taking into account the representation of the system in which the data exists.	Interpretability; Ease of understanding; Representational consistency; Concise representation
	Accessibility DQ	The data consumers judge data quality by taking into account the accessibility of the system in which the data exists.	Accessibility; Access security

First, it has been confirmed that a majority of mobile game development companies are offering almost the same form such as title, content, image, and so forth so that the suggested posting in the official community may be observed as a certain stereotyped way of expression. It has also been verified that the addition and elimination functions are possible in compliance with the demands of mobile game developers. Moreover, since mobile game developers have access to the official community anytime anywhere according to their needs, representational and accessibility data quality (DQ) categories do not match with the context of this study. Also, considering the characteristics of the official community in which users may express their opinions freely, we judged that it is hard to secure properly the characteristics of believability, accuracy, objectivity, and reputation, which belongs to the intrinsic DQ category. Under these circumstances, mobile game developers will preferentially take account of whether suggested postings are suitable for the use of mobile game development or not. Therefore, in this study, given the characteristics of the official community and mobile game developers, the contextual DQ category is deemed most important, and we use all of the dimensions which belongs to the contextual DQ category.

In line with the HSM, we can divide the dimensions of the contextual DQ category into content and non-content cues. Value-added, relevancy, timeliness, and completeness of a suggested posting which mobile game developers should read can be classified into content cues, while the amount of writing which mobile game developers obtain without reading can be classified into a type of non-content cue.

Research Model and Hypotheses

Based on the discussion above, this study employs knowledge adoption of mobile game developers as a dependent variable. In addition, while value-added, relevancy, timeliness, and completeness compose content cues, the amount of writing, the number of images, and the number of comments constitute non-

content cues as independent variables. Finally, attractiveness of title, the hybrid cue, is regarded as a moderating variable that can positively moderate the relationship between content cues and knowledge adoption, but negatively moderate (mitigate) the one between non-content cues and knowledge adoption. The proposed research model and hypotheses are presented in Figure 2.

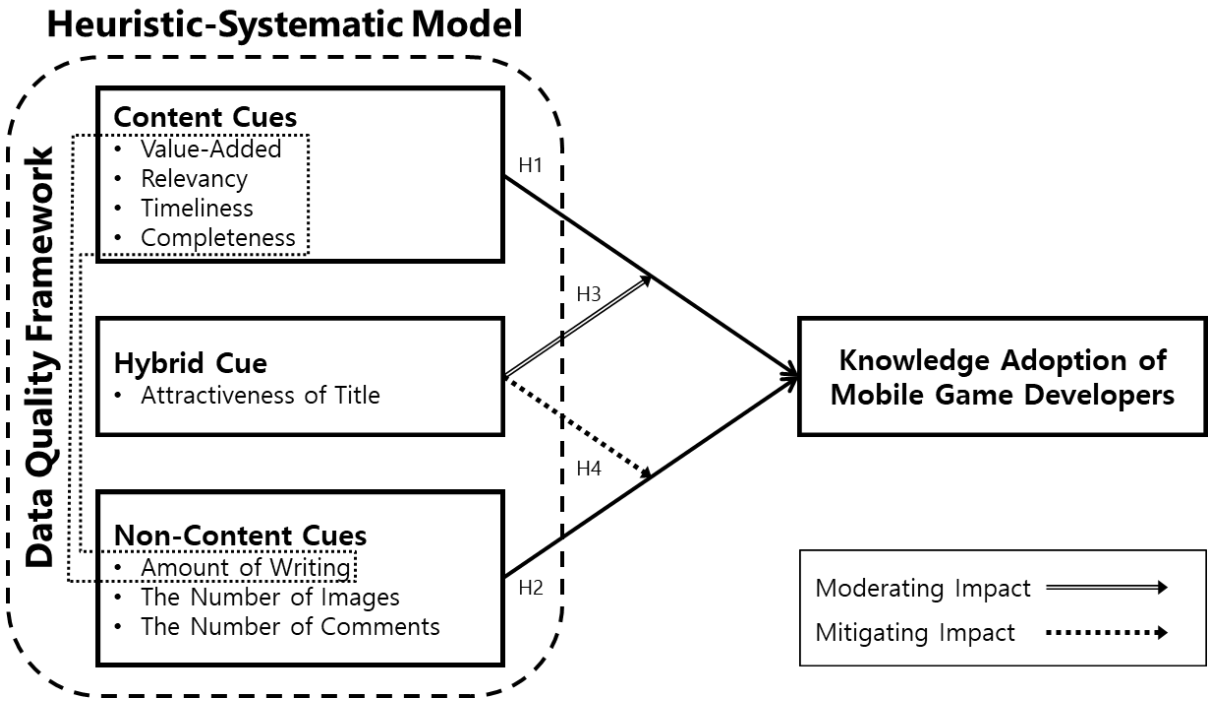

Figure 2. Research Model

First, mobile game developers may acquire content cues by taking a lot of time and efforts to review and interpret the content of suggested postings. These content cues will be evaluated by taking as a yardstick whether these cues are adequate in the use of developing mobile games in the context of work of mobile game developers or not. Specifically, (1) how worth, (2) how relevant, (3) how timely, and (4) how complete the content of a suggested posting is from the perspective of mobile game developers. Thus, the following hypothesis is posited:

H1: Content Cues (Value-Added, Relevancy, Timeliness, and Completeness) of a suggested posting is positively associated with Knowledge Adoption of Mobile Game Developers.

Second, mobile game developers may employ non-content cues for the acquirement of information about suggested postings, taking less time and efforts. These non-content cues consist of cues which mobile game developers may easily figure out from suggested postings. Specifically, whether a suggested posting will be taken or not may be determined by checking out (1) how long the suggested posting is, and (2) how many images and (3) comments the suggested posting has. Therefore, the following hypothesis is posited:

H2: Non-content Cues (Amount of Writing, The Number of Images, and The Number of Comments) of a suggested posting is positively associated with knowledge adoption of mobile game developers.

Lastly, mobile game developers may utilize a hybrid cue for the acquirement of information about suggested postings, taking the proper time and efforts. This hybrid cue may interact with the content and non-content cues. Specifically, when the title of the suggested posting is intriguing, mobile game developers may reinforce the use of content cues, while enervating the use of non-content cues, and vice versa. Thus, the following hypotheses regarding moderation effect of attractiveness of title are posited:

H3: Attractiveness of Title of a suggested posting positively moderates the relationships between Content Cues (Value-Added, Relevancy, Timeliness, and Completeness) and Knowledge Adoption of Mobile Game Developers.

H4: Attractiveness of Title of a suggested posting negatively moderates (mitigates) the relationships between Non-Content Cues (Amount of Writing, The Number of Images, and The Number of Comments) and Knowledge Adoption of Mobile Game Developers.

Research Methodology

Data Source and Sample

D mobile game's official community was chosen as the subject of the study since it satisfies all the criteria of a successful mobile game practically considered.[2] Moreover, its official community is actively operated to the extent that an average of 1,168 suggested postings a day are being posted. The unit of analysis for this study is a suggested posting written by users in an official mobile game community. The following process has been conducted to extract 200 samples which were intended to be used in content analysis. (1) All the suggested postings, written from December 28 of 2016 to January 11 of 2017, were collected from the official community of D mobile game by the web crawler. (2) 1,147 suggested postings which were below 200 characters with spaces were eliminated as we judged that they have no intention to provide quality opinions to mobile game developers. (3) 185 postings were excluded, following up on the cases in which the identical user wrote suggested postings of equivalent content repeatedly (n=835). Henceforth, a stratified random sampling has been implemented to select 200 samples in compliance with the proportion written in suggested postings.

Coding Scheme

This research has developed the coding scheme according to the procedure proposed by extant studies of content analysis (Creswell 1994; Weber 1990). Above all, the preliminary coding scheme for each variable was developed, following criteria suggested by extant studies. As a next step, the pre-coding was executed, employing the preliminary coding scheme by two mobile game developers of D mobile game. The coding scheme was refined by reflecting the advice of mobile game developers and was used as the final coding scheme (see Table 3). The dependent variable of this study, knowledge adoption of mobile game developers, and content cues and hybrid cue (Attractiveness of Title) were measured on the 7-point Likert scale. Non-content cues were respectively measured on the number of characters with spaces, images, comments in a suggested posting.

Table 3. Coding Scheme

Variable	Coding Scheme (items)	References
Knowledge Adoption of Mobile Game Developers (KAD)	The information in this post… KAD1: can be used to upgrade the existing content of this mobile game. KAD2: can be used to upgrade the developing content of this mobile game. KAD3: can be used to develop the new content of this mobile game that I already perceived. KAD4: can be used to develop the new content of this mobile game that I did not perceive.	Zhang and Watts (2008)

[2] (1) More than 1.1 million downloads during a month after its launch, (2) above 13% of customer retention rate (CRR) after a month, and (3) a daily average frequency of playing mobile games by users being more than four times after a month (IGAWorks 2015).

Value-Added (VAL)	The information in this post… VAL1: gives a high value to developing this mobile game. VAL2: gives a positive value to developing this mobile game. VAL3: gives a sufficient value to developing this mobile game. VAL4: gives a useful value to developing this mobile game.	Bailey and Pearson (1983)
Relevancy (REL)	The information in this post… REL1: is applicable to developing this mobile game. REL2: is relevant to developing this mobile game. REL3: is usable in developing this mobile game. REL4: is appropriate for developing this mobile game.	Wang and Strong (1996)
Timeliness (TIM)	The information in this post… TIM1: is sufficiently current for developing this mobile game. TIM2: is sufficiently timely for developing this mobile game. TIM3: is sufficiently up-to-date for developing this mobile game.	Lee et al. (2002)
Completeness (COM)	The information in this post… COM1: has the breadth of this mobile game development. COM2: has the depth of this mobile game development. COM3: covers all needs of this mobile game development. COM4: is sufficiently complete for developing this mobile game.	Lee et al. (2002); Wang and Strong (1996)
Amount of Writing (AOW)	AOW: The number of characters with spaces for a post	Mudambi and Schuff (2010)
The Number of Images (NOI)	NOI: The number of images for a post	Cheng and Ho (2015)
The Number of Comments (NOC)	NOC: The number of comments for a post	Duan et al. (2008)
Attractiveness of Title (AOT)	The title of this post… AOT1: is interesting AOT2: makes me curious about the content of this post. AOT3: makes me read this post's content.	Lee and Yang (2015)

Data Collection

Actual coding was conducted, using the final coding scheme. Six mobile game developers who did not engage in the pre-coding participated in the actual coding. Three mobile game developers conducted a content analysis on whether or not to adopt a suggested post, and the rest performed a content analysis on the extent of content cues and hybrid cue within a posting suggested by users. By doing this, the common method bias (CMB), which can occur when the identical coder conducts the content analysis at the same time, has been solved. Each coder was provided a final coding scheme and a booklet composed of 200 samples and 200 coding sheets, respectively.

Using the formula of R_{wg} (see Figure 3), the median values of R_{wg} were calculated to confirm inter-rater agreement among coders. As shown in Table 4, all median values of R_{wg} are above 0.71, ensuring strong agreement among coders (LeBreton and Senter 2008). Based on these results, we average out coding results of coders of dependent, independent, and moderating variables, respectively.

$$r_{WG(J)} = \frac{J\left(1 - \frac{\overline{S}^2_{X_j}}{\sigma^2_E}\right)}{J\left(1 - \frac{\overline{S}^2_{X_j}}{\sigma^2_E}\right) + \left(\frac{\overline{S}^2_{X_j}}{\sigma^2_E}\right)}$$

Figure 3. The Formula of R_{wg} (adopted from LeBreton and Senter 2008)

Table 4. The Results of the Inter-Rater Agreement Test

Variable	KAD	OBJ	VAL	REL	TIM	COM	AOT
Median (R_{wg})	0.898	0.800	0.741	0.800	0.841	0.879	0.872

Results

In this study, IBM SPSS Statistics 22 was used to verify the reliability and validity of the measurement items for each variable as well as the correlations and causal relationships among variables.

Reliability and Validity Test

To confirm the reliability of the measurement items for each variable, the Cronbach's Alpha values were calculated. Generally, if the Cronbach's Alpha value is above 0.7, it can be safely said that the reliability of the measurement items for each variable is rather high (Nunnally and Bernstein 1978). As shown in Table 5, all Cronbach's Alpha values were greater than 0.7. Therefore, we judged that the reliability of the measurement items for each variable used in this research was secured.

Moreover, the exploratory factor analysis (EFA) was conducted to confirm the validity of the measurement items for each variable. Principal component analysis (PCA) with Varimax rotation was used to extract nine fixed factors. Usually, if the factor loadings are above 0.5 and the cross loadings are below 0.5, it can be agreed upon that the convergent validity and the discriminant validity of the measurement items for each variable have been secured (Costello and Osborne 2005). As a result of the EFA (see Table 5), we judged that the validity of the measurement items for each variable used in this research was secured as all the factor loadings and the cross loadings reached above 0.5 and below 0.5, respectively.

Table 5. The Reulsts of the Exploratoy Fator Analysis (EFA)

Item	Cronbach's Alpha	KAD	VAL	COM	REL	TIM	AOT	NOI	NOC	AOW
KAD1	0.956	0.917	0.103	0.069	0.035	0.134	0.075	0.040	-0.032	-0.020
KAD2		0.924	0.108	0.043	0.071	0.131	0.077	0.005	0.015	0.060
KAD3		0.910	0.022	0.114	0.122	0.079	0.153	0.047	0.113	0.078
KAD4		0.912	0.003	0.076	0.133	0.081	0.138	0.083	0.092	0.087
VAL1	0.965	0.021	0.845	0.198	0.296	0.155	0.171	0.042	0.003	0.079
VAL2		0.102	0.830	0.180	0.312	0.207	0.218	0.023	-0.005	0.008
VAL3		0.099	0.820	0.257	0.308	0.192	0.180	0.028	-0.020	0.034
VAL4		0.065	0.781	0.235	0.354	0.263	0.197	0.020	-0.029	0.030

COM1	0.919	0.069	0.196	0.780	0.157	0.276	0.191	-0.065	0.071	0.156
COM2		0.098	0.166	0.815	0.163	0.093	0.135	0.026	0.059	0.285
COM3		0.025	0.166	0.898	0.094	0.050	0.161	0.100	0.028	-0.003
COM4		0.156	0.230	0.804	0.122	0.192	0.171	0.142	0.008	-0.031
REL1	0.939	0.093	0.289	0.134	0.849	0.159	0.161	0.000	0.028	-0.012
REL2		0.134	0.379	0.124	0.779	0.267	0.187	0.009	-0.008	0.009
REL3		0.131	0.332	0.154	0.807	0.222	0.174	-0.002	-0.045	0.033
REL4		0.139	0.443	0.207	0.647	0.306	0.113	-0.003	0.012	-0.070
TIM1	0.919	0.173	0.240	0.124	0.243	0.825	0.100	-0.061	0.005	0.095
TIM2		0.154	0.249	0.186	0.237	0.836	0.092	0.045	-0.065	-0.023
TIM3		0.134	0.166	0.196	0.202	0.843	0.127	0.070	0.019	0.071
AOT1	0.911	0.141	0.222	0.223	0.179	0.134	0.830	-0.023	0.044	0.066
AOT2		0.140	0.150	0.177	0.136	0.102	0.887	0.035	-0.002	0.028
AOT3		0.156	0.195	0.163	0.151	0.072	0.840	0.062	0.008	0.015
NOI	1	0.128	0.054	0.143	-0.002	0.031	0.054	0.944	0.157	0.151
NOC	1	0.138	-0.029	0.101	-0.012	-0.028	0.030	0.149	0.968	0.040
AOW	1	0.236	0.091	0.395	-0.042	0.138	0.100	0.246	0.061	0.800

Hypotheses Testing

The Pearson's correlation analysis was conducted to verify the correlations among variables prior to the hypotheses testing. Usually, a multicollinearity problem may occur when the correlation coefficients among independent variables are above 0.6 (Hair et al. 1998). As shown in Table 6, the correlation coefficient between value-added and relevancy is 0.752. Therefore, we conducted a multicollinearity test. In general, if the variance inflation factor (VIF) is above 10, it can be said that the multicollinearity problem is serious (Hair et al. 1998). As shown in Table 7, we confirmed that the VIF of all independent variables is less than 10, so the multicollinearity issue is not a major threat in this study.

Table 6. The Results of the Correlation Analysis

Variable	Mean	SD	KAD	VAL	REL	TIM	COM	AOW	NOI	NOC	AOT
KAD	3.224	0.789	1								
VAL	3.929	0.769	0.230**	1							
REL	3.902	0.727	0.296**	0.752**	1						
TIM	3.731	0.619	0.332**	0.556**	0.597**	1					
COM	3.098	0.615	0.248**	0.529**	0.450**	0.451**	1				
AOW	1261.13	960.70	0.343**	0.256**	0.150*	0.301**	0.542**	1			
NOI	0.245	0.793	0.209**	0.138	0.075	0.118	0.252**	0.441**	1		
NOC	1.320	2.612	0.193**	-0.004	0.011	0.002	0.155*	0.207**	0.324**	1	
AOT	2.958	0.620	0.322**	0.501**	0.463**	0.359**	0.464**	0.275**	0.148*	0.083	1

In this study, a hierarchical multiple regression analysis was performed to confirm the direct effects of both content (H1) and non-content (H2) cues on knowledge adoption of mobile game developers as well as the moderation effects of the hybrid cue (H3 and H4) on knowledge adoption of mobile game developers. The original values of independent and moderating variables were standardized and then multiplied to make the interaction term required for the moderating effect test, following the suggestion of previous study (Crate and Russell 2003).

Results in Table 6 (see Model 1) show that while the direct effect of relevancy (H1b), timeliness (H1c), amount of writing (H2a), and the number of comments (H2c) on knowledge adoption of mobile game developers are significant, the rest are not significant. Approximately 22 percent (R2=0.220) of the variance in knowledge adoption of mobile game developers was explained by direct effects of the content and non-content cues. Results in Model 3 of Table 6 indicate that the interaction effects of the amount of writing (H4a)/the number of comments (H4c) and attractiveness of title on knowledge adoption of mobile game developers are significant, whereas the rest are not significant. The proximity of 28.7% (R2=0.287) of the variance in knowledge adoption of mobile game developers were accounted for by the direct effects of the content and non-content cues as well as the interaction effects between the hybrid cue (attractiveness of title) and other cues.

Table 7. The Results of the Hierarchical Multiple Regression Analysis

DV=KAD	Model 1		Model 2		Model 3	
Variables	β	VIF	β	VIF	β	VIF
VAL (H1a)	-0.090$^{n.s.}$	2.644	-0.135$^{n.s.}$	2.725	-0.163$^{n.s.}$	3.037
REL (H1b)	0.241*	2.665	0.207*	2.709	0.207*	2.861
TIM (H1c)	0.185*	1.740	0.184*	1.740	0.194*	2.085
COM (H1d)	-0.073$^{n.s.}$	1.918	-0.115$^{n.s.}$	1.990	-0.088$^{n.s.}$	2.119
AOW (H2a)	0.270**	1.718	0.259**	1.723	0.351***	2.500
NOI (H2b)	0.037$^{n.s.}$	1.340	0.035$^{n.s.}$	1.340	0.027$^{n.s.}$	1.635
NOC (H2c)	0.133†	1.144	0.126†	1.146	0.125†	1.229
AOT	-	-	0.194*	1.476	0.183*	1.522
ST_VAL * ST_AOT (H3a)	-	-	-	-	-0.039$^{n.s.}$	3.646
ST_REL * ST_AOT (H3b)	-	-	-	-	-0.027$^{n.s.}$	3.711
ST_TIM * ST_AOT (H3c)	-	-	-	-	0.036$^{n.s.}$	2.565
ST_COM * ST_AOT (H3d)	-	-	-	-	0.103$^{n.s.}$	3.221
ST_AOW * ST_AOT (H4a)	-	-	-	-	-0.238*	2.637
ST_NOI * ST_AOT (H4b)	-	-	-	-	0.097$^{n.s.}$	1.728
ST_NOC * ST_AOT (H4c)	-	-	-	-	-0.137†	1.445
R^2	0.220	-	0.246	-	0.287	-
$\triangle R^2$	-	-	0.026	-	0.041	-

The insignificant relationship between value-added and knowledge adoption of mobile game developers (H1a) may come from the fact that while the coders of independent variables coded considering that the contents of a suggested posting give a benefit to the mobile game development, the coders of dependent variable coded considering not only the benefit but also the cost that can be incurred by the adoption of a suggested posting. The insignificant relationship between completeness and knowledge adoption of mobile game developers (H1d) comes from the fact that while mobile game developers seek a complete

suggested posting in the direction of satisfying many users, users write a complete suggested posting in the way of meeting their needs. The insignificant relationship between the number of images and knowledge adoption of mobile game developers (H2b) can be explained that when it comes to adopting knowledge, an individual who has a lot of experience and retains a high level of understanding regarding the corresponding field (e.g., a mobile game developer), is not misled by the amount of supplements such as images.

Moreover, the insignificant moderation effects of attractiveness of title and content cues on knowledge adoption of mobile game developers (H3) may come from the fact that the direct effect of a certain content cue might have attenuated the influence of attractiveness of title. Finally, the insignificant mitigating effects of attractiveness of title and the number of images on knowledge adoption of mobile game developers (H4b) can be explained that, as referred to earlier, experts such as mobile game developers may downplay the number of supplements such as images, regardless of the degree of interest of the title.

Discussion and Implications

Implications

The theoretical implications of this research are as follows: First, we identified the factors that help mobile game developers adopt suggested postings in their official communities. Given that the majority of previous studies on mobile games have conducted from the viewpoint of customers (e.g., Hamari and Keronen 2017; Rollin et al. 2017; Wei and Lu 2014), this study is among the first attempts to examine the influences of content, non-content, and hybrid cues on knowledge adoption focusing on mobile game developers, rather than mobile game users. Second, this study contributes to the body of knowledge adoption in the context of mobile game by extending the HSM. In the study, the HSM was applied to identify and validate the roles of such influencing cues (i.e., content cues, non-content cues, and hybrid cue) in fostering knowledge adoption in the context of mobile games. Third, in the study, the content cues of suggested postings identified from the HSM are specified by applying the DQ framework. Thus, this study contributes to the data quality literature by combining the HSM and the DQ framework.

The practical implications of this research can be divided into the perspectives of mobile game development companies (or developers) and mobile game users, respectively. First of all, this study identifies and validates the influencing cues of mobile game developers' knowledge adoption. By doing so, it provides practical guidelines and insights on how to manage suggested postings in their official communities in more effective and strategic ways in the mobile game context. In addition, this study provides the cues that mobile game users should focus on in order to make mobile game developers better adopt suggested postings when they leave them in the official community. For example, from findings of the study, it is proved that leaving more relevant and timely suggestions and posting larger amount of writing can lead to better understanding and adopting of mobile game developers.

Limitations and Future Research

If we go over suggested postings in an official mobile game community, in most cases, users only want to receive the benefit without considering the cost. However, to increase the value of products and services, the corresponding cost is inevitable. This also applies in the context of mobile games. To offer benefits users seek, mobile game developers' time and efforts will be spent as cost. Consequently, mobile game developers may not adopt suggested postings because, although the benefits of suggested postings are enticingly high, the accompanying costs are far greater. Therefore, future studies should consider not only the benefit but also the cost when measuring the value-added features of suggested postings in mobile game communities. In this study, we assume that there is little content in images embedded in suggested postings, and employ the number of images as non-content cues. However, in the case of infographics, which has been widely used recently, since a plethora of content is included in images as well, it is also possible to be classified into the content cue. Thus, future research can

advance by better classifying images embedded in suggested postings as either content, non-content, or hybrid cues in compliance with the degree of content within images.

Acknowledgements

This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2017S1A5A2A01027288).

References

Bailey, J. E., and Pearson, S. W. 1983. "Development of a tool for measuring and analyzing computer user satisfaction," *Management Science*, (29:5), pp. 530-545.

Carte, T. A., and Russell, C. J. 2003. "In pursuit of moderation: Nine common errors and their solutions," *MIS Quarterly*, (27:3), pp. 479-501.

Chaiken, S. 1980. "Heuristic versus systematic information processing and the use of source versus message cues in persuasion," *Journal of Personality and Social Psychology*, (39:5), pp. 752-766.

Chen, A., Lu, Y., and Wang, B. 2016. "Enhancing perceived enjoyment in social games through social and gaming factors," *Information Technology and People*, (29:1), pp. 99-119.

Cheng, Y. H., and Ho, H. Y. 2015. "Social influence's impact on reader perceptions of online reviews," *Journal of Business Research*, (68:4), pp. 883-887.

Costello, A. B., and Osborne, J. W. 2005. "Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis," *Practical Assessment*, (10:7), pp. 1-9.

Creswell, J. W. 1994. *Research Design: Qualitative and Quantitative approaches*. Thousand Oaks, CA: Sage.

De, M. D. V., and Formico R. M. A. 2011. "Experiences with rapid mobile game development using unity engine," *Computers in Entertainment*, (9:3), pp. 12-14.

Duan, W., Gu, B., and Whinston, A. B. 2008. "Do online reviews matter?-An empirical investigation of panel data," *Decision Support Systems*, (45:4), pp. 1007-1016.

Emamjome, F. F., Rabaa'i, A. A., Gable, G. G., and Bandara, W. 2013. "Information quality in social media: A conceptual model," in *Proceedings of the 17th Pacific Asia Conference on Information Systems*, J. N. Lee, J. Y. Mao, and T. James (eds.), Jeju Island, Korea, pp. 1-12.

Engström, H., Brusk, J., and Östblad, P. A. 2015. "Including visually impaired players in a graphical adventure game: a study of immersion," *International Journal on Computer Science and Information System*, (10:2), pp. 95-112.

Eric, P., and Takashi, M. 2015. *Nintendo Opens Door to Smartphone Games*, The Wall Street Journal, Available at: www.wsj.com/articles/nintendo-opens-door-to-smartphone-games-1426579567

Feijoo, C., Gómez-Barroso, J. L., Aguado, J. M., and Ramos, S. 2012. "Mobile gaming: Industry challenges and policy implications," *Telecommunications Policy*, (36:3), pp. 212-221.

Filieri, R., and McLeay, F. 2014. "E-WOM and accommodation: An analysis of the factors that influence travelers' adoption of information from online reviews," *Journal of Travel Research*, (53:1), pp. 44-57.

Fung A. 2017. *The Impact of the Rise of Mobile Games on the Creativity and Structure of the Games Industry in China*, (eds.) Mobile Gaming in Asia. Mobile Communication in Asia: Local Insights, Global Implications. Dordrecht, Netherlands: Springer.

Gavalas, D., and Economou, D. 2011. "Development platforms for mobile applications: Status and trends," *IEEE Software*, (28:1), pp. 77-86.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., and Tatham, R. L. 1998. *Multivariate data analysis*, Upper Saddle River, NJ: Prentice hall.

Hamari, J., and Keronen, L. 2017. "Why do people play games? A meta-analysis," *International Journal of Information Management*, (37:3), pp. 125-141.

Hamari, J., Alha, K., Järvelä, S., Kivikangas, J. M., Koivisto, J., and Paavilainen, J. 2017. "Why do players buy in-game content? An empirical study on concrete purchase motivations," *Computers in Human Behavior*, (68), pp. 538-546.

Hsiao, K. L., and Chen, C. C. 2016. "What drives in-app purchase intention for mobile games? An examination of perceived values and loyalty," *Electronic Commerce Research and Applications*, (16), pp. 18-29.

IGAWorks. 2015. *Mobile Games Market Status and Strategy*, IGAWorks, Available at: www.igaworks.com

Jeon, H., Ahn, H. J., and Yu, G. J. 2016. "What makes people react to the posts on the brand pages of mobile social network games?" *Online Information Review*, (40:3), pp. 435-448.

Katerattanakul, P., and Siau, K. 1999. "Measuring information quality of web sites: development of an instrument," in *Proceedings of the 20th International Conference on Information Systems*, P. De and J. DeGross, (eds.), Charlotte, NC, pp. 279-285.

Kim, S. L., Suk, H. J., Kang, J. H., Jung, J. M., Laine, T. H., and Westlin, J. 2014. "Using Unity 3D to facilitate mobile augmented reality game development," *IEEE World Forum*, Seoul, Korea, pp. 21-26.

Klein, B. 2002. "When do users detect information quality problems on the World Wide Web?" in *Proceedings of the Americas Conference on Information Systems 2002*, Dallas, TX, pp. 1101-1103.

LeBreton, J. M., and Senter, J. L. 2008. "Answers to 20 questions about interrater reliability and interrater agreement," *Organizational Research Methods*, (11:4), pp. 815-852.

Lee, K. Y., and Yang, S. B. 2015. "The role of online product reviews on information adoption of new product development professionals," *Internet Research*, (25:3), pp. 435-452.

Lee, Y. W., Strong, D. M., Kahn, B. K., and Wang, R. Y. 2002. "AIMQ: a methodology for information quality assessment," *Information and Management*, (40:2), pp. 133-146.

Lin, K. Y., and Lu, H. P. 2015. "Predicting mobile social network acceptance based on mobile value and social influence," *Internet Research*, (25:1), pp. 107-130.

Marchand, A., and Hennig, T, T. (2013). "Value creation in the video game industry: Industry economics, consumer benefits, and research opportunities," *Journal of Interactive Marketing*, (27:3), pp. 141-157.

Mudambi, S. M., and Schuff, D. 2010. "Research note: What makes a helpful online review? A study of customer reviews on Amazon.com," *MIS Quarterly*, (34:1), pp. 185-200.

Nakatsu, R., Rauterberg, M., and Ciancarini, P. 2017. *Handbook of Digital Games and Entertainment Technologies*, Singapore: Springer.

Newzoo. 2016. *Global Games Market Report: Trends, Insights and Projections toward 2019*, Available at: www.newzoo.com

Nunnally, J. 1978. *Psychometric theory*. New York City, NY: McGraw-Hill.

Ratneshwar, S., and Chaiken, S. 1991. "Comprehension's role in persuasion: The case of its moderating effect on the persuasive impact of source cues," *Journal of Consumer Research*, (18:1), pp. 52-62.

Rollin, R., Steinmann, S., Schramm-Klein, H., Neus, F., and Nimmermann, F. 2017. "Drivers of Market Success for Mobile Gaming Apps-Results of a Choice-Based Conjoint Experiment," in *Proceedings of the 38th International Conference on Information Systems*, Seoul, Korea, pp. 1-20.

Wang, R. Y., and Strong, D. M. 1996. "Beyond accuracy: What data quality means to data consumers," *Journal of Management Information Systems*, (12:4), pp. 5-33.

Weber, R. P. 1990. *Basic Content Analysis*, Beverly Hills, CA: Sage.

Wei, P. S., and Lu, H. P. 2014. "Why do people play mobile social games? An examination of network externalities and of uses and gratifications," *Internet Research*, (24:3), pp. 313-331.

Wikipedia. 2018. *Mobile Game*, Available at: en.wikipedia.org/wiki/Mobile_game

Wilhelmsson, U., Engström, H., Brusk, J., and Östblad, P. A. 2017. "Inclusive game design facilitating shared gaming experience," *Journal of Computing in Higher Education*, (29:3), pp. 574-598.

Zhang, W., and Watts, S. A. 2008. "Capitalizing on content: Information adoption in two online communities," *Journal of the Association for Information Systems*, (9:2), pp. 73-94.