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An Empirical Analysis of Users' Collaboration in Online Game Community

온라인 게임 커뮤니티에서의

이용자들의 협업에 대한 실증분석

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Abstract

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This study examines users' behavior and characteristics under the scheme of virtual communities and further investigates the influence of utility achievability. Using random sample data from an online game company, we find that the users' willingness to participate in virtual teams increases as users purchase virtual items more frequently. However, we also show that, when rewards from team tasks is equally distributed regardless of the contribution of each user, the users who can contribute more may be discouraged to participate in the collaboration in the community. Moreover, gender difference has heterogeneous impacts when participating in virtual teams. We find that male users join in virtual teams less frequently than female users do whereas male users who put more importance on utility take part in virtual teams. Lastly, experienced users refrain from participating in virtual teams. Also, they tend not to join in virtual teams although they have a

chance to obtain utility. These results suggest that companies who run virtual communities should encourage users to purchase virtual items and participate in more teams by providing carefully designed reward allocation scheme with considering the characteristics and behavior of users.

Keywords: virtual community, virtual item, user participation, gender differences, virtual community experience

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1. INTRODUCTION

The number of virtual community (VC) users and the market size of the community are continuously expanding in current digital environment (Bagozzi and Dholakia, 2002). VC plays considerable role in providing individuals with abundant information and therefore is regarded as an interesting research area in business, especially in the IS field (Butler, 2001). Virtual community is defined as a social network of individuals established to pursue mutual interests or goals through online media (Rheingold, 1993).

There have been numerous prior studies on VC (Koh et al., 2003). Especially, the purchase and use of virtual items (Animesh et al., 2011; Kim et al., 2012), virtual teams and their performances (Nath et al., 2008), and economic incentives of users (Roberts et al., 2006; Wasko and Faraj, 2005) have been the subject of extensive research. Although many studies focus on overall performance of the team (Guinan et al., 1998), few studies shed light on factors that determine whether or not an individual will participate in a team. Thus, we decide to take a closer look at the individual activities of the team members, rather than the performance of the team as a whole. Under the scheme where reward is distributed to the team members regardless of their contribution in the task, how would the attainable utility influence users' behavior? Would members of a team purchase virtual item to increase team's task efficiency as a whole?

The purpose of our paper is to elucidate how utility-driven characteristics affect users' decision whether they would participate in virtual teams or not. Specifically, we look into how willingness of virtual item buyers and non-virtual

item buyers to participate would be affected in a scheme where incentives are allocated equally regardless of each player's contribution (equal-distribution scheme) in virtual teams in which users' objective is to improve the status or performance in their activities. Individuals tend to reveal their social status and participate in social interaction by purchasing a product (Dholakia et al., 2004). We examine whether the same holds true in a VC by applying conspicuous consumption theory. Also, we analyze the behavior of virtual item buyers and non-virtual item buyers according to the reward allocation system, and if free riding occurs under an equal-distribution scheme (Holmstrom, 1982). Furthermore, we look at how gender difference affects virtual team participation in which users' objective is to improve the relationship among users and to achieve utility (Bem, 1974). Lastly, we investigate how users decide to join in virtual teams as they become more experienced in VC.

We test our hypotheses with secondary sample data acquired from one of the leading online game companies in Korea. Using longitudinal data analysis, we examine users' behavior pattern in VC.

Numerous findings are drawn from our analysis. First, virtual item purchase positively affects the user's willingness to take part in virtual teams. This coincides with the prior studies that individuals consume virtual items and participate in social activity to reveal their ability and status (Animesh et al., 2011; Kim et al., 2012). Second, virtual item buyers are more reluctant to take part in virtual teams than non-virtual item buyers in equal-distribution scheme. This results from non-virtual item buyers being allotted additional values a virtual item buyer should have received, which leads to free riding phenomenon (Holmstrom, 1982). Third, gender

difference affects virtual team participation. While female users show stronger tendency to join in virtual teams than male users do, male users have preference for participation in virtual teams to obtain utility. This heterogeneity originates from different socialization (Bem, 1974). Whereas males are more goal-oriented and focus on achievements (Broverman et al., 1972), females emphasize relationships (Ibarra, 1997). Last, users are not willing to participate in virtual teams when they have long experiences in VC. Also, they are not willing to join in virtual teams even though they are given a chance to gain utility.

The contribution of this paper is that it empirically proves findings using actual data set. It makes possible for us to precisely measure and quantify the results, which survey data analysis or conceptual researches cannot provide due to their inherent limitations (Webb et al., 1966). In business, practitioners are advised that they manage VC with a long-term point of view. Not only should they pursue revenues from selling virtual items but they should provide users, especially item buyers, with reasonable compensations. This way, item users are encouraged to purchase virtual items continuously (Mittal and Kamakura, 2001). Put in another way, it is suggested that managers pay attention to delicate incentive allocation scheme considering users' satisfaction. Users who participate in virtual teams remain longer in VC (Ray et al., 2014). As users remain longer, the VC itself remains longer with creating a larger source of profit.

2. THEORETICAL BACKGROUNDS & HYPOTHESES

Extensive prior studies have dealt with virtual community (Kim et al., 2012; Roberts et al., 2006). Kim et al. (2012) state VC users purchase decorative items to present themselves to other users in same community. Roberts et al. (2006) find out which motivations trigger software developers to participate in certain projects. Existing research studied team as a whole, but we focus on individual members in teams. We divide individual behavior into four related literatures respectively - conspicuous consumption, user participation incentives, gender difference, and utility driven collaboration. Figure 1 shows the conceptual model of three hypotheses developed in this section of our study.

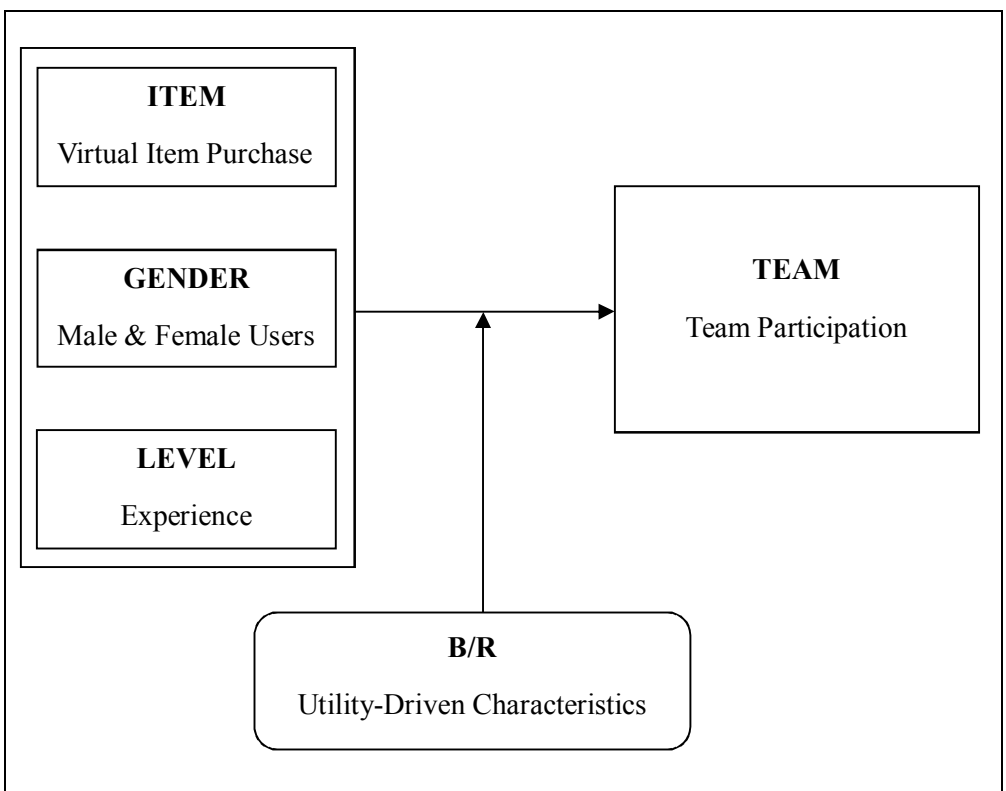

Figure 1. Conceptual Model

2.1. Conspicuous Consumption

Conspicuous consumption theory is applied to diverse research fields (Corneo and Jeanne, 1997). Corneo and Jeanne (1997) argue that consumers show their social status and high income standard to others through purchasing products. Similar phenomenon exists in VC. Animesh et al. (2011) and Kim et al. (2012) prove that people buy virtual items to show their symbolic value in online community. This is consistent with the research that an individual is eager to express his/her identity to other members who are in the same community (Kamau, 2009). Therefore, users in VC are willing to participate in virtual teams to show their own ability and status through purchasing virtual items.

H1 a: Virtual item purchase will be positively associated with team participation.

2.2. User Participation Incentives

Virtual team is an interesting topic in IS field (Nath et al., 2008). Forming a virtual team is more efficient and it draws out better result than acting individually when undertaking tasks (Nath et al., 2008). In this way, users can benefit by collaborating with other users in a team (Cole and Griffiths, 2007). Rational people seek for proper rewards when incentives are allotted in teams (Granovetter, 1985). However, under the equal-distribution scheme, item users are not willing to participate in virtual teams. Additional values an item buyer can obtain are distributed to non-virtual item buyers as well, which leads to free riding (Holmstrom, 1982).

H1 b: Utility-driven characteristics will weaken the relationship between virtual item purchase and team participation.

2.3. Gender Differences

Prior research suggests that men and women show different aspects of behaviors due to their heterogeneous socialization (Bem, 1974). In fact, gender difference has been a widely researched subject across IS field (Baroudi and Igbaria, 1994; Mark et al., 2004). Broverman (1972) said that males put greater importance on goals, results, and achievements whereas females value relationship. These heterogeneous features appear when performing team tasks (Lind, 1999). As suggested by Liu et al. (2013), it is valuable to examine gender and other related issues in digital games. Thus, these differences will be demonstrated in our research as well. In other words, male users are less willing to participate in virtual teams than female users do whereas male users who are eager to achieve utility will join in virtual teams.

H2 a: Male users will be negatively associated with team participation.

H2 b: Utility-driven characteristics will strengthen the relationship between male users and team participation.

2.4. Experience in Virtual Community

Previous studies on shared understanding among workers in the offline environment demonstrated that the experienced participants contributed more constructs initially (Bittner and Leimeister, 2014). Similarly in virtual communities, users spend money to purchase tools that will make themselves more efficient and faster to accumulate experience (Greengard, 2011). However, Kim et al. (2013) found that the users' spending decreases as experienced users already achieved high capabilities after certain points. Also, Lin and Lin (2011) showed that among

VC experience activities, level increasing was perceived by the users to be less exhilarating as the users more get involved in the community. In our research context, users will not participate in virtual teams when they are more experienced in VC. In other words, the higher the users' level is, the lower the users are involved in virtual teams.

H3 a: Users' experience will be negatively associated with team participation.

User behaviors can be based upon utilitarian needs on what experiences users obtain (Voss et al., 2003). They prefer to obtain benefits through utilitarian tasks efficiently with less time and efforts (Payne et al., 1993). Thereby, users who are utility-driven will attempt to earn marginal utility even though the users have long time experiences in VC.

H3 b: Utility-driven characteristics will strengthen the relationship between users' experience and team participation.

3. DATA

3.1. Data Descriptions

We use a set of MMORPG (Massively Multiplayer Online Role Playing Game) community's data from one of the most popular online game companies in Korea. MMORPG is a computer mediated video game that provides virtual place for users to interact with one another using their own avatars. Sample data set consists of individual unit level with daily history activities of 193,006 users for a month from 18th of February 2010 to 19th of March 2010. Appendix 1 shows the number of users who played the game in each day. Approximately 30 percent of users logged in the game more than total 10 days in a month. Appendix 2 indicates the number of days users played the game incessantly. Most of the users played one day out of one month. Therefore, we select 14,223 users out of 193,006 who participated in the game for more than total 10 days. In addition, we exclude users who did not play at least twice during randomly assigned 10 days. We assume that these players are active participants in the online game.

Appendix 3 provides descriptive statistics and correlations among variables. The correlations do not show any multicollinearity problems. To check this further, we analyzed collinearity diagnostics. Variance inflation factor (VIF) indicates that all the values are less than 1.09. Thus multicollinearity is not a problem in this model.

3.2. Variable Descriptions

Variables are described in Appendix 4. BATTLE TIME is defined as the amount of time spent for an individual user to hunt virtual monsters. Users are able to receive certain points after defeating virtual monsters. Points are accumulated and used to move the user's avatar to upper level to build a stronger avatar. Thus, BATTLE TIME is considered as the amount of time spent in utility-oriented tasks for users to grow up by engaging in battle with virtual monsters. REST TIME is defined as the amount of time spent by a user engaging in activities other than battle. Users spend time to chat with other users and rove around the map together. B/R denotes the ratio of BATTLE TIME to REST TIME. Therefore, users with high B/R are active participants in utility-oriented tasks. ITEM is the total number of virtual items an individual user has purchased. These items make users complete tasks efficiently and quickly (Guo and Barnes, 2007). LEVEL was measured to proxy for the magnitude of user experience in the VC. Users increase levels not only by fighting with virtual monsters but by participating in tasks other than the battle. TEAM is the total number of temporary alliance by an individual user with other users. When in a team, he/she collaborates with other team members to complete tasks that are difficult for an individual user to handle with. Also, users chat and rove with other team members.

4. MODEL

We set an econometric model to estimate the impacts of virtual item purchase, gender differences, levels of users and the effect of moderator, B/R, on team participation.

$$(\mathrm{TEAM})_{i,t} = \beta_0 + \beta_1(\mathrm{ITEM})_{i,t} + \beta_2\left(\mathrm{ITEM} \times {}^{\mathrm{B}}/_{\mathrm{R}}\right)_{i,t} + \beta_3(\mathrm{GENDER})_i + \beta_4\left(\mathrm{GENDER} \times {}^{\mathrm{B}}/_{\mathrm{R}}\right)_i + \beta_5(\mathrm{LEVEL})_{i,t} + \beta_6\left(\mathrm{LEVEL} \times {}^{\mathrm{B}}/_{\mathrm{R}}\right)_{i,t} + \beta_7\left({}^{\mathrm{B}}/_{\mathrm{R}}\right)_{i,t} + \mu_i + \epsilon_{i,t}$$

We set the panel data and analyze them to obtain richer results by controlling variables that cannot be observed or variables that change over time but not across individual entities rather than cross sectional data which can lead to serious endogeneity problems (Greene, 2003).

5. RESULTS

The results are shown in Table 1. The variable 'ITEM' in this model is treated as dummy variable with 1 if purchased at least once, 0 if never been purchased. We make interaction term with ITEM and B/R to figure out whether the effect of item purchase behavior has on team formation is affected by utility-driven characteristics. Also, GENDER is coded as dummy variable with 1 if male and with 0 if female and we use interaction term with GENDER and B/R. Lastly, LEVEL is a continuous variable with positive integers and we generate interaction term with B/R.

Table 1 shows the result of pooled OLS, fixed and random models. The F-statistics from fixed effect analysis show that it provides more efficient results than pooled OLS model because it controls the unobserved heterogeneity which cannot be measured. Moreover, we conduct Hausman test and the result suggests that fixed effect model is proper than random effect model. However, our study investigates the relationship between the gender heterogeneity and team participation. This time invariant covariate is controlled, thereby would be omitted in fixed effect model. In the presence of time invariant regressors, it is still possible to estimate random effect model to test H2 (Greene, 2003). To further test the appropriateness of random effect model, we demonstrate Breusch and Pagan Lagrangian Multiplier test and find that random effect model is more efficient than pooled OLS model in terms of coefficients and standard errors.

Table 1. Regression Results			
D.V.: TEAM	Pooled OLS	Fixed Effect	Random Effect
ITEM	17.279*** (0.11)	**(H1 a)** 18.58*** (0.12)	17.624*** (0.11)
ITEM × $^{B}/_{R}$	-0.616** (0.29)	**(H1 b)** -2.369*** (0.30)	-0.973*** (0.29)
GENDER	-0.834*** (0.10)	-	**(H2 a)** -0.617*** (0.14)
GENDER × $^{B}/_{R}$	2.11*** (0.25)	-	**(H2 b)** 1.372*** (0.28)
LEVEL	0.199*** (0.00)	**(H3 a)** -0.392*** (0.07)	-0.203*** (0.00)
LEVEL × $^{B}/_{R}$	-0.089*** (0.01)	**(H3 b)** -0.108*** (0.01)	-0.116*** (0.01)
$^{B}/_{R}$	0.334 (0.42)	3.716*** (0.47)	2.956*** (0.44)
AGE	-0.03*** (0.00)	-	-0.03*** (0.00)
* p<0.05, ** p<0.01, *** p<0.001, Number of obs=213,026			

First, it is highly significant that users get more involved in virtual teams when they purchase virtual items more (H1 a supported). However, utility-driven characteristics weaken the relationship between item purchase behavior and team participations. In other words, item buyers tend to not participate in virtual teams (H1 b supported). This is completely opposite to the first findings and shows item buyers are sensitive to additional values derived from item usage. Second, males are less willing to get involved in virtual teams than females do (H2 a supported) whereas males join more in virtual teams than females do when there exists attainable utility (H2 b supported). This finding is consistent with the previous

study (Billieux et al., 2013), the research based on online survey. Third, users eschew from taking part in virtual teams as they have more experience in VC (H3 a supported). In contrast to our expectations, utility-driven characteristics weaken the relationship between level and team participation in a small magnitude. Thus, users tend not to participate in virtual teams although they pursue utility (H3 b not supported).

6. ROBUSTNESS CHECKS

6.1. Autocorrelation

We conduct robustness checks of the results and then test the previous model whether autocorrelation exist or not. The result suggests that autocorrelation exists in our research model. Estimating AR(1) model, we find that the results still hold in terms of direction and magnitude except for minor changes in parameters. Consequently, autocorrelation should not be a major problem.

6.2. Simultaneity

Explanatory variables are not perfectly exogenous in the panel data model. A potential problem of endogeneity issues rises, of which we need to control. In our study, we find a valid instrument, $(\mathrm{ITEM})_{i,t-1}$, for $\mathrm{ITEM}_{i,t}$. The lagged variable we identified is highly correlated with the endogenous variable and is not correlated with the error term at time t, since the past virtual item buying had happened at earlier in time. By using two-stage least squares (2SLS), we figure out that the directions and significance of the regressors are not distinctively different from the main results. The standard errors are higher in overall and few parameters turn out to be insignificant. However, the directions of the coefficients remain the same to support the main analysis. Therefore, we conclude that the simultaneity does not seriously affects the model, thus the results are shown to be robust.

Table 2. AR(1) and 2SLS Analysis				
D.V.: TEAM	FE with AR(1)	RE with AR(1)	FE 2SLS	RE 2SLS
ITEM	18.276*** (0.13)	16.423*** (0.11)	21.884*** (0.39)	19.728*** (0.33)
$\text{ITEM} \times {}^{B}/_{R}$	-2.904*** (0.30)	-0.665** (0.28)	-2.040** (0.98)	0.398 (0.88)
GENDER	-	-0.508*** (0.13)	-	-0.649*** (0.14)
$\text{GENDER} \times {}^{B}/_{R}$	-	0.938*** (0.27)	-	1.448*** (0.29)
LEVEL	-0.136*** (0.02)	-0.180*** (0.00)	-0.901*** (0.08)	-0.202*** (0.00)
$\text{LEVEL} \times {}^{B}/_{R}$	-0.072*** (0.01)	-0.078*** (0.01)	-0.105*** (0.01)	-0.119*** (0.01)
${}^{B}/_{R}$	3.032*** (0.45)	2.132*** (0.42)	3.822*** (0.48)	3.059*** (0.46)
AGE	-	-0.029*** (0.00)	-	-0.031*** (0.00)
* p<0.05, ** p<0.01, *** p<0.001, Number of obs=213,026				

6.3. Dependent Variable as '$(\text{TEAM})_{i,t+1}$'

Mithas et al. (2013) additionally estimated predicted strategic posture as a dependent variable to check the robustness of the main results and to provide insights to the executives who make IT investment decisions. Following the study of Mithas et al. (2013), we conduct similar estimation in that the dependent variable is the expected number of parties an individual user has had with other users. Without the ITEM related hypothesis, which is turned out to be insignificant however the direction of coefficients does not change, the outcomes appear to be

nearly as same as the main results as well.

Table 3. Robustness Checks		
D.V.	$(\text{TEAM})_{i,t+1}$ (FE)	$(\text{TEAM})_{i,t+1}$ (RE)
ITEM	12.748*** (0.16)	13.003*** (0.15)
ITEM $\times$ $^{B}/_{R}$	-0.447 (0.41)	-0.407 (0.39)
GENDER	-	-0.6*** (0.13)
GENDER $\times$ $^{B}/_{R}$	-	1.465*** (0.41)
LEVEL	-0.338*** (0.10)	-0.202*** (0.01)
LEVEL $\times$ $^{B}/_{R}$	-0.129*** (0.02)	-0.091*** (0.01)
$^{B}/_{R}$	4.593*** (0.75)	1.538** (0.66)
AGE	-	-0.029*** (0.00)
* p<0.05, ** p<0.01, *** p<0.001, Number of obs=213,026		

7. Discussion and Conclusion

This paper contributes to both academic and practical fields. We have empirically analyzed how users behave differently depending on the amount of incentives allocated when working as a team. In this way, we quantitatively assess the intention to purchase, users' behavior toward compensation scheme, different motivations to joining in virtual teams due to heterogeneous gender characteristics, and users' perspectives toward the utility according to their duration of the experiences with the econometric model. For the business perspectives, this paper provides appropriate strategies for the practitioners to manage VC. It helps them to motivate users to buy extra virtual items by assigning users compensations based upon individual's contributions. Also, we offer valuable insights for managers to maintain VC. Users are encouraged to form a team which is an important way for users to interact with one another (Kraut et al., 1999). The more users have interactions, the longer they stay in VC. In this way, participants in VC would be considered as potential source of profits (Jiang et al., 2010). Finally, the value of social involvement in VC gives useful information to community vendors. They are able to create proper marketing strategies with such knowledge.

One of the limitations of this paper is that the analysis was conducted with limited variables. Despite a large scale sample size and a long duration of the period, the number of the variables used in this study may be insufficient to output the efficient estimations. Otherwise, there is a possibility of falling into the specification bias. Moreover, it is difficult to generalize the results. This is due to the fact that our study is based on online game data setting. However, the overall

concept of the paper is about peoples' behaviors in VC. Furthermore, the results are applicable to other forms of online community cases. This is reasonable because VC is a reflection of a real society where many people are bound to form networks (Turoff, 1997).

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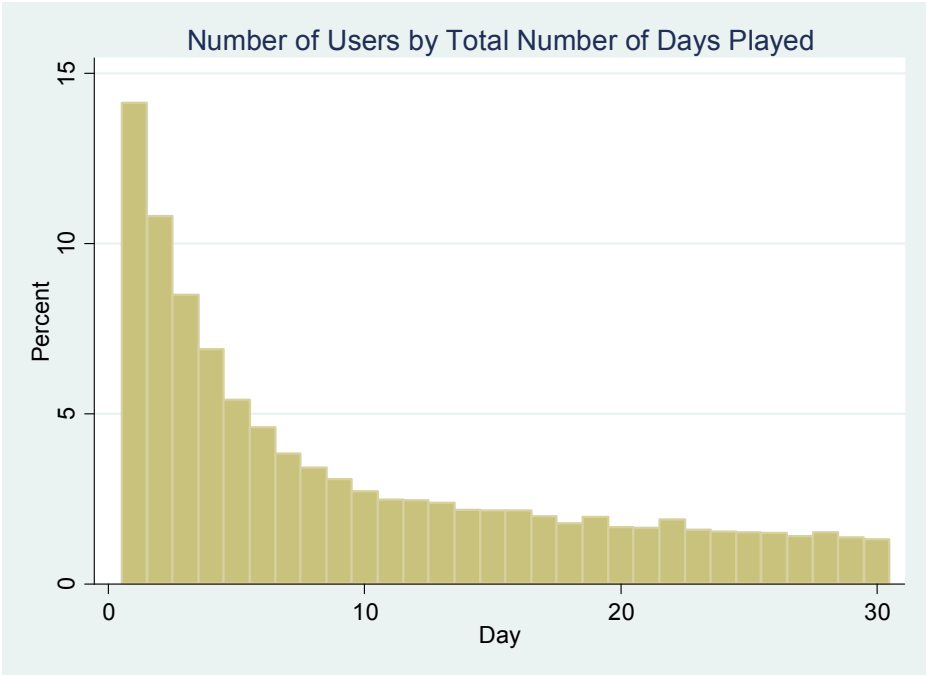
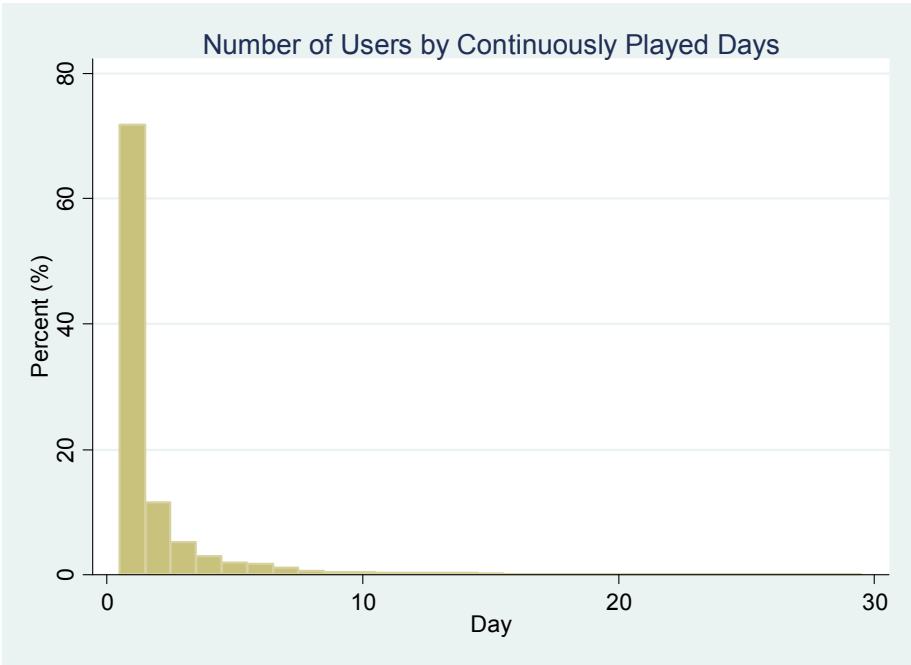
Appendix 1: Number of Users by Total Number of Days Played



Appendix 2: Number of Users by Continuously Played Days



Appendix 3: Correlations and Descriptive Statistics

	Variables	Mean	S.D.	1	2	3	4	5	6
1	TEAM	5.19	16.14	1.00					
2	ITEM	5.22	18.24	0.27	1.00				
3	LEVEL	39.87	14.03	0.14	-0.01	1.00			
4	B/R	0.32	0.25	-0.01	-0.01	0.22	1.00		
5	AGE	25.84	11.95	0.01	-0.01	0.18	0.03	1.00	
6	GENDER	0.36	0.48	-0.01	0.01	-0.05	-0.06	0.06	1.00

Appendix 4: Variable Descriptions

Variable	Definition	Description
TEAM	The number of alliances an individual user has had with other users	The number in which an individual user form a team with other users
ITEM	The number of items an individual user has purchased	The frequency in which virtual items are purchased by an individual user
LEVEL	A number that represents an individual user's overall experience	A number that shows an individual user's strength and ability to accomplish more difficult tasks.
BATTLE TIME	Time engaged in battle by an individual user	Time engaged in battle to hunt virtual monsters by an individual user
REST TIME	Time engaged in all the other activities except for battle time	Time engaged in all the other activities except for battle time such as chatting with other users
B/R	The ratio of battle time to rest time	Described above
AGE	Age	Individual user's actual age
GENDER	Male or female	A dummy variable coded as 1 if a user is male, 0 if female

국문 초록

온라인 게임 커뮤니티에서의

이용자들의 협업에 대한 실증분석

본 연구는 가상 커뮤니티 체계 내에서 발생하는 이용자들의 행동과 특성을 분석하고, 이용자들에게 미치는 효용(utility)이 이들의 행동과 특성을 어떻게 변화시키는지에 대해 고찰하였다. 특정 온라인 게임 업체에서 제공한 실제 표본 데이터를 사용하였으며, 분석 결과 이용자들이 가상 아이템(virtual items)을 구매할수록, 가상 팀(virtual teams)에 더 참여하려하는 것으로 나타났다. 그러나, 팀 임무 완료 후 받을 수 있는 보상이, 이용자들의 팀 내에서의 기여도와는 상관없이, 동등하게 배분되는 경우, 팀 내에서 더 기여할 수 있는 이용자들이 팀 단위의 협업에 참여하지 않으려 하는것으로 나타났다. 또한, 남녀 간의 성별 차이도 가상 팀의 참여 여부에 서로 다른 영향을 끼치는 것으로 나타났다. 남성 이용자들은 여성 이용자들보다 가상 팀에 참여하지 않으려 하지만, 오히려 효용 지향적인 남성 이용자들은 가상 팀에 참여를 하는 것으로 밝혀졌다. 이 외에도, 커뮤니티 이용도가 높은 이용자들일수록 가상 팀에 참여하려 하지 않는 것으로 판명되었으며, 이용도가 높으며 효용 지향적인 이용자들 역시 가상 팀에 참여하지 않는 것으로 나타났다. 본 논문은, 분석된 결과들을 바탕으로, 가상 커뮤니티를 운영하는 비즈니스 주체들이 이용자들의 특성과 행동패턴을 고려하여 더욱 정교한 보상 체계를 설계할 수 있다는 점에서 의의가 있으며, 이용자들의 가상 아이템 구매와 팀 참여도의 크기를 측정하여 수치화된 값을 바탕으로 실무자들이 비즈니스 전략에 활용할 수 있다는

점에 가치가 있다.

주요어: 가상 커뮤니티, 가상 아이템, 가상 팀, 이용자 참여, 성별 차이, 가상 커뮤니티 경험

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