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An Investigation of the Diffusion of Online Games in Taiwan: An Application of Roger's Diffusion of Innovation Theory

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ABSTRACT

Online games have shown the potential to grow from a small to a major portion of the global entertainment sector. The increasing maturity of broadband technology and infrastructure development will facilitate this growth. In these circumstances, an investigation of the diffusion of online games in a social system will provide some insight into gamer behaviors and further the development of online games in the near future. Nevertheless, a robust review on the literature has revealed a lack of research in the subject matter. Therefore, in this paper, an investigation of the diffusion of online games in Taiwan is therefore conducted. Rogers' (2003) Diffusion of Innovation model (DOI) is applied in the investigation. Cluster analysis is utilized to divide the current diffusion stages of online games into: innovators, early adopters and the early majority categories. The differences in attributes/characteristics among the three categories are assessed. Implications based on the research findings are discussed, and future research suggestions are also provided.

1. INTRODUCTION

Online games, a form of interactive electronic games rooted in the Internet, have shown the potential to grow from a small to a major portion of the global entertainment sector. The global sales revenue was estimated to increase to second place in the total game market in 2003 (IDC, 2003). As well, uncountable breakthroughs in technology and broadband infrastructure development will further facilitate this future growth (Fu, 2003). Hence, studies on the diffusion of online games within a social system providing better insight into online gamer profiles has become essential. A robust review on the literature has revealed only a limited number of academic papers associated with the current subject matter (e.g. Morahan-Martin, and Schumacher, 2000; Kim *et al.*, 2002, Choi, and Kim, 2004). In order to shed more light on this subject, an attempt has been made to study the diffusion of online games in Taiwan, the second largest market worldwide (IDC, 2003). Rogers' (2003) Diffusion of Innovation model (DOI hereafter), a frequently adopted DOI theory for explaining innovation diffusion across various products, is applied for the study. The current online game diffusion stage is investigated, and online gamer profiles within each stage are revealed. In considering various innovation diffusion rates across different products (Martinez, Polo, and Flavian 1998), a comparison of players' innovative attitudes towards online games and general products is also conducted to reveal possible reasons. Such a comparison devotes to Rogers' DOI theory as the disciplines of Rogers' DOI school of thought has only centered on consumer attitudes towards a single product, or the existing research has failed to discuss distinguishing the differences in consumer attitudes towards different products (e.g. Wells and Anderson, 1997; Martinez *et al.*, 1998; Aarnio *et al.*, 2002). The paper begins in the following section with a review of the literature on online games and the DOI theory. The research methodology is then discussed, followed by a data analysis. Conclusion, including research implications and future research, will be drawn in the last section.

2. LITERATURE REVIEW

2.1. Online games

A brief online game history is discussed below, followed by its current research:

2.1.1 A History of Online Games

The predecessors of online games were video games, PC games, and arcade games. Online games were initially created in the USA in 1969 and became popular in universities in the 1980's with the emergence of the TCP/IC network communication agreement at that time. The enhancement of computer multi-media functions and the emergence of the World-Wide-Web (WWW) brought online games a newborn stage in the early 1990's. Several years later, in the late 1990's, online games entered a new era, a growth stage, with the number of players swelling sharply (Institute for Information Industry, 1999). In 2004, worldwide sales are estimated to reach about US$ 4,500 million, with an average growth rate of 37.6% for each of the last 5 years. Overall sales have helped online games to reach second place in the electronic game market, while South Korea and Taiwan are the two largest markets, with their market size ranking in that order (IDC, 2003). Current online games can be categorized into simulation games, role playing games, and shooting

games (Kim *et al.*, 2002).

2.1.2 Current Online Games Research

Two mainstream types of research regarding online games have been gamer demographics and gamer behaviors. Fattah and Paul (2002) investigated the demographics of American online gamers, such as their gender, income, and the racial percentages. A more interesting finding was that gamers were beginning to resemble the general population. This implies that it is necessary to diversify online game contents in order to satisfy various classes of players in the USA. Dixon and Karboulonis (2001) and Cheng, Chen, and Wu (2002) also made the same comments for online game vendors who participated on European and Asian markets. As for online gamer behavior research, Morahan-Martin and Schumacher (2000) found that, in the USA, pathological Internet undergraduate users were more likely to play online games. Moreover, the study conducted by Kim *et al.* (2002) indicated that, in South Korea, an e-lifestyle influence motivated individuals to play online games, and the types of online games played had an important effect on the relationship between e-lifestyles and the motives for the use of online games. An e-lifestyle was conceptualized by Kim *et al.* as a lifestyle on the cyberspace, including the four elements of content, community, commerce, and communication. More recent research related to online gamer behaviors was conducted by Choi and Kim (2004) in South Korea. Their results revealed that optimal online games experiences led people to continue to play online games. An optimal experience could be attained if the player had effective personal interaction with the system, or pleasant social interactions with other people connected through the Internet.

2.2. Diffusion of Innovation Theory

The Diffusion of Innovation theory is as a theory of communication which has been studied extensively in the literature from the viewpoint of various disciplines and with respect to different types of products, services and ideas. Bass (1969), Moore (1995), and Rogers (2003) are three of the mainstream types of research in the DOI school of thought, with the latter receiving more attention.

2.2.1 Bass' model

By utilizing mathematical methods, Bass developed an innovation diffusion model in 1969 in which five adoption categories were proposed, from the earliest adoption onward: innovators, early adopters, the early majority, the late majority, and laggards. The movement of the adoption stage is supposed to be affected by two types of communications, i.e., "mass media" (or internal influence) and "word of mouth" (or external influence) (Mahajan, Muller, and Srivastava, 1990; Martinez and Polo, 1996).

2.2.2 Moore's model

In 1995, Moore developed his own diffusion model of technological innovations. The same five categories were used as the traditional DOI school of thought, with the same terms to represent the forward stages of innovation adoption (Sroufe *et al.*, 2000). The major difference from traditional DOI school of thought was the assumption of a discontinuous innovation process and the focus only on organization, with a new technology adoption requirement.

2.2.3 Rogers' model

Rogers introduced his famous innovation diffusion theory in his book in 1962, "Diffusion of Innovations". Since then, due to its popularity for analyzing technological innovation adoption, five editions (1962, 1971, 1983. 1995, 2003) have been printed. Rogers classifies diffusion in his innovation adoption framework into five onwards stages: innovators, early adopters, the early majority, the late majority, and laggards, with 2.5%, 13.5%, 34%, 34%, and 16% of the population respectively. The adoption of an innovation, according to Rogers, is mainly affected by four elements, the innovation itself, communication channels, time, and the social system. Differences between stages are discussed under headings, such as socioeconomic status, personality values, and communication behavior. Rogers' theory can be applied to both individuals and organizations.

Empirical studies related to Rogers' DOI theory can be classified into three agendas: the operationalization of the innovativeness construct, characteristics and behaviors of innovation adopters across diffusion stages, and the validation of the elements derived by Rogers to facilitate the adoption of innovation. Researchers utilize thee mechanisms to classify innovation adopters into adoption categories: the innovativeness construct, a set of consumer behaviors, and "years to adopt". The use of the former is deemed a more precise approach by the research to cluster the adoption groups. According to Rollins (1993), an early scale of the innovativeness construct was operationalized in 1971 by Roger and Shoemaker. In 1991, in view of the weakness of the existing scales, Goldsmith and Hofacker, through comprehensive reading and a robust review of the literature, also developed an innovative scale, titled the "Respondents' Innovativeness Scale". With its ease of administration, high reliability, and adaptability across domains, their scale has been applied in various studies (e.g. Park and Jun, 2003; Roehrich, Valette-Florence, and Ferrandi, 2003). Regarding research on the characteristics and behaviors of innovation adopters across diffusion stages, in general, previous research results have been consistent with Rogers' assumption that communication behaviors (e.g. credit, social and business travel, etc.), personality values (e.g. Sympathy, Curiosity, etc.), and so on are positively correlated with the attitudes towards innovation (see among others, Rollins, 1993; Wells and Anderson, 1997; Martinez *et al.*, 1998; Aarnio *et al.*, 2002). In respect to the validation of the elements to facilitate the adoption of innovation, the facilitators frequently examined are the relative advantages, compatibility, trialability, observability, and complexity. The findings generally support Rogers' proposition that the former

four facilitators have a positive effect on facilitating the adoption of innovation, while the latter has a negative influence on it (see among others, Sonnenwald, Maglaughlin and Whitton, 2000; Ferle, Edwards and Mizuno, 2002).

3. RESEARCH METHODOLOGY

As mentioned above, this research is designed to investigate Taiwan's current online game diffusion stage and online gamer profiles within each stage. In addition, a comparison of online gamers' innovative attitudes towards these games and general products is also conducted. The research methodology is designed based on the above purposes.

3.1. Questionnaire design and pre-testing

The questionnaire included four main parts. The first part contained one question that distinguished whether the participant was an online gamer, i.e., an innovation adopter. The purpose of this question was to identify the current diffusion rate of online games (Prendergast, 1993). The second part contained a scale for the clustering of online gamers into internally coherent subgroups. Adopted from the Respondents' Innovativeness Scale (Goldsmith and Hofacker, 1991), a 6-item, 7-point Likert scale of innovative attitudes towards online games was operationalized, which included "gaining newest game information", "knowledge of newest game trends", "purchasing the newest games", "purchasing without prior game knowledge", "earliest game players", and "playing more types of games". The third part contained questions related to the gamers' socioeconomic status, personality variables and communication behavior. The innovative attitude measurements associated with general products were printed in part 4. The questionnaire was pre-tested to refine the questions. Three researchers with a theoretical DOI background were involved to clarify the relevance of the questions. Then, three heavy online gamers were requested to fill out the questionnaire. Appropriate modifications were made in accordance with their comments.

3.2. Sampling and data collection

Current Taiwan residents between 13-50 years old were chosen for the research sample. This was in consideration of the lack of maturity of youngsters below 13 and the lack of online game knowledge of people aged over 50 (cf. MIC, 2003; Fu, 2003). Questionnaires were collected at Taipei MRT stations (Mass Rapid Transit stations) by systematic sampling. One out of ten people walking through the entrance was chosen as potential participants. Prior to participation, a question associated with their ages was asked for the purpose of qualification. A total of 350 questionnaires were finally collected.

4. DATA ANALYSIS

The SPSS statistics program was employed as the data analysis tool. Individual analysis results are discussed below.

4.1. Participant's Demographic Statistics

In order to offer an insight into the participants, a brief profile of their demographic statistics is given. As seen in Table 1, the age distribution of the participants is quite equal in each category. A large number of them have disposable income of more than NT$10,000, with the next most common distribution being between NT$7001-10000. A university background is the dominant educational degree of the participants, while senior high school/junior college is in second place. A large proportion of participants' occupation is student, while manufacturing industry ranks second. 54.6% of all participants are female, however, the majority of online gamers are male (see Table 2).

Table 1: Participants' demographic statistics

Age	Freq.	%	Education	Freq.	%
13-15	34	9.7	Junior high school	45	12.8
16-18	45	12.9	Senior high school/Junior college	112	32.0
19-22	43	12.3	University	163	46.6
23-25	46	13.1	Masters degree	30	8.6
26-30	45	12.9	Occupation	Freq.	%
31-35	37	10.6	Manufacturing	40	11.4
36-40	32	9.1	Information/Computer	23	6.6
41-45	33	9.4	Engineering Architecture	4	1.1
46-50	35	10.0	Communication and Transportation	5	1.4
Disposable income	Freq.	%	Telecommunications and Communications	28	8.0
=< NT$1000	49	14.0	Finance and Insurance	16	4.6
NT$1001-NT$2000	37	10.5	Medical Treatment and Sanitation	10	2.9
NT$2001-NT$4000	43	12.3	Mass media	12	3.4
NT$4001-NT$7000	36	10.3	Public administration	8	2.3
NT$7001-NT$10000	51	14.6	Solider	7	2.0
>= NT$10001	134	38.3	Teacher	6	1.7
			Student	135	38.6
			Service industry	31	8.9
			Others	25	7.1

Table 2: The proportion of online game players and non-players

Innovation adoption	Male		Female		Total	
	Freq.	%	Freq.	%	Freq.	%
Players	84	24.0	51	14.6	135	38.6
Non-players	75	21.4	140	40.0	215	61.4
Total	159	45.4	191	54.6	350	100

4.2. Adoption clusters/categories

According to Rogers' DOI theory and following Prendergast's (1993) suggestion, as the adoption rate has reached 38.6% (see Table 2), online game diffusion has currently reached the early majority stage. Therefore, on the basis of the Respondents' Innovativeness Scale (see Section 3.1), three online gamer clusters/categories are formed: innovators, early adopters, and the early majority. From the statistics in Table 3, it is clear that not only the significant differences but also the tendency among the clusters follow Rogers' DOI theoretical descriptions. In other words, innovators (i.e., the first cluster) have more new online game information and always possess knowledge about current trends; in addition, they purchase the newest versions of online games, although they do have not heard of them. Of course, these innovators are the earliest players of new versions of online games, and play more different types of games. The second group mentioned are early adopters (i.e., the second cluster), followed by the early majority (i.e., the third cluster).

Table 3: Online gamers' adoption behaviors in each cluster

Adoption behaviors	Rogers' original sign	Mean Values			Sig.
		Cluster 1: Innovator	Cluster 2: Early Adopter	Cluster 3: Early Majority	
O1: Gaining newest game info.	+	5.93	4.58	2.63	0.00
O2: Knowledge of newest trends	+	6.33	3.96	3.17	0.00
O3: Purchasing of newest games	+	6.13	3.48	2.51	0.00
O4: Purchasing without knowledge	+	5.53	3.18	1.97	0.00
O5: Earliest gamers	+	6.27	4.58	2.23	0.00
O6: Playing more types of games	+	6.07	3.94	2.00	0.00

* Measures for O1-O6 are based on a Likert scale where 1 indicates "totally agree" and 7 "totally disagree"
** O1-O6: Cluster 1 > Cluster 2 > Cluster 3

4.3. Participants' characteristics and behaviors across clusters

In this section, on the basis of Rogers' DOI theoretical assumption, participants' characteristics and behaviors (i.e., communication behaviors, personality values, socioeconomic status, and information sources and spreading) are compared across the above three clusters. As observed in Table 4, all communication behaviors are significantly different. Nevertheless, there is no credit difference between innovators and early adopters; the same applies for business travel effects between early adopters and the early majority. However, the results approximately follow Rogers' theoretical assumption that, online game innovators value credit as more important than the other two clusters. They also travel for more social and business purposes. Making friends is their preference more than for the other two clusters. Early adopters also enjoy the faster moves than the early majority.

Table 4: Characteristics across clusters

Innovation adopter characteristics		Rogers' original sign	Mean Values			Sig.
			Cluster 1: Innovator	Cluster 2: Early Adopter	Cluster 3: Early Majority	
Communication behaviors	C1: Credit	+	6.60	5.92	5.16	0.00
	C2: Social travel	+	5.40	4.50	3.59	0.00
	C3: Business travel	+	4.40	3.30	2.87	0.01
	C4: Making friends	+	6.07	2.22	4.33	0.00
Personality values	P1: Sympathy	+	6.20	5.12	4.13	0.00
	P2: Curiosity	+	6.47	5.74	4.97	0.00
	P3: Abstract concepts	+	6.20	5.24	4.37	0.00
	P4: Control of future	+	5.60	4.58	3.61	0.00
	P5: Education	+	6.40	5.38	4.49	0.00
	P6: New technology	+	5.80	4.92	4.09	0.00
	P7: Effective methods	+	6.27	5.28	4.44	0.00
Socioeconomic status	S1: Age	+	2.80	3.38	4.17	0.01
	S2: Disposable income	+	2.53	3.68	3.89	0.05

* Measures for C1-C2, and P1-P7 are based on a Likert scale where 1 indicates "totally agree" and 7 "totally disagree"
** Age: 1: 13-15 (years old); 2: 16-18; 3: 19-22; 4: 23-25; 5: 26-30; 6: 31-35; 7: 36-40; 8: 41-45; 9: 46-50
*** Disposable income: 1: =< NT\$1000; 2: NT\$1001-NT\$2000; 3: NT\$2001-NT\$4000; 4: NT\$4001-NT\$7000; 5: NT\$7001-NT\$10000; 6: >= NT\$10001 **** C1: Cluster 1= Cluster 2 > Cluster 3; C3: Cluster 1> Cluster 2 = Cluster 3; S1: Cluster 3 > Cluster 1; S2: Cluster 3 = Cluster 2 > Cluster 1; Others (C2, C4, P1-P7): Cluster 1 > Cluster 2 > Cluster 3

As for the participants' personality values, it is clear in Table 4 that, all the participants' personalities across clusters are significantly different and the tendency is to follow Rogers' theory. That is, online game innovators are more sympathetic and curious; they can handle abstract concepts and better control their future; they look upon education as positive, and accept new technologies quickly. These can help to explain why they prefer to utilize effective methods to complete a job. The second movement mentioned above is early adopters, followed by the early majority. Socioeconomic status in this research includes gender, age, disposable income and educational level (see Table 4 and Table 5). From the results, it appears that male find it easier to play online games while females are more likely to be later adopters. In addition to gender, the online game innovator cluster is comprised of relatively young people with lower disposable incomes and lower educational level, findings that are inconsistent with Rogers' proposition. It could be that current online game markets target young people/students with relatively low incomes and educational level.

Table 5: Gender and educational level

Socioeconomic status		Cluster 1: Innovator			Cluster 2: Early adopter			Cluster 3: Early majority			Total Freq.	Sig.
		Freq.	%	Cum.	Freq.	%	Cum.	Freq.	%	Cum.	Freq.	
Education	Junior high school	6	40.0	40.0	5	10.0	10.0	6	8.6	8.6	17	0.02
	Senior high school/ Junior college	3	20.0	60.0	23	46.0	56.0	30	42.9	51.5	56	
	University	6	40.0	100.0	18	36.0	92.0	32	45.6	97.1	56	
	Master degree	0	0.0	100.0	4	8.0	100.0	2	2.9	100.0	6	
	Total	15	100.0	100.0	50	100.0	100.0	70	100	100.0	135	
Gender	Female	4	26.7	26.7	13	26.0	26.0	34	48.6	48.6	51	0.03
	Male	11	73.3	100.0	37	74.0	100.0	36	51.4	100.0	84	
	Total	15	100	100.0	50	100	100.0	70	100	100.0	135	

The information sources, including internal and external, indicate that online game innovators are the highest percentage, followed by early adopters, and then the early majority (see Table 6). As for spreading information, the percentage of information spread to others by online game innovators is the highest, followed by early adopters, and the early majority group in last place. The above two facts support Rogers' assumption that innovators use relatively more internal and external information sources than early adopters and the early majority do. Besides, there are more opinion leaders or change agents among online the game innovator group.

Table 6: Information sources and information spreading

Information sources and spreading		Cluster 1: Innovator		Cluster 2 Early Adopter		Cluster 3 Early majority		Total (Freq.)
		Freq.	%	Freq.	%	Freq.	%	
Internal sources	TV	13	86.7	22	44.0	16	22.9	51
	Magazine	13	86.7	13	26.0	17	24.3	51
	Internet	14	93.3	16	32.0	20	28.6	43
	Mean		88.9		34		25.3	
External sources	Friend	13	86.7	26	52.0	33	47.1	50
	Colleague	13	86.7	35	70.0	16	22.9	72
	Classmate	14	93.3	33	66.0	33	47.1	64
	Family	11	73.3	26	52.0	34	48.6	80
	Mean		85		60		41.1	
Information spreading to	Friends	14	93.3	44	88.0	52	74.3	110
	Family	5	33.3	9	18.0	14	20.0	28
	Colleague	6	40.0	12	24.0	13	18.6	31
	Classmate	11	73.3	25	50.0	32	45.7	68
	Club mate	1	6.7	1	2.0	1	1.4	3
	Mean		49.3		36.4		32	
Players in each cluster		15		50		70		135

4.4. A comparison of the participants' adoption behaviors towards online games and general products

As mentioned above, in this study, not only is an attempt made to validate the suitability of the application of Rogers' theory to online gamers, but an effort is made to examine its theoretical generaliability applied to the adoption of various innovations. The adoption behavior towards general products compared with online games adoption behaviors is therefore conducted, which is an innovative approach beyond the scope of previous research

(see among others, Wells and Anderson, 1997; Martinez *et al.*, 1998; Aarnio *et al.*, 2002). An analysis of the results indicates that the participants' adoption behaviors towards general products failed to follow the DOI theory. This can be seen from Table 7 that no difference among the 3 diffusion clusters exists in purchasing new products.

Table 7: Participants' general product adoption behaviors in each cluster

General product Adoption behaviors	Rogers' original sign	Mean Value			Sig.
		Cluster 1: Innovator	Cluster 2: Early Adopter	Cluster 3: Early Majority	
G1: Gaining the newest info.	+	5.40	5.10	4.56	0.05
G2: Knowledge of newest trends	+	5.00	3.94	5.17	0.00
G3: Purchasing of newest products	+	3.60	3.44	4.53	0.00
G4: Purchasing without knowledge	+	2.33	2.40	3.50	0.00
G5: Earliest new product buyers	+	5.20	4.66	4.40	0.17
G6: Purchasing of more new products	+	5.13	4.12	3.91	0.04

* Measures for G1-G6 are based on a Likert scale where 1 indicates "totally agree" and 7 "totally disagree"
** G1: Cluster 1 > Cluster 3;G2: Cluster 1 = Cluster 3 > Cluster 2; G3: Cluster 3 > Cluster 2 = Cluster 1;G4: Cluster 1 > Cluster 2 = Cluster 3; G5: Cluster 1 = Cluster 2 = Cluster 3;G6: Cluster 3 = Cluster 2 > Cluster 1

Moreover, some of these adoption behaviors are inconsistent with Rogers' theoretical ground, such as the fear of innovators to purchase general products without prior knowledge, a reverse circumstance from the theory. The analysis results also provide evidence of differences in participants' adoption behaviors related to normal products and online games among the 3 diffusion clusters. It is shown in Table 8 that 25 out of 30 paired t tests are significant. A possible reason for these outcomes could be simply because of people's interests. People who possess a high interest in online games may not share the same level of interest in other products, which results in inconsistencies in the comparison of their attitudes between normal products and online games.

Table 8: A comparison of participants' adoption behaviors towards general products and online games

	Attitudes and behaviors	Sig.		
		Cluster 1: Innovator	Cluster 2: Early adopter	Cluster 3: Early majority
Pair 1	O1 ⇔ G1	0.20	0.02	0.00
Pair 2	O2 ⇔ G2	0.02	0.93	0.00
Pair 3	O3 ⇔ G3	0.00	0.89	0.00
Pair 4	O4 ⇔ G4	0.00	0.00	0.00
Pair 5	O5 ⇔ G5	0.06	0.00	0.00
Pair 6	O6 ⇔ G6	0.02	0.46	0.00

5. CONCLUSION

This study investigated the current diffusion of online games among Taiwan residents aged between 13-50. The current adoption rate is at 38.57%. Thus, according to Rogers' DOI theory, online game diffusion has reached the early majority stage, and three categories of online gamers are formed: innovators, early adopters, and the early majority. A comparison of the characteristics of the online gamers from these clusters indicates that, in general, Rogers' DOI theory can be applied to predict the personalities of online gamers. In other words, earlier players are more innovative towards online games. They receive online game information from more sources and play an opinion leader/change agent role in distributing online game information. These gamers are more likely to be young males with low disposable income. They are more sympathetic, experience a larger amount of social and business travels, like to make friends, and value credit as important. Moreover, curiosity and educational-driven leads them to acknowledge new technologies more quickly and they love to utilize effective methods to complete jobs. It is therefore easier for them to take control of their own life.

Based on the results, it is clear that the early majority of online gamers will still occupy the mainstream in the near future. As the online game market is entering to the early mature stage, vendors must simplify complicated online game features to attract the early majority audience. Brand competition is becoming more intense within the industry, therefore, diversity and concentrated marketing strategies turn to become more practical, and varying the types of online games offered becomes a necessity (Cheng and Kao, 2003). Complementary partnerships to jointly develop online game businesses (such as for product development) become more important within such a fast moving environment.

As for future research, current research focuses on the assessment of online gamers' internal characteristics on the basis of Roger's DOI theory, something more descriptive. Future research should concentrate on the

perceived attributes of the innovativeness of online games as a modern entertainment device, such as their relative advantages, compatibility, triability, observaility, and complexity. Causal-driven type research can further validate the usefulness of the perceived attributes of innovativeness suggested by Rogers to influence the adoption of online gaming. In addition to this approach, it is also necessary to look for moderators (e.g. interest) that interfere with consumer attitudes towards the adoption of different products, a hint from the research result that online gamers show different innovative attitudes towards different products. The findings will contribute to help fill in the lack of discussion that has been identified by the authors.

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