Simulation of Marketing an Arcade Game for Japanese Girls

- The Influence of User Asset-Sharing Consumer Game Release Timing on Arcade Game Performance **-**

Makoto Kimura
Nagano University, Faculty of Business and Informatics
kimura@nagano.ac.jp, kmakoto@bekkoame.ne.jp

Abstract :

This study discusses the management of sales performance and lifecycle of digital games by the adjustment of release timing, focusing on the pioneer case of the digital games market for Japanese girls, "Fashionable Witches: Love and Berry (Love and Berry)". Simulating the performance of an arcade game that utilizes trading cards with printed barcodes and a later released consumer version that utilizes the same trading cards, the study evaluates real decision-making through the results of multiple simulations, and several growth scenarios for the digital game ecosystems, based on the findings of these simulations are provided.

Keywords: digital games, platform, contents, trading card games, TCG, Fashionable Witches: Love and Berry, Bass model, ecosystem

1. Introduction

This study discusses management of the influence that the timing of the release of digital games with shared user assets has on the performance of other games (market size and lifecycle), an issue that may be peculiar to digital game ecosystems. “Ecosystem” is used here to mean "the contents of the original work and the entirety of goods composed of derivative contents thereof". For that reason, this study looks at a digital game comprised of both original contents and derivative contents, in particular, at a case study of an arcade game that uses trading cards printed with barcodes, and a later-released consumer game that uses the same trading cards. Quantifiable performance of the ecosystem (number of card and game sales) was drawn from the discussion of the case study. A system dynamics modeling approach was used to compute approximations of time variations seen in the performance data, and simulations were performed by varying several parameters.

Novelty of this study with system dynamics includes specialty of the game software, restriction of target product and the diffusion-impulse. Specialty of the game software address not only the relation between the platform and complements (Eisenmann et al., 2006, 2011) but also the relation between the original and the derivation. In addition, an arcade game and the consumer game greatly vary in the revenue operation, but constitute an ecosystem to have a relationship of the original and the derivation. The arcade game has an architecture of to charge every play and let the the users play many times. On the contrary, the consumer game is package release of the simple substance and has characteristic that a release first week records the biggest sale number.

The restriction of target product means that this study analyzes the limited ecosystem includes the products developed and sold by the single company, unlike a conventional research for the diffusion of product and the specific technology (Bass, 1980, Chintagunta et al., 2009).
And then, the diffusion-impulse is to try the replication in the shock function-like diffusion that is approximately simultaneous with game release and the substitute process by it, unlike the SD modeling (Milling, 1996) of the substitution process by product diffusion for several years.

Kimura(2011) discussed issues that were specific to the design of ecosystems built around digital games through a comparative case study of cases where an interface was implemented for transferring data from the arcade game (the original work) to the consumer game (the derivative contents) with cases where no such interface was implemented. This previous study used a "relationship model for digital game contents" as an analytical framework, combining a successor relation, between the original contents (works) and derivative works, and a hierarchical relation, between complementary contents composed of a trading card game (application) and the platform contents. A graph of the time series variation of the sales numbers of trading cards for use with the arcade game and the sales numbers of the consumer game was offered as an empirical evaluation to support the validity of this content relationship model, but the reasons for the shape of the growth curve were not discussed.

This study consists of seven sections: Section 2 presents an outline of the trading card game-based program "Oshare Majo Rabu and Berii [Fashionable Witches: Love and Berry]" (2004-2008) and the analytical framework to examine the influence that the release date of a consumer game with shared user assets can have on the performance of an arcade game. Section 3 introduces as a system dynamics model, a "Digital Game Diffusion Model" based on the Bass Product Diffusion Model to calculate patterns in sales variations drawn from the case study, and examines the validity of the model by comparing the computed results with the actual performance. Section 4 varies the parameters put into the Digital Game Diffusion Model to simulate and compare changes in the sales performance of the arcade game in the cases of earlier and later release dates for the consumer software, and examines the suitability of the actual release date.

Section 5 references the adopter classification approach based on the findings of the analysis of the Bass Model by Mahajan et al. (1995), and attempts to create user classifications and business lifecycle classifications based on time series variations observed in the simulated numbers of new arcade games and specific events in the behavior from the actual case study data. Section 6 examines simulation results in the case where no consumer game is released. Section 7 presents the several scenarios for the digital game ecosystem as new implications of this study. Section 8 presents details some of the issues that remain.

2. "Fashionable Witches: Love and Berry", Case Study Analysis Case Study Summary

"Fashionable Witches: Love and Berry (Love and Berry)" was a Sega-developed arcade game targeted at young girls and began operating in late October 2004. A single play cost 100 yen, and offered a reward of one "fashion magic" [Oshare Mahou] card. The "magic" cards came in four types: hair and make-up cards, dress-up cards, footwear cards, and special item cards. When the player scans magic cards, one of the CG female characters "Love" and "Berry" appears on the device's screen dressed in the fashions shown on the cards. A point value is awarded for a combination of cards, and the choreography of the dance game is determined based on that point value. The player's success is determined by pressing the buttons in rhythm with the dance. The Love and Berry arcade cabinet was available as a free rental, and was commonly placed in shopping center game corners throughout Japan. Love and Berry was very popular with young girls interested in fashion and with their mothers. Sega created special designated areas for Love and Berry in their directly operated video arcades. Sega Toys, a Sega subsidiary, developed a line of toys based on the property, and official "LB Style Square" shops selling original young girls' apparel and character goods were opened in department stores and shopping centers. By August 2006, one year and ten months after the release of the game, there were reportedly 10,100 arcade cabinets, and 194,000,000 cards had been sold. Two years after the release of the arcade game, on November 22, 2006, a consumer version of the game for the Nintendo DS handheld console "Fashionable Witches: Love and Berry – DS Collection" was released, at a retail price of JPY 6,090.

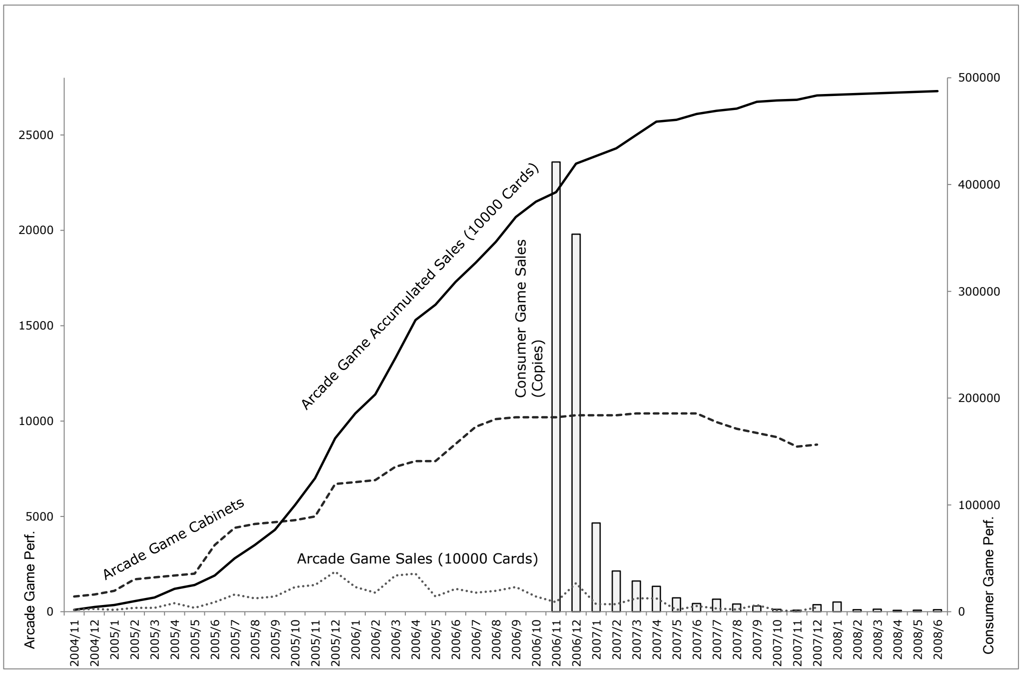

Figure 1: Performance of Fashionable Witches: Love and Berry (2004–2008)[Based on data provided by Media Create Co., Ltd.]

Love and Berry DS was packaged with a card reader device to scan cards collected for the arcade game. The consumer game console had some limitations on input and output, but generally allowed for play in a way that was faithful to the arcade game. This consumer version of the game sold over a million copies, and the 2007 Tokyo Game Show honored the unprecedented and ground-breaking game with a special award. However, the performance of the arcade cabinets began to decline following the release of the consumer game.

3. Analyzing the Case Study with Digital Game Analytic Frameworks

Kimura (2011) proposed a "relationship model for digital game contents" as an analytical framework, combining a successor relation, between the original contents (works) and derivative works, and a hierarchical relation, between the complementary contents (as seen in the card application) and the platform contents (see. Figure 2). The "platform contents" in this case were the execution environment or realization of the interface and rules for the complementary contents. The arcade game and consumer game software can be considered examples of platform contents. The complementary contents realize the digital game content components permitting the user to customize and the user interface in order to use them, which can be stored as user data. The data input/output cards for the arcade and consumer games can be considered as examples of complementary contents.

Digital game businesses, by providing a digital interface between arcade and consumer games, allow for the transfer of user data between the digital games, or in other words, the transfer of complementary contents. Using this model as an analytic framework for the case of Love and Berry, the "Fashionable Witches: Love and Berry" arcade software is both the original work and platform contents, and the "magic cards" are original works and complementary contents. The consumer game "Love and Berry DS" is both a derivative work and platform contents, and the DS-specific versions of the cards are derivative works and complementary contents.

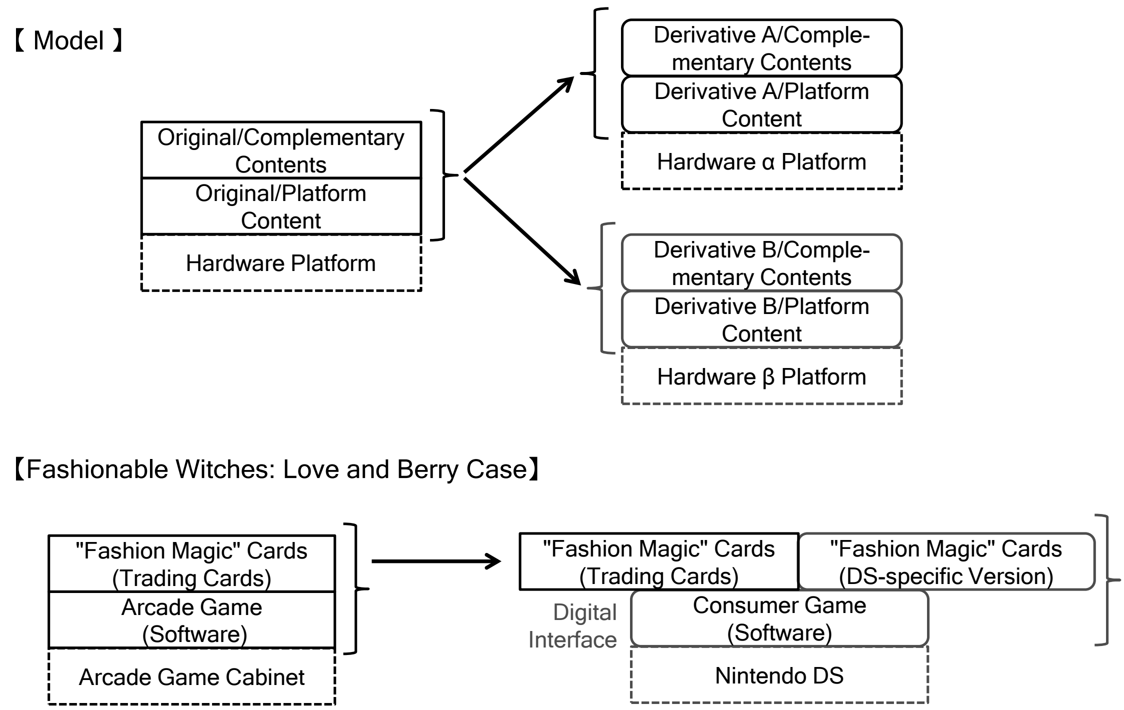

Figure 2: Relationship Model for Digital Game Contents (Kimura, 2011)

Love and Berry created a "single-directionality of original work and complementary contents" to give a new added value to arcade game users. In this case, the original work and complementary content (magic cards) could be used with the derivative work and platform content (Love and Berry DS), but the reverse usage was not possible. Special DS magic cards could not be used with the arcade game. Love and Berry established interchangeability between original platform contents and derivative platform contents. In this case, the release of the consumer version of Love and Berry removed the necessity for young players to travel to game centers, and played a part in reduced monthly sales and a reduction in the number of cabinets installed. That is to say, when the original complementary contents are made one-directional, the diffusion of highly interchangeable derivative content poses the risk of shortening the lifecycle of the original contents. However, at the same time, the transition of original content users can be expected to drive quicker diffusion of the complementary contents (Kimura, 2011).

The above discussion concerns qualitative research using the qualitative "Relationship Model for Digital Game Contents" and attempts to explain the mechanism through which the release of a consumer game that shares the trading card user assets affects the performance of the arcade game. However, no strategies or workarounds to prevent or minimize negative impacts have yet been examined.

4. Digital Game Diffusion Modeling and Simulations

The Bass Product Diffusion Model (1969) is a model for the distribution of new products (first-order differential equations), and incorporates advertising effects and word-of-mouth effects in addition to user categories (innovators and imitators) based on a revision of the population distribution-based categories (innovators, early adopters, early majority, late majority and laggards) put forth by Rogers (1962).

$$\boldsymbol{n(t) = \frac{dN(t)}{dt} = \left(p + \frac{q}{M}N(t)\right)(M - N(t)) = p(M - N(t)) + q\frac{N(t)}{M}(M - N(t))}$$

M = m(t) + F(t) = a constant

n(t): Number of new adopters in time "t"

N(t): Aggregate users at time "t"

M: Potential adopters (fixed upper limit)

m(t): Number of potential adopters at time "t"

p: Coefficient of innovation (the external influence factor): ratio of people affected by media (advertising, etc.)

q: Imitation coefficient (internal influence factor): ratio of people affected by personal communications (word of mouth).

Easingwood et al.(1981) proposes an Asymmetric Response Logistic Model to set the time independently internal influence factor specified by power coefficient, with the external influence factor using zero. Mahajan et al. (1990) offered an approach for categorizing adopters of product innovation, based on an analysis of the Bass Model (employing the maximum value of the new adopter curve and the time value of the inflection point). Sterman (2000) introduced an updated Bass Model that incorporates system dynamics (SD).

The "Love and Berry" arcade game developed by single company, SEGA is the original game which creates the new market for little girls. Its sales performance seems to be a proxy variable for the market size of arcade game market for Japanese girls in those days.

We introduce the SD model, called "Digital Game Diffusion Model " to replicate the sales performance of Love and Berry case caused by the interaction in the digital game ecosystems consisting of arcade game and consumer game. To introduce a Digital Game Diffusion Model that recreates time series variation patterns (time series patterns) observed in the number of trading cards shipped monthly in the case of Love and Berry, it is necessary to fix a number of the potential game users. The numbers of arcade game users (ARG users) and consumer game users (CSG users) were not available for this study, so the following assumptions have been made.

•One ARG user will pay a total of JPY 10,000 in per-play fees. In other words, one player will buy 100 cards (number of ARG users x 100 cards = number of arcade game trading card sales).

•One CSG user will buy one copy of the consumer game (number of CSG users = number of consumer game sales). The CSG was released 25 months after the release of the ARG. The number of CSG users increased by 340,000 each month following the release of the CSG, totaling 1,020,000 units sold in three months.

•The number of potential users will be calculated as the sum of 1/100 of total sales of trading cards for arcade use plus the total number of consumer game sales, for a total of 3,700,000 (including users who purchased both).

•The word-of-mouth awareness ratio among potential users was set at 10%.

•To perform the time integration, the time step was set at 1 month and repeated 38 times of calculations (38-months lifecycle).

The Love and Berry case, the subject of this model, was an arcade game (with associated trading cards) primarily installed in shopping center game corners, and directed toward little girls. The customer base was extremely limited, and the property was not converted into a televised animated series. It is presumed that the so-called advertising effect was not strongly influential. We considered a Digital Game Diffusion Model which accounted for the word-of-mouth effect only and not the advertising effect in order to make the results of this case computable. However, we set the word-of-mouth effect as a time variant step function, rather than a fixed imitation coefficient. Specifically, the adverting coefficient “p” was set to zero, and the imitation coefficient “q” was experimentally set as a step function over time ranges in which the actual number of ARG trading card sales more closely matched the calculated time history curve. In order to calculate the time series patterns for the Love and Berry case, the coefficient of imitation was set as a three-level step function as shown below (t = the number of months since ARG release):the coefficient of imitation, $q = \{9\ (0 \leq t < 3), 3\ (3 \leq t < 15), 1.25\ (15 \leq t)\}$ This setting of the coefficient of imitation allowed for a better approximation of the coefficient of determination (R^2 = 0.998).

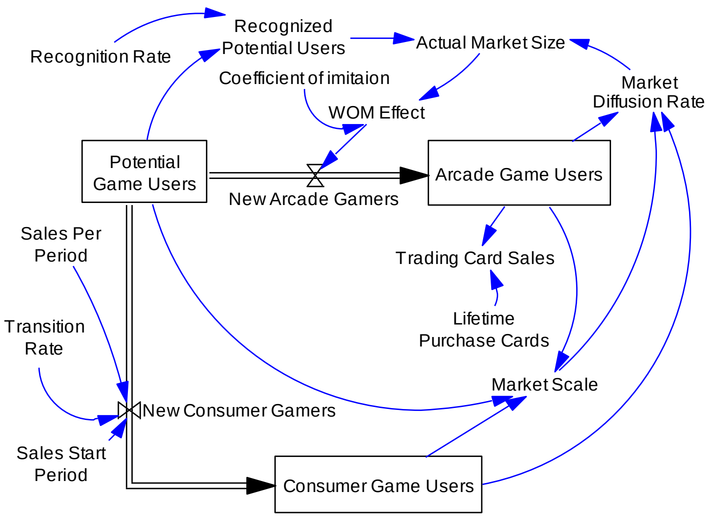

Figure 3: Digital Game Diffusion Model using SD Modeling Notation

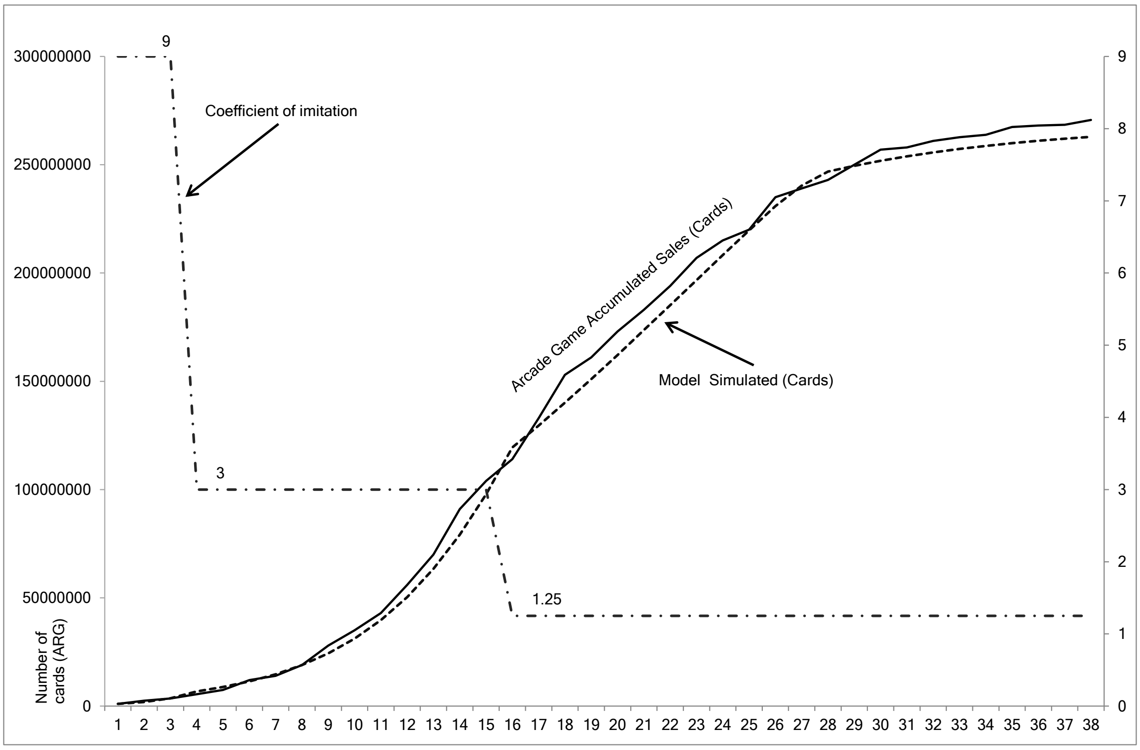

Figure 4: Digital Game Diffusion Model Imitation Factor Settings and Comparison of Calculations

5. Multiple Simulations using Digital Game Diffusion Model

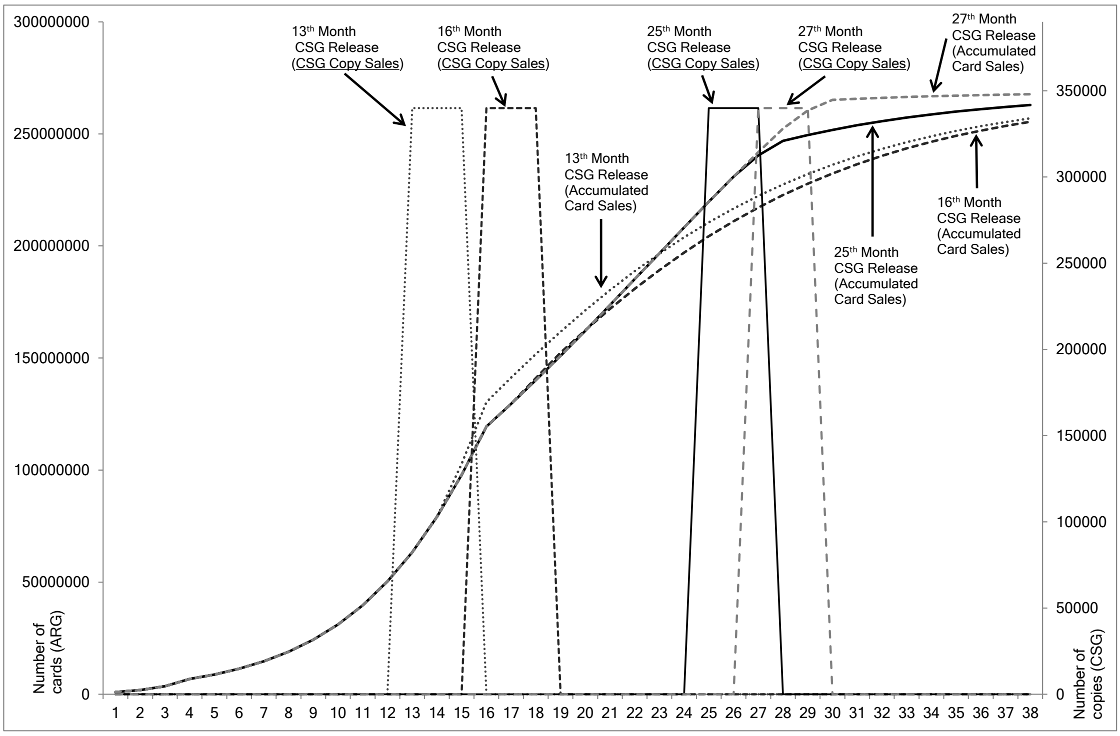

Figure 5: Simulation of Varied CSG Release Dates

This section uses Digital Game Diffusion Model with no changes to constants, to run a simulation varying only the release date of the CSG. This simulation calculated estimated sales of ARG trading cards and CSG copies when the CSG release date was moved from its actual timing (25 months after the release of the ARG) to 13, 16 and 27 months after the ARG release (See Figure 5). Total performance of ARG and CSG under the various settings were then compared in Table 1. Simulations based on a release date in or after the 28th month were not considered because the number of potential users dropped to a negative value.

Table 1: Simulation of Varied CSG Release Dates using Digital Game Diffusion Model

CSG Release Date	CSG Copy Sales (ten thousand units)	CSG Performance (ten thousand Yen)	Peak ARG User Increase Timing	ARG trading cards (accumulated cards sold)	ARG Performance (ten thousand Yen)	Total Performance (ten thousand Yen)
13th month	102	621,180	15th month	256,939,024	2,569,390	3,190,570
16th month	102	621,180	15th month	255,404,992	2,554,050	3,175,230
25th month	**102**	**621,180**	**15th month**	**262,873,648**	**2,628,736**	**3,249,916**
27th month	102	621,180	15th month	267,683,120	2,676,831	3,298,011

In comparing the results of the simulations of a 13th month CSG release date and a 25th month CSG release date, moving the CSG release date to one year earlier resulted in a 5,930,000 reduction in the number of trading cards sold. Simulating a 16th month release produced 7,460,000 fewer card sales than the simulated 25th month release. This simulation case showed the largest opportunity loss for ARG performance of any of multiple simulations. When the simulation of a 27th month release was compared to a 25th month release simulation, the later release estimated that 4,800,000 more cards would be sold. Based on the simulations, the actual CSG release date 25 months after the release of the ARG was generally appropriate, and delaying the CSG release by two months indicated a very minor increase in overall performance.

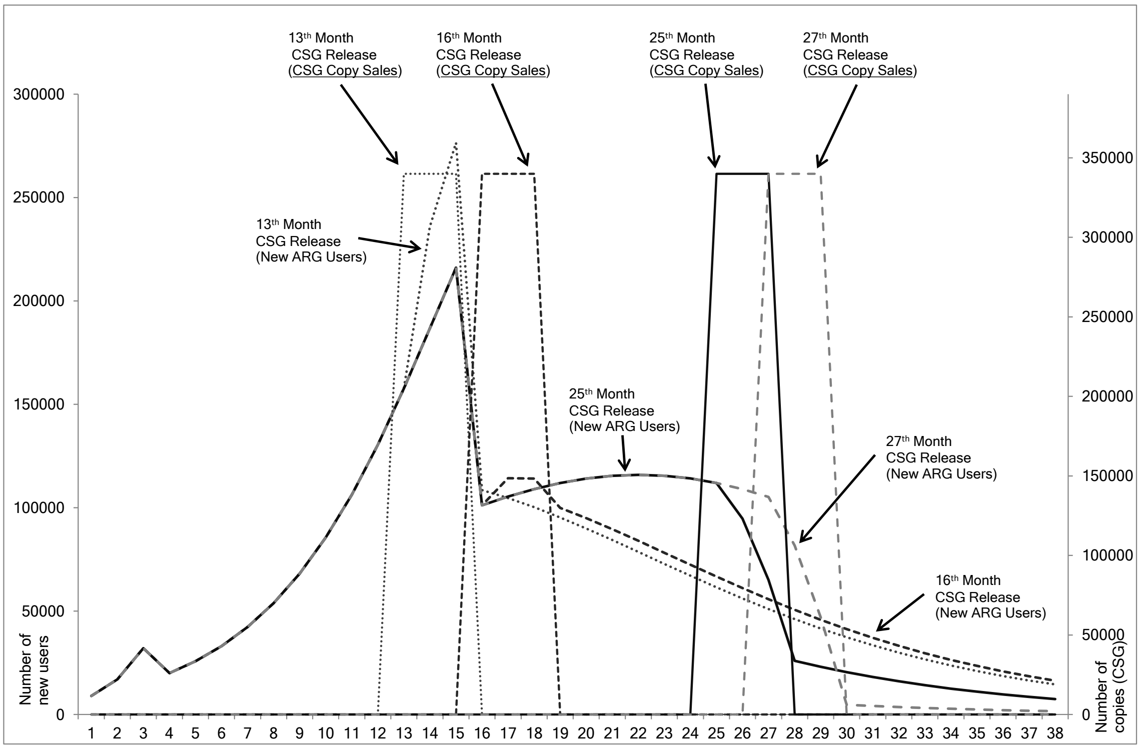

Figure 6: Fluctuation Patterns of New ARG Users

Shown in Figure 6, we examine time series patterns for "New Arcade Gamers" (numbers of new ARG users) in cases using varied CSG release dates. In these simulations, the peak number of new ARG users occurred in the 15th month. The peak was highest at 276,000 users in the case of a 13th month CSG release, and was 216,000 users in all other cases.

In the case of the 13th month release, the number of new ARG users increased dramatically during the CSG sales period, reaching its peak in the 15th month, and crossed an inflection point in the 16th month then continued to decline exponentially. In the case of a 16th month release, the number of new ARG users reached its pre-CSG release peak in the 15th month crossing an inflection point in the 16th month, then increased again by approximately 10% in the 17th and 18th months and, after reaching a small local maximum, declined exponentially. In the cases of the simulated 25th month and 27th month releases of the CSG, the number of ARG users in months 1–25 was unchanged. The number of new ARG users reached its peak in the 15th month, and crossed an inflection point in the following month, leveling off to approximately 110,000 users until the 25th month. Then, following a dramatic decrease during the release of the CSG, the number of new ARG users showed a gradual decline.

The new insights about the influence of CSG release date timing on ARG performance provided by multiple simulation of Model results are summarized below:

– By overlapping the release timing of the CSG with the timing of the maximum number of new ARG users, it is possible to achieve a rapid increase in the number of ARG users. That is to say, the market can be rapidly expanded. However, this is followed by an exponential decline in ARG users.

– These Model simulation findings indicate that by avoiding overlap between the release timing of the CSG and the time period of the maximum new ARG users, the negative impact of CSG (derivative contents) performance on ARG (original work contents) performance can potentially be mitigated.

– The number of new ARG users will be reduced by half after reaching their peak, but a fixed number of new users will be maintained until the later release of the CSG.

The following hypotheses are offered on the basis of these insights. The validity of these hypotheses are examined in the following sections:

Hypothesis (1): The ARG business lifecycle can be divided into a growth phase and a mature phase.
Hypothesis (2): The release of a CSG that shares user assets with the ARG will shorten the ARG business lifecycle.
Hypothesis (3): The combined market for an ARG and a CSG that shares user assets with the ARG is larger than the market for the ARG alone.

6. Lifecycle Phase Categorization Based on Simulation Findings

Figure 7 shows the month-to-month ARG trading card sales (actual figures, in 100-card units) from the Love and Berry case study, as well as the Digital Game Diffusion Model imitation coefficient (a 3-level step function), and the time series patterns of new ARG users (calculated figures). The actual figures fluctuated from month to month, but accorded well with the timing of related sales operations from Love and Berry developer Sega. The calculated values smoothly approximated the curve of the averages of the actual values.

Here, we look at the maximum values of the calculated time series variations of the number of new ARG users, the inflection points, and the imitation coefficient produced by the Digital Game Diffusion Model. We also employ the Mahajan et al. (1990) approach to adopter classification based on the analysis of the Bass Model, by attempting to create user and lifecycle categories, then comparing these categories to the adopter categories of Rogers (1962) and Mahajan et al.

The model considered only the word-of-mouth effect. If we use as an indicator the ease with which word of mouth can influence the chosen 3-level imitation coefficient (word-of-mouth sensitivity), we can allocate users into three categories: high sensitivity, moderate sensitivity, and low sensitivity imitators. In the results of the Love and Berry case study simulations, those ARG users in the range with an imitation coefficient of 9 can be considered high sensitivity imitators, those in the imitation coefficient range of 3 can be considered moderate sensitivity imitators, and those in the 1.25 range can be considered low sensitivity users. The case of Love and Berry can be understood to be highly word-of-mouth sensitive, given that the number of high sensitivity imitators was 3 times that of moderate sensitivity users and 7.2 times that of low sensitivity users.

The following categorization of lifecycle phases for the ARG market can be adopted : market creation phase, market growth phase, market maturity phase, and market decline phase. Based on the results of the Love and Berry case simulations, we can assume correspondences between these categories: the market creation phase with high sensitivity imitators, the market growth phase with moderate sensitivity imitators, the market maturity phase with low sensitivity imitators, and the market decline phase also with low sensitivity imitators.

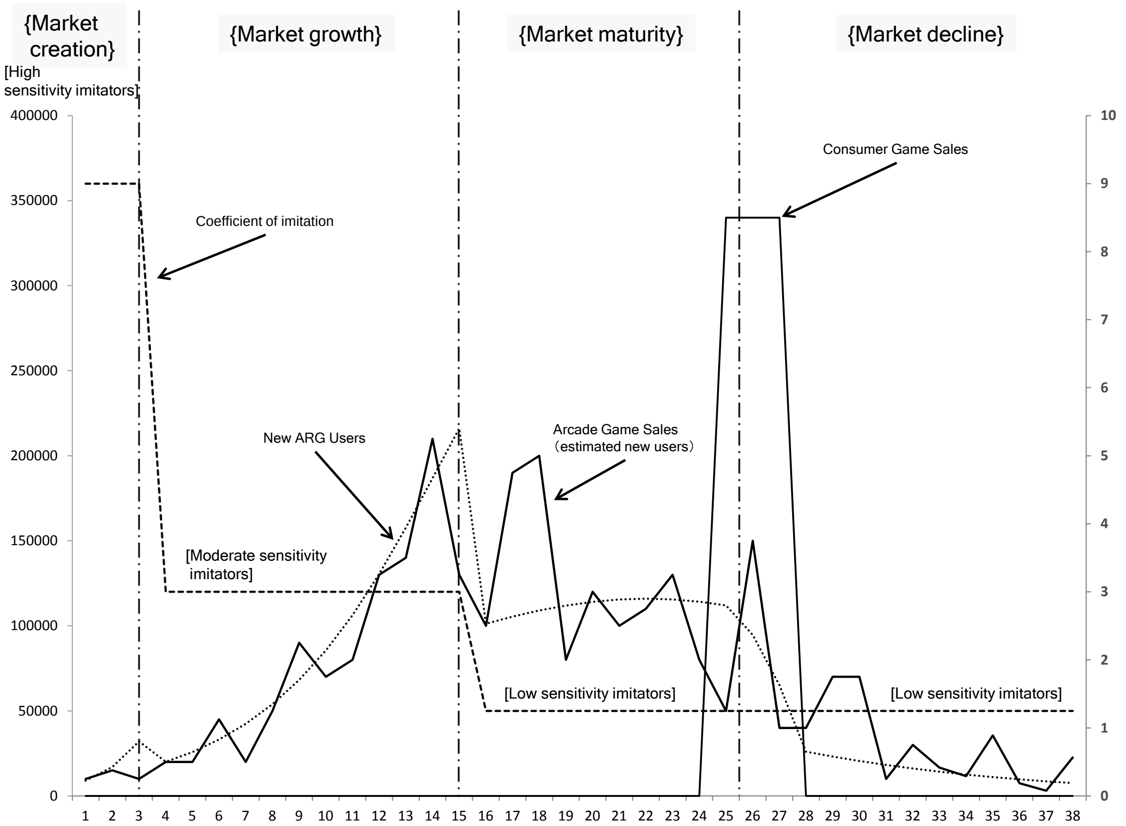

Figure 7: ARG Lifecycles using Digital Game Diffusion Model Simulations

6.1 The Market Creation Phase with High Sensitivity Imitators

We considered the market creation phase to be the first three months after release, when the high sensitivity imitators began to play. During this period, the imitation coefficient was highest (9.0), and the first phase maximum number of new users was achieved during the third month. In Roger's (1962) Technology Adoption Lifecycle, the innovators are dominant for roughly 1/4 of the product lifecycle. In this case, the market creation phase comprised 3/38 of the total market lifecycle, and the success of the market creation was decided in a short period of time. The key events of the market creation phase included the developer Sega installing arcade game cabinets nationwide in game corners and game centers as free rentals, the free provision of advertising materials for "official game tournaments" and prizes (certificates, etc.) to award.

6.2 The Market Growth Period with Moderate Sensitivity Imitators

Moderate sensitivity imitators took part in the market growth phase, which was approximately 12 months long. During this phase, the imitation coefficient was 1/3 that of the previous phase. The number of users reached a second phase maximum value during the 15th month. From the 4th to the 15th month, the number of new ARG users expanded exponentially, and the market grew to 10 times its size at the start of the phase. Key events of the market growth phase included the marketing of Love and Berry character-based toys by Sega subsidiary Sega Toys in the 11th month.

6.3 The Market Maturity Phase with Low Sensitivity Imitators

Low sensitivity imitators participated during the market maturity phase, which lasted approximately 10 months. During this phase, the imitation coefficient dropped to approximately 40% of the preceding period (1.25). The number of new ARG users during this phase was about half of the number during the market growth phase, but the number remained consistent (around 110,000 new users per month). This phase predated the release of the CSG, and demonstrated stabilization of the ARG business. The market maturity phase comprised 10/38 of the total market lifecycle, approximately double the proportion of the late-adopter phase in Rogers' (1962) Diffusion Model. Key events of the market maturity phase included the installation of designated Love and Berry corners ("Magical Stations") in the directly operated game centers and the opening of "LB Style Square" shops selling girls’ clothing in department stores (a total of 56 shops were opened nationwide, each with two ARG cabinets).

6.4 The Market Decline Phase with Low Sensitivity Imitators

Low sensitivity imitators also participated in the market decline phase, which lasted 13 months, and showed the same growth coefficient as the preceding market maturity phase. However, during this phase, in the 25th month, the CSG, which was substitutable for the ARG, was released. During the three-month release period of the CSG, new ARG user numbers declined dramatically, and then declined exponentially, followed by a further gradual decline. Although the market decline phase was characterized by low sensitivity innovators with the same receptivity to word of mouth as the preceding market maturity phase, the trends during these two phases differed. The key event of the market decline phase was the release of the million-selling CSG, Love and Berry DS.

6.5 Total Lifecycle of Arcade Game Business

This section attempts to explain the lifecycle shown in the simulation results, by treating the time series patterns demonstrated in the Digital Game Diffusion Model as a demonstration of the strengths or weaknesses of the word-of-mouth effect among young girls and their mothers. During the first three months of ARG operation in nationwide game corners, the word-of-mouth effect among children was at its greatest, and title awareness spread quickly among children (the high sensitivity imitator, market creation phase). Three months after the release of the ARG, the word-of-mouth effect dropped to 1/3 of its earlier levels, but the number of children using the game grew, and within one year had increased tenfold (moderate sensitivity imitators, market growth phase). Later, the word-of-mouth effect decreased to approximately 30% of the previous phase (approximately 1/10th of the level of the market creation phase), and the number of monthly users reached a stable equilibrium (low sensitivity imitators, market maturity phase). During the market maturity phase, it was possible to maintain business performance through large-scale marketing campaigns, but these campaigns were not sufficient to restore growth. The later decline in the number of new ARG users took around the same length of time as the market growth phase (low sensitivity imitators, market decline phase).

This examination of the case study findings supports the validity of hypothesis (1) above. Unlike the CSG business, which saw its greatest performance at the time of release followed by exponential decline, the ARG business saw a cycle of market growth, market maturity, and market decline over a longer period of time. The findings of this examination indicate that there may be objective indicators beyond the number of users and sales performance, such as imitation coefficients, in digital game diffusion cases where the business lifecycle spans many years, as was the case with the ARG.

Table 2: Comparison of Product Diffusion with Simulation Results

Classification of Diffusion Phases	Innovation Diffusion Model (Rogers, 1962)	Classification by Bass Model (Mahajan et al.,1990)	Digital Game Diffusion Model (Simulation Results)
Phase I {Total Population Ratio}: [Time ratio]	Innovative Adopters {2.5%}: [25%]	Innovative Adopters {0.2 - 2.5%}	<Market Creation Phase> High Sensitivity Imitators' Imitation Coefficient (9), {2%}: [8%]
Phase 2 {Total Population Ratio}: [Time ratio]	Early Adopters {13.5%}: [12.5%]	Early Adopters {9.5 - 20.0%}:	<Market Growth Phase> Moderate Sensitivity Imitators Imitation Coefficient (3) {43%}: [34%]
Phase 3 {Total Population Ratio}: [Time ratio]	Early Majority {34%}: [12.5%]	Early Majority {29.1 - 32.1%}	
Phase 4 {Total Population Ratio}: [Time ratio]	Late Majority {34%}: [12.5%]	Late Majority {29.1 - 32.1%}	<Mature Market Phase> Low Sensitivity Imitators' Imitation Coefficient (1.25) {43%}: [24%]
Phase 5 {Total Population Ratio}: [Time ratio]	Laggards {16%}: [37.5%]	Laggards {21.4 - 23.5%}	<Market Decline Phase> Low Sensitivity Imitators' Imitation Coefficient (1.25) {12%}: [34%]

7. Simulation without CSG Release

This section attempts to perform and examine a simulation of the ARG performance without the release of the CSG, with other conditions held constant. For this reason, a simulation was performed with integration over a range of timeframes. In this case, the number of potential game users was below 20,000 by the 62nd month, and the number of new users had shrunk to 2,430. The 62nd month was set as the upper limit of the time integration range. In the results of this simulation where the CSG was not released, the ARG business lifecycle was extended by 24 months from 38 months total to 62 months total.

Table 3 compares the actual data with the results of the previously described model simulations. In the cases in which the CSG was released, CSG performance was presumed to be identical. As stated above, releasing the CSG in the 16th month returned the worst overall performance. Under the simulation, releasing the CSG in the 27th month was better than the actual release timing in the 25th month, improving the performance of the ARG by approximately JPY 500,000,000.

A simulation modeling five years of continued ARG operation following release showed that overall performance was increased by approximately JPY 4,000,000,000 when the CSG was not released. However, this result depended upon the assumption that the imitation coefficient remained constant in the two years following the 38th month of release, and that the number of new ARG users did not dramatically decline.

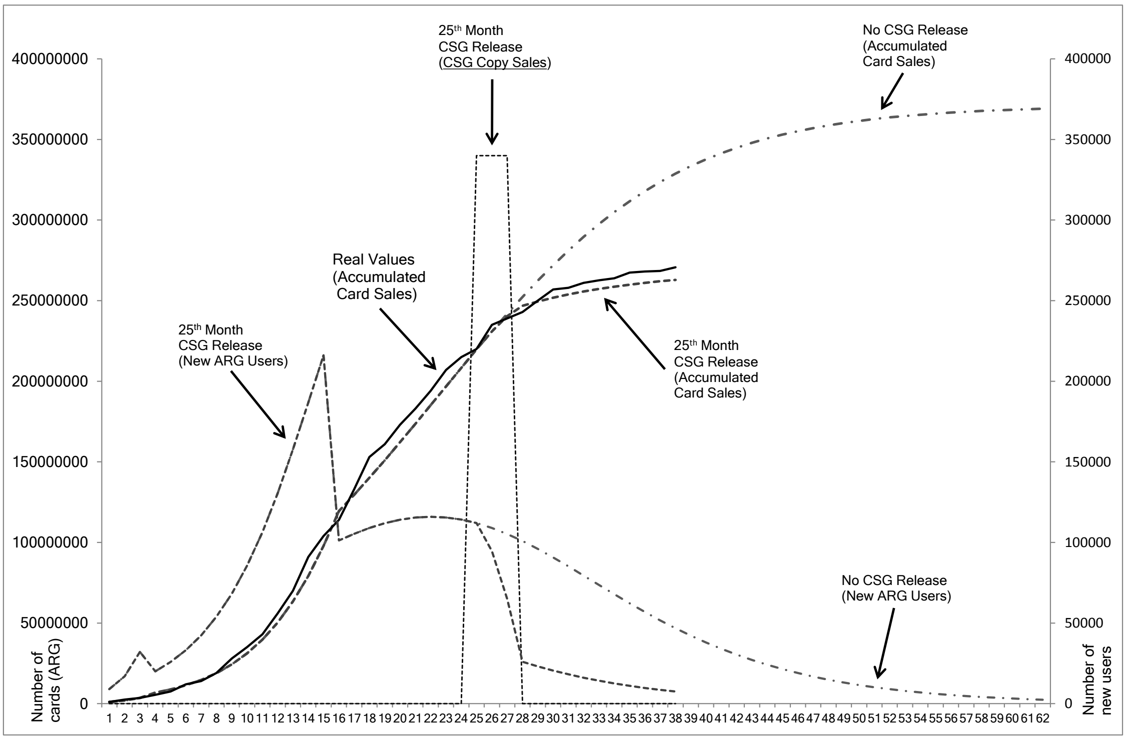

Figure 8: Simulation of Extended ARG Business Lifecycle

Table 3: Comparison of Simulation Results and Actual Data

CSG Release Timing	CSG Sales (ten thousand units)	CSG Performance (ten thousand Yen)	Number of ARG Trading Card Sales	ARG Performance (ten thousand Yen)	Total Performance (ten thousand Yen)	Total Business Lifecycle (months)
Actual Values	102	621,180	270,709,984	2,707,100	3,328,280	38
16th month	102	621,180	255,404,992	2,554,050	3,175,230	38
25th month	**102**	**621,180**	**262,873,648**	**2,628,736**	**3,249,916**	**38**
27th month	102	621,180	267,683,120	2,676,831	3,298,011	38
No release	0	0	328,777,312	3,287,773	3,287,773	38
No release	0	0	369,045,408	3,690,454	3,690,454	62

These simulation findings support the validity of hypothesis (2) above. It may be possible to extend the lifecycle of the ARG by avoiding the release of the CSG. That is to say, the simulation results confirmed that the release of a CSG that shares user assets with the ARG poses a risk of shortening the lifecycle of ARG. However, these simulation findings do not appear to support hypothesis (3). Comparing simulations over the same 38-month lifecycle, the cases in which the CSG was not released appeared to have better overall performance than cases in which the CSG was released at a non-optimal timing. In the cases in which the CSG was not released, the lifecycle of the ARG was increased by two years, increasing the ARG performance and the size of the market. These simulations results suggest that the market of an ARG alone may be larger than the overall market for an ARG combined with a CSG that shares its user assets. However, these results are based on holding the imitation factor at a constant rate after it dropped (1.25), and presuming that no competing devices entered the marketplace. They also do not give significant consideration to variable costs, such as development costs for an updated version for long-term operation. The results obviously do not consider the changes in the tastes of potential users over a timeframe of several years.

8. Conclusions and Digital Game Ecosystem Growth Scenarios

This research, based on the results of multiple simulations utilizing a Digital Game Diffusion Model, examines a scheme for the managing the influence that the timing of the release of digital games with shared user assets on the performance of other games (market size and lifecycle) which might be an issue peculiar to digital game ecosystems. When the advertising effect was considered in model simulations, the calculated maximum value of monthly trading card sales arrived later, and differed from patterns seen in the actual data. When the advertising effect was set to zero to completely remove it, the calculated maximum value occurred earlier, and the time series patterns of the data more closely approximated the actual data.

Multiple simulations of changes to the release date of the consumer game offered the following insights: 1) it appears that overlapping the release of the consumer game with the peak number of new arcade game users, or with the inflection point immediately following caused a decline in overall performance over the full lifecycle, and 2) the actual timing of the release of the consumer game relative to the release of the arcade game in the case study appears to have been appropriate. And, in order to evaluate the overall performance of the digital game ecosystems, a simulation of the ARG performance in the event that consumer game was not released was modeled, and the results of the simulation were compared with the actual performance figures when the consumer game was released. The examination of the Digital Game Diffusion Model and simulation results in this study suggests the possibility of assessment of business risks for game companies deploying CSG business from ARG business, and how to determine the optimal timing of release for such a CSG.

Table 4 below suggests several growth scenarios for ecosystems built from arcade games (original contents) and consumer games (derivative contents), based on the findings of these simulations. The most desirable scenario for digital game providers is either Scenario D, in the case that derivative contents released after peak diffusion of the original contents, or Scenario E, where consumer game is not released and resources are instead concentrated on an improved version of the arcade game. However, in Scenario D, it may be very difficult for businesses to correctly identify the peak period, and to develop an exit strategy, and in Scenario E, there are business risks involved in concentrating on the arcade game business.

Table 4: Summary of Digital Game Ecosystem Growth Scenarios

Scenario Name	Centrality of Original Contents to the Ecosystem	Creation and Distribution of Derivative Contents	Presence of a Digital Inter - face for Trans-ferring Date	Possibility of Ecosystem Changes	Strengths	Issues
A	Independence of original and complementary contents	○	×	×	No negative impact on the market size of the original contents	The size of the derivative contents market place is not dependent on the original contents marketplace (not calculable)
B	One-direction transfer of original and complementary contents (Derivative contents released prior to peak diffusion of the original contents)	○	○	Prior to the peak performance of the original contents	Opportunity to gain original contents profits from the link with the derivative contents. Increased profit from diversified business, diversified risk.	Uncertainty of the timing of release of the derivative contents.
C	One-direction transfer of original and complementary contents (Derivative contents released during peak diffusion of the original contents)	○	○	During the peak performance of the original contents	Increased profit from diversified business, diversified risk	Difficulty identifying the peak of original content business. Loss of opportunity to gain original contents profits from the release of the derivative contents.
D	One-direction transfer of original and complementary contents (Derivative contents released after peak diffusion of the original contents)	○	○	Following the peak performance of the original contents	Short-term stabilization of original contents business. Increased profit from diversified business, diversified risk.	Awareness by game business of original contents business lifecycle. Formulation of exit strategy .
E	Concentration on upgrading/ updating of original/ complementary contents (No derivative contents)	×	×	×	Faster, higher quality upgrades through focused resources	Business risk in focusing resources. Lost opportunity for new business on different platforms.

(○: Yes, ×: No/ None)

8. Limitations in This Study and Topics for Future Research

This study only confirmed the calculability of the actual data from a single case study. The reproducibility of these findings must be confirmed with multiple case studies. In addition, other issues include the presumption of homogeneity among potential game users and, specifically, the presumption that ARG users spend identical amounts. For the purposes of the simulation, the average expenditure of each ARG user was calculated to be JPY 10,000 (an amount equal to 100 trading cards).

It seems that there was broad heterogeneity among ARG users in the number of cards purchased. Although it is possible to create a model and simulation that consider variety in the amounts purchased by ARG users, no such data are currently available. This investigation treated the amounts as equal in imitation coefficient and purchase timing. However, it is possible that different Digital Game Diffusion Models and simulations that consider the distribution of amounts purchased by potential game users may provide different results and new insights. In addition, the competition from other digital game makers is an important determinant of business in identifying digital game distribution. The development of a system dynamics model that can reflect and simulate competition between products would be able to provide new insights. These are challenges for future research.

Thanks and Acknowledgements

We greatly appreciate the cooperation of Media Create Co., Ltd. who provided digital game performance data used in this study.

References

Adner R. 2012. The Wide Lens: A New Strategy for Innovation. Portfolio.

Bass FM. 1969. A New Product Growth for Model Consumer Durables. Management Science 15(5): 215-227.

Bass FM, Krishnan TV Jain DC. 1994. Why the Bass model fits without decision variables. Marketing Science 13(3): 203–223.

Easingwood CJ. Mahajan V., Muller E. 1981. A Nonsymmetric Responding Logistic Model for Forecasting Technological Substitution. Technological Forecasting and Social Change .20: 199-213.

Eisenmann T, Parker G, Alstyne MW. 2006. Strategies for Two-Sided Markets. Harvard Business Review 84(10): 92-10.

Eisenmann T, Parker G, Alstyne MW. 2011. Platform Envelopment. Strategic Management Journal 32(12): 1270–1285.

Kimura M. 2011. Degitaru Gemu no eko shishutemu tou Gensaku/Hokan Kontentsu no Iko Opushon : Akedo Gamu tou Konshuma Gamu no Hikaku Jirei Bunseki (The Content Ecosystem and the Original-Complementary Content Transition Options of Digital Games: A Comparative Study of Video Game Arcade and Video Game Console). Soshiki Kagaku (Organization Science) 45(1): 58-68.

Mahajan VE, Srivastava RK. 1990. Determination of Adopter Categories by Using Innovation Diffusion Models Journal of Marketing Research 27(1): 37-50.

Mahajan VE, Bass FM. 1995. Diffusion of New Products: Empirical Generalizations and Managerial Uses Marketing Science 14(No.3) : G79-G88.

SEGA. Oshare Majo Rabu and Berii [Fashionable Witches: Love and Berry] Official Home Page. http://osharemajo.com/

Sterman JD. 2000. Business Dynamics: Systems Thinking and Modeling for a Complex World. McGraw-Hill.

Appendix: Formulation of Digital Game Diffusion Model

Actual Market Size = Recognized Potential Users*Market Diffusion Rate
Arcade Game Users = INTEG (New Arcade Gamers,10000)
Coefficient of imitaion = IF THEN ELSE(PULSE(0,3),9,IF THEN ELSE(PULSE(3,12),3,IF THEN ELSE (PULSE(12,20),1.25,1.25)))
Consumer Game Users= INTEG (New Consumer Gamers,0)
FINAL TIME = 37 ; INITIAL TIME = 0
Lifetime Purchase Cards = 100
Market Diffusion Rate = (Arcade Game Users+Consumer Game Users)/Market Scale
Market Scale= Potential Game Users+Arcade Game Users+Consumer Game Users
New Arcade Gamers = WOM Effect
New Consumer Gamers = IF THEN ELSE(PULSE(Sales Start Period,3),Sales Per Period*Transition Rate,0)
Potential Game Users = INTEG (-New Arcade Gamers-New Consumer Gamers, 3.7e+006)
Recognition Rate = 0.1
Recognized Potential Users = Potential Game Users*Recognition Rate
Sales Per Period = 340000 ; Sales Start Period = 24
TIME STEP = 1
Trading Card Sales = Arcade Game Users*Lifetime Purchase Cards
Transition Rate = 1
WOM Effect = Coefficient of imitaion*Actual Market Size