Discontinuous Innovation and Market Chasm: The Case of Digital Convergence Services

Yeong-Wha Sawng

Electronics and Telecommunications Research Institute, 161 Gajeong-dong, Yuseong-gu, Daejon, Korea
Email: sanctus69@paran.com

Kiyong Om

Korea University of Technology and Education, Gajeon-ri, Byeongcheon-myeon, Cheonan, Chungnam Province, Korea
Email: kyom@kut.ac.kr

Bongsik Shin

San Diego State University, 5500 Campanile Drive, San Diego, CA 92182-8228 USA
Email: bshin@mail.sdsu.edu

Jungmann Lee*

Hoseo University, Anseodong 268 Cheonan city, Chungnam Province, Korea
Email: mann@hoseo.edu

This study explores the phenomenon of chasm in the marketing process of discontinuous innovations. Drawing on Moore's concept of chasm crossing, an empirical analysis is performed using the data gathered from a survey of potential users of satellite DMB. First, the demand of satellite DMB is forecasted. Then, the demand changes in different innovation adopter groups are determined from the continuous innovation perspective relying on Rogers' technology adoption life cycle model. Finally, the diffusion process of this high-tech service is re-examined from the perspective of discontinuous innovation in order to identify the market gap and elaborate strategies to overcome the chasm. In the analysis, time points of innovation adoption are used as the basic unit of analysis for the purpose of shifting the analytical focus from market diffusion to consumer acceptance. This study is expected to provide a useful methodological framework for future empirical applications in this field.

Keywords: Digital convergence, Satellite DMB, Discontinuous innovation, Market diffusion, Demand forecast, Technology acceptance, Innovation adopters, Chasm

A.C.M. Classification: H.O.

1. INTRODUCTION

High-tech products are introduced in turbulent environments where fast and significant technological changes result in technological discontinuities in the marketplace. Such changes create high levels of uncertainties for both sellers and buyers in a high-tech market. In order to devise effective marketing strategies, companies need to understand precisely why and how consumers make purchase decisions

* Corresponding author

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for high-tech products. Discontinuous innovation characterizes consumers' adoption behaviour in high-tech products. Consumption patterns in products of this type, furthermore, tend to change rapidly (Gatignon *et al*, 1989). It is therefore reasonable to assume that consumers' behaviour in adopting a new telecom-broadcasting convergence service such as satellite DMB (Digital Multimedia Broadcasting) allowing subscribers to receive broadcasts on their cell phones or in-car terminals may have determinants that are not identical to those influencing the adoption of traditional IT services, and that this difference is caused by a discontinuous innovation that the new service engenders (Kim, 2004).

Even a breakthrough technology product can face a tepid market response or fail to meet with the kind of reception that could have been expected based on the degree of innovation it brings. When consumers turn a cold shoulder to quality innovative products, the most likely cause is psychological resistance. The strength of psychological resistance depends on the degree to which existing products and the associated use environment have become a habit for consumers, and also the degree of risk they perceive they would run by adopting a new product (Ram, 1987). Meanwhile, with innovations in the latest cutting-edge technology fields like satellite DMB, the absence of a well-formed or deep-rooted habit, rather than facilitating the acceptance process, can contribute to further increase the level of risk perceived by consumers (Bagozzi and Lee, 1999). 'Chasm,' a concept from the marketing field, precisely refers to this discontinuity in the process of diffusion of innovations caused by consumers' resistance.

The chasm, according to Moore (1991), is the phenomenon whereby a high-tech product, after successful early sales, fails to elicit further demand, in other words, fails to cross over to the mainstream market, from the early market. Moore argued that there exists a huge gap between the customers of the early market and those of the mainstream market, and that crossing this gap is the crucial test for all high-tech firms. Moore's chasm model is regarded today as an indispensable tool for understanding high-tech consumers and high-tech marketing (Kim, 2004).

Research in related subjects, however, has remained thus far limited to inquiries on innovations at a technological level, in other words, studies focused on traditional continuous innovations and 'cracks,' or smaller market discontinuities. Existing works, therefore, fall short of adequately explaining the chasm, a phenomenon occurring at the level of consumers' behaviour and having to do with behavioural changes caused by high-tech products. Insights into how discontinuous innovations, in other words, radical changes brought about by innovative high-tech products, affect consumers' adoption behaviour vis-à-vis these products are long overdue. To properly assess the impact on consumer behaviour, it is necessary to expand the technology adoption life cycle model. This is precisely what Moore (1995) did in his chasm model.

In this study, we turn to satellite DMB, one of the leading digital convergence services in South Korea, to identify chasms that may appear in the process of diffusion of a discontinuous innovation and determine the causes of these chasms and develop the strategies to bridge them. The study is, hence, an empirical application of the chasm theory, where discussions have thus far been primarily conceptual.

The remainder of the paper is organized as follows. First, theoretical background and research methods are described in Sections 2 and 3 respectively. Then, in terms of a continuous innovation, the cumulative demand for the satellite DMB service is predicted using Bass's demand forecasting model, and the prediction results are integrated into Rogers' technology adoption model in Section 4. Meanwhile, in Section 5 the concept of discontinuous innovation serves to explain the fluctuation of demand across different stages of diffusion and according to the category of consumers by applying Moore's chasm model. Finally, strategies for crossing the chasm are discussed in Section 6, while implications and limitations of the study are in Section 7.

2. THEORETICAL BACKGROUND

2.1. Innovation and Chasm Theory

Of the countless innovative products hitting the market every year, only an exceedingly small minority enjoys the good fortune of finding favour among consumers in a lasting manner. There are also products that succeed in generating a buzz among early adopters, yet fail to make the cut, as they falter at the stage of creating a mainstream market. In the high-tech sector, many innovative products experienced marketing fiascos, often due to an inability to perceive invisible gaps occurring in the technology adoption life cycle. The chasm lying between the early market and the mainstream market, important as it is, is only the first of the many pitfalls a high-tech product can encounter in its diffusion process.

Innovation naturally entails resistance and anxiety. Consumers, reacting to changes brought about by innovation, develop reticence. Faced with an innovation, and the implied demand to abandon what they are accustomed to, consumers enter into a state of psychological imbalance. They may react either by adapting to the innovation, or by resisting the changes. Ram and Sheth (1989) distinguish resistance arising from the innovation adoption process into two main types: functional barriers and psychological barriers. Functional barriers are resistances determined by value, usage and risk. Psychological barriers have to do with tradition, image and other factors related to social conventions and perception from others. A cold response from the market is always a possibility, which even the best of new products cannot rule out. Consumers need time to warm up to a product. How a product fares in a market is also a matter that needs to be determined over time. A positive early response, for instance, is certainly not a guarantee that an innovative product will succeed in generating broad or long-term demand. The possibility of sales falling flat and consumers losing interest is always around the corner.

The chasm model precisely enables one to understand the process of high-tech marketing from the perspective of consumers and their resistance to innovation. The chasm indeed is the main pitfall in the high-tech market, created by consumers' resistance. This is because discontinuous innovations brought about by high-tech products are more apt to trigger a response of resistance in consumers than continuous innovations (Kim, 2004).

'Chasm,' in its original geological context, means a large gorge or abyss between rock strata, caused by crustal movements. It became a term with currency in the marketing field, when in 1991, Geoffrey Moore, then a Silicon Valley consultant, used it to describe the development cycle of U.S. ventures. The chasm, in simple terms, is a gap lying between two consumer groups, early adopters and the early majority, which is not always easy to cross. The early majority being the mass market, a product, unable to bridge the chasm, will ultimately fail in its marketing bid. The chasm theory remains an influential theory for understanding the success and failure of ventures, often applied to marketing projects involving discontinuous innovations, causing major changes in customer's behavioural patterns and attitudes.

2.2 Types of Innovation: Continuous vs. Discontinuous Innovation

Kotler and Zaltman (1976), in their investigation of the characteristics of innovators and early adopters, found individual differences in consumers' response to innovation. The individual differences observed among innovative consumers are explained by the nature of innovation. In other words, even technology-friendly consumers respond differently to an innovation depending on its type and characteristics.

Innovations are classified into different categories, generally according to three criteria: product benefit, technology capability and consumption or usage pattern (Kim, 2004). From consumers' perspective, an innovation may be either a continuous or discontinuous innovation, depending on the consumption or usage pattern it creates. Continuous innovations refer to normal products or service upgrades which do not require modifications in consumption pattern. The upgrade from a 386 PC to a 486 PC, or to a Pentium PC, for instance, is a typical example of a continuous innovation. Unlike continuous innovations, discontinuous innovations entail changes in consumption behaviour. A fine example of a discontinuous innovation would be switching from an analog product to a digital product like from a past analog mobile terminal with voice only service to a current digital mobile terminal with voice, data and even media service. Continuous innovations take place either within the same product group or take the form of incremental changes. Discontinuous innovations, on the other hand, tend to give rise to an entirely new product group or create a new market. Such is precisely the case with satellite DMB, a new type of mobile broadcasting service (TV inside the palm) which also fulfills the function of communication, spawning a new market converging telecom and broadcasting. Hence, satellite DMB constitutes a classical example of a discontinuous innovation.

Satellite DMB, a much publicized next-generation convergence service, is widely perceived by South Korean consumers as an innovative cutting-edge technology. The patterns of innovative behaviour among consumers are much more apparent when one considers an innovative breakthrough technology as a discontinuous innovation, rather than a continuous innovation (Kim, 2004). It is easier and more effective to explain consumers' response to satellite DMB, when one conceives its adoption process as a diffusion of a discontinuous innovation than as a continuous innovation; hence the explanatory power of Moore's chasm theory, in this case, is superior to that of the continuous innovation model proposed by Bass (1969) or Rogers (1995).

Following Moore (1991), one can envision a discontinuous pattern of diffusion for satellite DMB, interspersed by two cracks and one chasm. Moore (1991) argued that researchers and marketers are often unaware of the discontinuous pattern of diffusion in high-tech products, due to an over-reliance on macro market trends. Moore, therefore, implied that a careful examination of the diffusion process can unveil hidden cracks and chasms that a transaction-centered approach to marketing research tends to overlook.

2.3 Innovation Adoption and Diffusion

In marketing of discontinuous innovations, customers are classified into five distinct categories; innovators, early adopters, the early majority, the late majority and laggards, as defined by Rogers in his technology adoption model (1995). Rogers stressed the important role played by early adopters in the process of diffusion of a high-tech product, as opinion leaders (Rogers, 1995; Rogers and Cartano, 1962). Moore, who, expanding on Rogers' model, attempted to explain the causes of stalled diffusion of innovative high-tech products through his concept 'chasm,' also called attention to the importance of early adopters for marketing success (Moore, 1991). According to Moore, the chasm is caused by the difference between early adopters making up the early market and the consumers of the mainstream market, in their attitude toward high-tech products including reasons for purchase and preference (Moore, 1991). Unlike early adopters, for whom the innovative features of a product are qualities favourably disposing them toward its purchase, the early majority prefers changes to be incremental and tends to try to reduce as much as possible any risk associated with the adoption of a new product. The concepts of adoption and diffusion developed by Rogers (1995) provide the basic analytical units for a chasm analysis. High-tech products being generally high-price items as well as durable goods, consumers tend to be more cautious with their initial decision to purchase these goods than with other types of products. From a consumer behavioural perspective, the decision to purchase an innovative technology product may be therefore interpreted as an act of adoption. Diffusion is defined as the process of a gradual increase in the number of consumers adopting a new product. If adoption describes individual consumers' actions, diffusion describes the same phenomenon from a global perspective, at the level of the market (Kim, 2004).

Consumers exchange information with each other and influence each other according to behavioural patterns and attitudes. A typical consumer manifests a tendency to rely on others for evaluation of a product they consider purchasing (Robertson, 1971). Consumers of this type imitate others more knowledgeable and experienced in a given category of product and seek advice from them (Flynn *et al*, 1996). The process whereby consumers influence each other concerning the adoption of new products plays an important role in the diffusion of innovation (Rogers, 2003). The process of adoption may be regarded as the process of diffusion seen from the perspective of consumers. On this subject, Rogers remarked that the Bass model, while a convenient tool for estimating the overall market per maturity stage in an aggregate way, is limited when it comes to explaining the phenomenon of adoption and non-adoption at the level of individual consumers (Rogers, 2003). To identify the characteristics of consumers in markets that succeed each other over time, Rogers distinguished adopters of new products into distinct categories and proposed a theory of innovation diffusion built upon these adopter categories.

3. METHOD

3.1 Method of Analysis

While the importance of the chasm theory for high-tech marketing has been frequently underlined in much of the existing literature, attempts to empirically verify it have been exceedingly few. Most prior works on the subject are either explanations of the chasm as a theoretical model or conceptual discussions on why and how the chasm occurs. In this paper, we attempt to move beyond the conceptual approach prevalent in the existing literature by performing an empirical analysis using the case of satellite DMB.

For this study, we used Rogers' categories of innovation adopters, providing the basic framework for Moore's chasm model, without modification. Meanwhile, for more precision in the analysis of market transformation in satellite DMB, our chasm analysis considers points-in-time of adoption as a basic analytical unit. In other words, the analysis will focus on the status of adoption by consumers, rather than market diffusion. Using different points-in-time of adoption of satellite DMB, we perform a clustering simulation to divide samples into different groups and determine the precise time frame of occurrence of the chasm.

As has been already mentioned, satellite DMB falls into the category of discontinuous innovation. Notwithstanding, determining the pattern of diffusion and adoption of satellite DMB from a consumer perspective makes it necessary to consider this new service both as a continuous and discontinuous innovation. This is because the diffusion of satellite DMB at an industry level (macro level) is a cumulative phenomenon, hence, continuous, while the changing demand for the same service at different periods in time (micro level) makes its diffusion discontinuous. In our empirical analysis, we, therefore, choose to consider satellite DMB as a continuous innovation, so that we can estimate the overall demand for it in its cumulative effect and predict the diffusion pattern of this service accordingly. A micro-analysis of the diffusion process follows next, to determine the level of adoption at different stages of marketing and identify any chasms that may occur over the process. To sum up, we, first, analyzed the diffusion process of satellite DMB and estimated the overall market demand for this service according to the diffusion model for continuous innovations and the perspective of market acceptance. Next, using Rogers' technology adoption life cycle model, we analyzed the pattern of demand distribution among different groups of innovation adopters. Finally, satellite DMB was considered as a discontinuous innovation, chasms that may exist in its diffusion process were located, and the strategies to bridge the chasms were identified.

3.2 Data

Data used in this study were collected through a survey of potential users of the satellite DMB service. The survey, conducted by a market research organization, involved three stages: a preliminary in-depth interview, a pilot survey and the actual survey. The purpose of the preliminary in-depth interview was to determine the most effective way to describe satellite DMB services that are not yet available for commercial use. A series of preliminary in-depth interviews were conducted on 50 consumers, chosen from an online advertisement for a face to face survey. The preliminary in-depth interview sessions were held three times a week, for three weeks and totaled 10 hours per week.

Based on the results of these interviews, information materials describing essential features of satellite DMB (including photos) and a scale were developed. The measurement tools developed through this step were used during the pilot survey. Questionnaire items which proved doubtful at the pilot survey, in terms of validity and reliability, were discarded. Finally, the actual survey was conducted between 16 February and 16 March, 2004, on a nationwide sample of 1,400 mobile users, aged 15 to 59, residing in Seoul and six other major Korean cities (500 from Seoul, 300 from Busan, 200 from Daegu, and 100 from each of the remaining cities), selected through proportionate quota sampling. To increase the validity and reliability of the data, this survey was conducted over a one-month period and enlisted 100 surveyors, who were each assigned to interview 5 to 6 respondents a day, one-on-one. As the surveyors were instructed to offer respondents thorough explanations on the provided information brochure on satellite DMB before proceeding with the actual interview, each interview lasted at least 30 minutes. 1,000 total responses were collected through the month-long process. The survey, which proved quite costly, was made possible thanks to corporate contributions to this research project.

Questions regarding the intention to adopt a satellite DMB service were asked to 1,000 mobile phone users. The potential demand for the satellite DMB service was estimated by the data collected through this survey.

4. DEMAND PREDICTION AND ANALYSIS OF INNOVATION ADOPTION MODEL

4.1 Prediction of Demand for Satellite DMB Using Bass Model

By estimating a diffusion model for the satellite DMB service, we were able to compute the pace of its market acceptance and subsequently its maximum potential demand. In the case of the Bass model, the adoption speed is determined by the coefficient of innovation and the coefficient of imitation (Meade and Islam, 1998). The coefficient of innovation (internal influence, p) is a parameter that captures the behaviour of an individual responding to his/her internal judgment solely based on the attributes of a service such as satellite DMB, while the coefficient of imitation (external influence, q) represents the degree to which individual decision to subscribe a service is influenced by others. The model is:

$$T_t = [\, p + q\,(Y_{t\text{-}1}/N)\,]\,(N - Y_{t\text{-}1})$$

N = Estimated value of maximum potential demand

T_t = Net subscriber at a given point in time

$Y_{t\text{-}1}$= Cumulative number of subscribers at a given point in time

p = Coefficient of external influence (coefficient of innovation)

q = Coefficient of internal influence (coefficient of imitation)

t = Point in time (yearly increments)

Sample Characteristics		Overall	Seoul	Busan	Daegu	Daejeon	Gwangju	Incheon	Ulsan
Number of samples		(1000)	(454)	(164)	(108)	(109)	(59)	(61)	(45)
Age	Late teens	11%	10%	11%	11%	11%	12%	11%	11%
	20s	26%	27%	25%	26%	24%	27%	26%	22%
	30s	26%	26%	23%	26%	29%	27%	26%	31%
	40s	24%	23%	25%	24%	25%	20%	23%	24%
	50s	14%	14%	16%	13%	11%	14%	13%	11%
Occupation	Admin. & Professional	14%	15%	11%	10%	17%	14%	10%	20%
	Sales	15%	14%	20%	17%	14%	12%	15%	0%
	Production	7%	6%	8%	0%	10%	8%	10%	16%
	Self-employed	18%	18%	21%	17%	11%	15%	21%	16%
	Housewives	22%	22%	17%	20%	28%	20%	18%	24%
	Students	20%	20%	16%	24%	17%	25%	25%	20%
	Others	6%	5%	7%	12%	3%	5%	2%	4%
Education	High school students or graduates	33%	37%	31%	32%	23%	25%	34%	27%
	Undergraduate students or bachelor's degree holders	14%	14%	13%	13%	10%	24%	25%	7%
	Postgraduate students or master's/doctor's degree holders	52%	48%	55%	54%	67%	51%	41%	67%
Household Income (unit: Korean Won) (1 USD = 1,026 Korean Won)	Below 1,000,000	0%	0%	0%	2%	0%	2%	0%	0%
	1,000,000 ~ 1,999,000	9%	5%	21%	12%	7%	20%	5%	0%
	2,000,000 ~ 2,999,000	25%	18%	29%	31%	37%	34%	34%	24%
	3,000,000 ~ 3,999,000	33%	35%	28%	31%	38%	20%	36%	38%
	4,000,000 ~ 4,999,000	14%	17%	9%	14%	7%	14%	11%	18%
	Over 5,000,000	15%	19%	9%	9%	11%	10%	11%	20%
	Declined to answer	4%	6%	5%	1%	0%	0%	2%	0%

Table 1: Profile of respondents

Category	Variables
Demographics	Area of residence; Gender; Age; Education; Income; Occupation
Lifestyle	Activity; Interests; Opinion
Service Acceptance	Subscription intention; Immediate adoption intention; Expected timing of subscription
Service Preference	Content; Monthly subscription fee (Appropriate, and maximal level); Reception device type and price

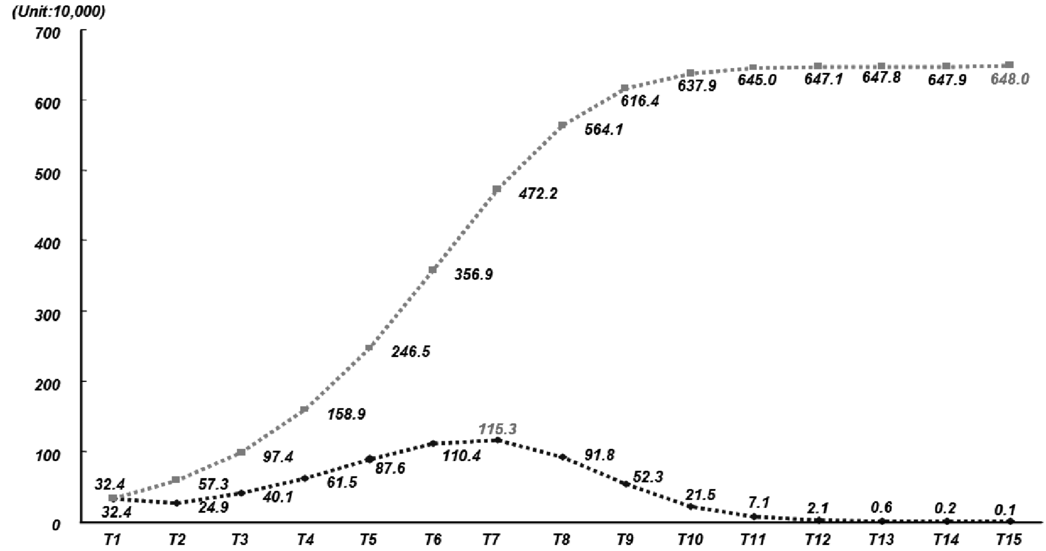
Table 2: Survey questionnaire items

To develop the model, parameters *p* and *q* must be estimated first. As there is no previous data available for satellite DMB, estimation has to be indirect. Several studies exist on the subject of how to estimate parameters for the Bass model when there is no past data (Mahajan *et al*, 1990; Mahajan *et al*, 1988). Many of them propose to derive the information relying on the sound judgment by the firm leadership looking to introduce new services or products. For several reasons, we derived the parameters *p* and *q* by estimating the coefficients of innovation and imitation for the mobile phone service. First, when estimating a diffusion model of a new service whose subscription rate is uncertain, the estimates of similar services may be embraced (Sultan, 1990). Second, considering that both services are largely offered through hand-held devices resembling in every aspect, we expect that the satellite DMB service will propagate following the diffusion pace of the mobile phone service. Third, Korea's mobile phone service market is near to its saturation point at 33.6 million subscribers. This is equivalent to 74% of the population. With that the mobile phone market is approaching saturation, it seems to be reasonable to believe that 74% of population is theoretically the largest market the satellite DMB service can attain in Korea. Finally, with increasing merger between multimedia and mobile communications, multimedia experience from the mobile phone service could speed up the bandwagon effect of the satellite DMB service, potentially a killer application. We used the official statistics on mobile phone service subscribers, published on a monthly and annual basis by the Korean Association of Information & Telecommunications (KAIT, http://www.kait.or.kr). Using the annual total numbers of subscribers between 1985 and 2003, the above equation was estimated by performing a nonlinear regression analysis (Gauss-Newton method). To enhance the validity of prediction, we excluded data from 1998, 1999, and 2001 as these years saw an explosive growth of the mobile service market, caused in part by ad hoc promotion programs such as the subsidization of phone purchase by service providers. The diffusion coefficients obtained were p=.0005 and q=.710 and they were applied to the prediction of longitudinal demand for the satellite DMB service.

As for the maximum potential demand for the satellite DMB service, *N*, we made use of 33.6 million, the official figure of mobile phone subscribers at the end of 2003 (74% of Korean population), provided by the KAIT. Demand (T_t) was computed by applying the diffusion coefficients (*p* and *q*) and maximum potential demand (33.6 million). In order to calculate T_1, estimation of Y_0 is necessary. To approximate Y_0, we used the 'Yes' percentage (1.3%) of the survey question concerning the immediate adoption intention. Accordingly, T_1 is calculated as follows.

$$T_1 = [\ 0.0005 + 0.71\ (Y_0 / 33{,}590{,}000)\ ]\ (33{,}590{,}000 - Y_0),\ Y_0 = 33{,}590{,}000 \times 0.013$$

Based on the predicted demand for T_1, expected demands for subsequent years are computed (Figure 1). About 5% of the total users are projected to sign up the service during the first year, while the cumulative number of subscribers in the 6th year would reach over half of the total projected users (55.1%). The size of the saturated market was estimated at 6.48 million (about 14.4% of the Korean population) and the new demand is expected to peak in its seventh year. The numerical summary of Figure 1 is given in Appendix 1. As shown in Figure 1, the cumulative adoption of the satellite DMB service forms an S-shaped growth curve. Further, the proportion of individuals ready to join the services over time shows approximately normal distribution. Assuming that the satellite DMB service will propagate successfully at the similar pace of the mobile phone diffusion, the result coincides with the general pattern of innovation diffusion (Meade and Islam, 1998).



	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15
Net Increase	32.4	24.9	40.1	61.5	87.6	110.4	115.3	91.8	52.3	21.5	7.1	2.1	0.6	0.2	0.1
Cumulative	32.4	57.3	97.4	158.9	246.5	356.9	472.2	564.1	616.4	637.9	645.0	647.1	647.8	647.9	648.0

(Unit:10,000)

Figure 1: Demand predictions for the Satellite DMB service

4.2. Combining the Bass Estimation Model with Rogers' Innovation Adoption Model

Estimating the satellite DMB diffusion in terms of customer types in each stage of market growth has theoretical as well as practical values. Rogers (2003) identified five adopter types in terms of people's reaction timing to an innovative product. According to him, adopters are divided into five sequenced groups in terms of their expected time of adoption, which is expected to be normally distributed. The distribution of their percentages is innovator (2.5%), early adaptor (13.5%), early majority (34%), late majority (34%) and laggard (16%).

Instead of borrowing the distribution percentage by Rogers (2003) in identifying adopter groups of the satellite DMB service, we re-distributed the percentages of adopter groups in terms of their clustered nature of adoption time. That is, the adopters were sequenced in the order of their expected adoption time, and then five distinctive groups were identified based on the vicinity of adoption time with statistical difference between neighbouring categories in their mean waiting period.

In this study, we derived the clustering approach for two main reasons. First, many indicated the early participation in the satellite DMB service resulting in the significant cluster of responses. Second, if we classify the adopters strictly according to the Rogers' percentages, adopters with negligible differences in their adoption time could still be separated into two different adopter groups, compromising the reliability of the categorization. The small differences in adoption time may not represent a significant gap because of the subjective (and therefore perception-based) responses. The re-distributed adopter groups are identified based on 396 (out of 1000) responses that indicated the adoption of satellite DMB. Several experiments were iteratively conducted to

<table>
<tr><th>Type of Innovation Adopter</th><th>Frequency (no. of samples)</th><th>Share (%)</th><th>Year</th><th>Average Time of Subscription (month)</th><th>Standard Deviation</th><th>df</th><th>F-value</th></tr>
<tr><td>Innovators</td><td>27</td><td>6.8</td><td>0.5</td><td>2.86</td><td>1.59</td><td rowspan="6">Between groups (4)
Within a group (391)</td><td rowspan="6">1,245.441**</td></tr>
<tr><td>Early adopters</td><td>102</td><td>25.8</td><td>3.1</td><td>27.15</td><td>8.03</td></tr>
<tr><td>Early majority</td><td>128</td><td>32.3</td><td>5.7</td><td>59.70</td><td>6.69</td></tr>
<tr><td>Late majority</td><td>89</td><td>22.5</td><td>7.8</td><td>87.46</td><td>5.87</td></tr>
<tr><td>Laggards</td><td>50</td><td>12.6</td><td>12</td><td>119.56</td><td>19.90</td></tr>
<tr><td>Total</td><td>396</td><td>100</td><td></td><td>61.24</td><td>34.75</td></tr>
</table>

**p<0.01

Table 3: Bass Estimates redistributed according to Rogers' Categories of Innovation Adopters

identify the optimal categories and all categories were statistically different in the average waiting period. Table 3 also summarized the ANOVA test with very high level of treatment (adopter types) effect on average waiting period.

The redistribution of adopter groups based on data cluster leads to the following adoption categories along the timeline: innovators (~ 0.5 year), early adopters (0.5~ 3.1 years), early majority (3.1~ 5.7 years), late majority (5.7~7.8 years), and laggards (7.8 ~12 years). The results of this classification suggest that the satellite DMB market will enter the growth stage from the year following the initial launch. The breakdown of people was 6.8% for innovators, 25.8% for early adopters, 32.3% for early majority, 22.5% for late majority, and 12.6% for laggards. The percentages of adopters are shown to be rather different from the Rogers' percentages (2003), consisting of 2.5%, 12.5%, 34%, 34% and 16%.

Then, the expected total number of adopters (6.48 million people) derived based on the original Bass function (Figure 2) are proportionately divided into the categories of Table 3. To calculate the number of first year participants (440,000), for example, 6.48 million is multiplied by 6.8% from Table 3. The solid line in Figure 2 is the calibration of the predicted number (6.48 million) according to cluster categories as in Table 3. This solid line, therefore, represents a combination of the Bass model and the clustered Rogers' model to predict the satellite DMB diffusion grounded on the analysis of 396 (out of 1000) survey responses. The estimation of satellite DMB adoption based on the original Bass model is shown as the dotted line in Figure 2. Although both predictions in their cumulative numbers are similarly s-shaped, the adoption speed differs and the clustered Rogers' model indicates much faster growth in the initial stage.

The non-cumulative graphs reveal that the estimation based on the original Bass function is closer to normal distribution than that of clustered Rogers'. The comparison indicates that the estimated number of adopters during the initial phase (early adopters and early majority group) is higher with the clustered Rogers' model than the Bass model. This trend, however, reverses from the early majority stage in which the adoption becomes faster with the prediction of the Bass model.

5. CHASM ANALYSIS

To locate the chasm appearing in the process of diffusion of satellite DMB, we used points-in-time at which consumers subscribe to a satellite DMB service as the smallest unit of analysis. 398 respondents expressing a positive intent to use satellite DMB indicated 106 total points-in-time at

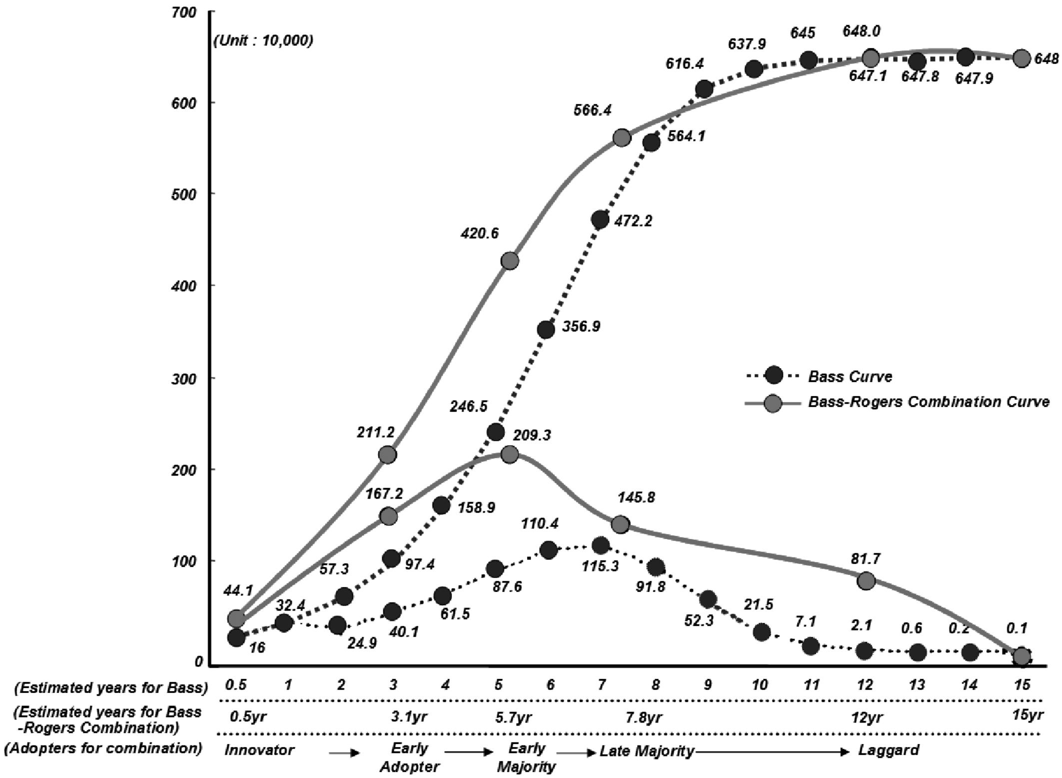


Figure 2: Bass-Rogers Combination Diffusion Curves

which they intend to subscribe to the service[1]. To group the respondents into the five categories of innovation adopters, we performed a cluster analysis[2] through repeated simulations. We used the results from combining the demand estimates obtained via the Bass model with Rogers' innovation adopter categories as clustering criteria. (See Table 3)

The first clustering round yielded 19 criterion groups. These criterion groups serve as the basic units in the analysis of the chasm. The 19 criterion groups from the first clustering round were made up of three innovator groups and three laggard groups, four early adopter and four later majority groups and five groups from the early majority, accounting for the largest segment of the market.

The analysis, however, revealed that no statistically-significant differences in characteristics and tendencies separated the 19 criterion groups; evidence indicating their inappropriateness for use in the chasm analysis. This situation can occur when a group is divided into too many subgroups (criterion groups), enough to erase any differences distinguishing the groups from one another. A typical example of this kind would be dividing a group of individuals in their 20s into, say, five

1 The time of subscription to a satellite DMB service may be equated with the time of the first purchase. The survey question inquiring about the time of subscription, asked to 398 respondents indicating a positive intention to use satellite DMB ('I will definitely subscribe,' 'I will probably subscribe,' 'I might, but I am not sure'), was formulated as follows: "At what point in time after the initial roll-out of satellite DMB do you think you will subscribe to the service? Respondents are asked to indicate the time of subscription by providing the numbers of years and months that would have elapsed after the rollout.

2 Clustering was performed using an agglomerative hierarchical method.

Innovation Adopter Group	Subgroup (2nd clustering)		Criterion Group (1st clustering)	
Innovators (6.8%)	I1	5.5	i1	3.0
			i2	2.5
	I2	1.3	i3	1.3
Early Adopters (25.8%)	Ea1	22.5	ea1	9.1
			ea2	13.4
	Ea2	3.3	ea3	2.0
			ea4	1.3
Early Majority (32.3%)	Em1	14.4	em1	6.8
			em2	7.6
	Em2	16.2	em3	7.1
			em4	9.1
	Em3	1.8	em5	1.8
Late Majority (22.5%)	Lm1	18.7	lm1	8.1
			lm2	10.6
	Lm2	3.8	lm3	3.0
			lm4	0.8
Laggards (12.6%)	La1	11.6	la1	7.6
			la2	4.0
	La2	1.0	la3	1.0
Total		100%	Total	100%

Table 4: Final Clustering Results

different subgroups at age intervals of two years; differences between the subgroups will be too minor to be meaningful for any statistical purposes.

We, therefore, proceeded to a new round of clustering. Repeated simulations were performed on the 19 criterion groups until we found statistically-significant differences between the groups. The second round of clustering yielded 11 total subgroups. The 11 subgroups comprised three early majority groups and two groups from each of the four other adopter groups.

As has been stated above, our analysis of the adoption of satellite DMB came out to106 points-in-time of intended subscription by 398 likely adopters who indicated a positive intention to use satellite DMB(refer to footnote 1). That has found the following:

First, the adoption/diffusion process for satellite DMB followed a path similar to that described by Moore (Midgley and Dowling, 1978). For Bass and Rogers, demand for new products grows forming a continuous upward curve through to the stage of market maturity before it gradually diminishes in the stage of decline (Bass, 1969; Rogers, 2003). Moore, on the other hand, advanced, in his chasm theory, that stagnations of demand occur between innovation adopter groups, and that the demand for a new high-tech product declines at the end of the growth curve for each of the adopter groups (Moore, 1991). Hence, the growth curve for innovative high-tech products would form a staircase curve, rather than a classical S-shaped curve. Our estimation results on the demand for satellite DMB corroborate the market growth pattern of the chasm model. Declines in demand observed in satellite DMB correspond to demand stagnation (big discontinuity in demand) occurring between adopter groups under Moore's model, lending empirical support to his view of the diffusion of high-tech products as a discontinuous process. In other words, satellite DMB is a discontinuous innovation, whose diffusion does not follow the pattern of continuous diffusion according to Bass or Rogers, applying to traditional new products, but the pattern of discontinuous diffusion proposed in Moore's (1991) chasm theory.

Second, the demand gaps observed in the diffusion process of satellite DMB did not precisely coincide with Moore's description of the phenomenon. Instead of one chasm and two cracks as Moore suggested, we found two chasms and one crack in the demand curve for satellite DMB. In Moore's chasm model, the chasm occurs only once between early adopters and the early majority. Moore qualifies two other occurrences of demand gap between the rest of market phases as 'cracks' (Moore, 1991). In our analysis of the diffusion of satellite DMB, we located a second chasm within the mainstream market, between the early majority and late majority. Concerning the distinction between a chasm and a crack, there are, unfortunately, no clearly established criteria, as Moore, himself, was less than explicit on this topic. What we do know is that both chasm and crack have to do with the phenomenon of the demand growth for a new innovative product coming to a halt (Moore, 1991). Notwithstanding, a crack may be understood as a temporary time lag between two phases of diffusion, while the term chasm implies a long-term stagnation or decline in demand. In applying this criterion to the case of satellite DMB, we looked for the evidence of a crack or chasm based on points in time when demand recovers to the level in the immediately preceding subgroup. To distinguish a crack from a chasm, we used the r-control building technique. A deviation from UCL or LCL exceeding the range of $\pm1\sigma$ (3.8) was taken as an indicator of a crack, and a deviation exceeding the range of $\pm2\sigma$ (7.8), an indicator of a chasm. We considered one time lag and a fraction of it as a crack and two or more time lags as a chasm. We found one such crack and two chasms in the diffusion curve of satellite DMB.

Concerning the causes of the crack (Crack 1) appearing at an early point in the diffusion process and the first chasm (Chasm 1) that follows it, one can turn to Moore's own explanation of the phenomenon (Moore, 1995). Moore attributes the first crack (Crack 1) occurring between innovators and early adopters to the difficulty of commercialization faced by a new product due to a failure to create the perception of its innovative characteristics as a new value. As examples of products having faced such an early commercialization barrier, he cites neural network software and video conference (Moore, 1995). Our results indicate that an early marketing setback might indeed be in store for satellite DMB.

Next, the first of the two chasms (Chasm 1), situated between early adopters and the early majority, coincides with the border between the early market and the mainstream market. Moore (1995) viewed the chasm as a phenomenon manifested during the transition from progressive and strategically-minded early adopters to the pragmatically-oriented early majority. The chasm, says Moore, occurs when marketers fall short of winning over consumers in the early majority market whom he describes as having a strong tendency to refer to documented examples of use and being addicted to follow-up support. Hence, Moore attributes the chasm chiefly to meager documentation and inadequate support structure (Moore, 1995).

It is less straightforward to explain the second chasm in the diffusion of satellite DMB, replacing Crack 2 in Moore's own model. Moore situated the second crack between the early majority and the late majority. He considered the second crack as having to do with end-users' ability to understand the technical aspect of a product and proficiency in using it. He viewed this demand gap dependent on consumers' learning curve as a temporary time lag inherent in the process of innovation adoption

(Moore, 1995). Our analysis, however, found that the demand gap appearing between the early majority and the late majority market of satellite DMB was not a short-lived crack, but a longer-lasting chasm. To explain the second chasm, we must turn to the phenomenon of telecom-broadcasting convergence, the background to the emergence of satellite DMB. Nam and Kim (2003), in their study dealing with converged telecom-broadcasting services, pointed out the influence of the competition characteristics of an innovative product on its diffusion. Satellite DMB is only one of the many new services born out of the process of telecom-broadcasting convergence which continue to spawn new technological innovations. Consumers can therefore always be won over by another competing convergence service. Although the first convergence service of its kind to make market debut, satellite DMB was shortly followed by terrestrial DMB, a competing technology offering similar features. The public is also increasingly familiarized with more evolved convergence services like DVB-H (Digital Video Broadcasting-Handheld), Media FLO (Media Forward Link Only) and HSDPA (High Speed Downlink Packet Access). Services capable of substituting satellite DMB like WiBro (Wireless Broadband), Korea’s homegrown mobile high-speed Internet service which offers broadband access in a car moving at 100 kilometre per hour, have entered the market as well. Consumers’ anticipation of upcoming release of competing products and substitutes can put a halt to the growth of demand in a manner more lasting than a crack and may explain why the third demand gap takes the form of a chasm. Another factor that may prolong the market gap is that no competing providers have yet entered the satellite DMB market in which TU Media is so far the sole supplier. Faced with lingering uncertainties about regulations and demand, potential market participants have been keeping a wait-and-see stance. These various obstacles, slowing down the diffusion of satellite DMB in the mainstream market, may contribute to the occurrence of a chasm at this stage of market development.

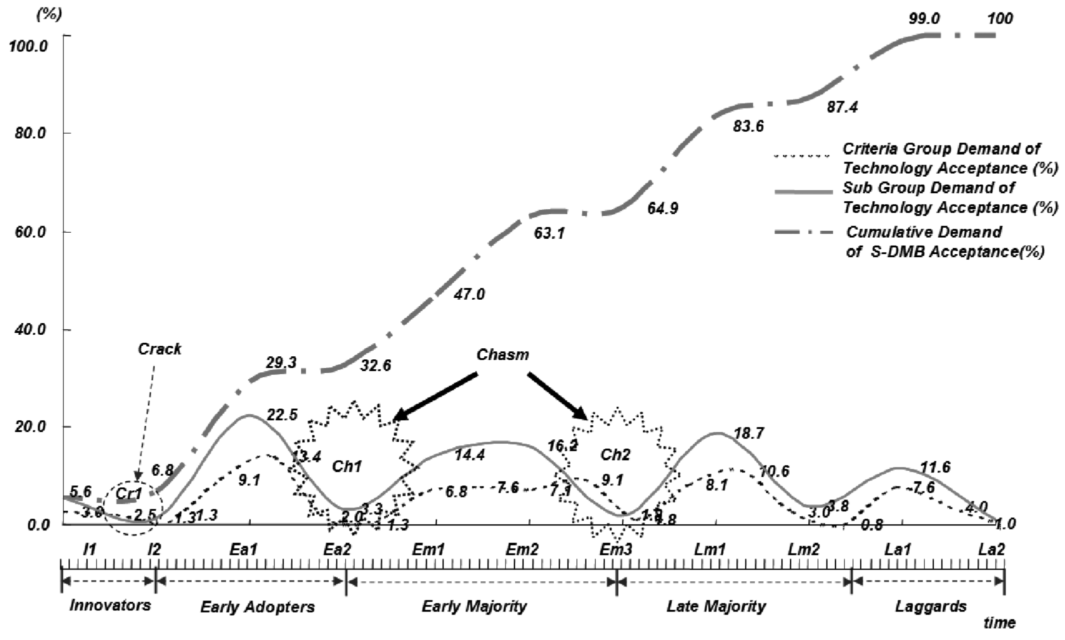


Figure 3: Diffusion of Satellite DMB and Chasms

6. DISCUSSION: STRATEGY FOR CROSSING THE CHASM

The chasm is a temporal gap in demand for a new innovative technology which, otherwise, has fared successfully in the early adopter market, occurring before the stage of broader adoption in the early majority market (Kim, 2004). Meanwhile, chasm marketing refers to discontinuous innovations in high-tech industry sectors and market changes brought about by them. Progressing beyond the chasm is considered crucial for the ability of an innovative technology to reach the mainstream market for mass adoption.

One of the strategies Moore proposes for high-tech marketers to cross the chasm is to target niche markets (Moore, 1995). The chasm, Moore says, can be overcome by selecting a strategic niche market, apt to serve as a beachhead toward the mainstream market of pragmatists, and provide products that can appeal to this market segment. Moore compared the passage between the early adopter market and the mainstream adopters to a bowling alley (Moore, 1995). The bowling alley is a stage where a new product has elicited a positive response in the beachhead (niche) market, but still awaits broader take-up by the mass market. Just as a bowling pin hit by a ball topples other pins near it during its fall, a product can gain momentum, as it progresses from one niche market to another, to ultimately reach the tornado stage. According to Moore, a product, past the chasm, undergoes four different stages of adoption: Bowling Alley, Tornado, Main Street and Total Assimilation (Moore, 1995). The tornado stage describes a phase of marketing in which a new technology succeeds in triggering a paradigm shift to rapidly emerge as a universal technology. During this stage, pragmatic buyers (mainstream adopters) select a collective supplier, completing the replacement of infrastructure. This is also the period during which leading market players experience accelerated growth. During this period, it is essential that marketers develop new niche markets where they should try to emerge as frontrunners. This is because mainstream consumers are practically-oriented individuals who have a deep respect for order and stability and value the experience of early adopters, exposed to a new technology before them. When selecting the first niche market, corresponding to the first bowling pin, a marketer must, Moore argues, choose one upon which a product can exert a powerful appeal (Moore, 1995). Moore's marketing theory, borrowing innovation adopter categories from diffusion theories, stresses the importance of adopting targeted marketing strategies suited to different adopter groups in different market phases. In the early market, for instance, the strategy must focus on early adopters to have these innovative buyers to drive the diffusion process. Once into the bowling alley stage, marketers must try to continually develop niche markets and win over consumers from select target market segments. In the tornado stage, strategic priorities should be retaining newly-acquired customers to develop a lifelong relationship, for instance, by providing standard infrastructure. Finally, during the main street stage, attempts to generate new demand must be made by offering differentiated products to target specific customer types (Moore, 1995).

Moore's theory, concerned with discontinuity in the growth of demand in high-tech marketing and related market changes, offers strategic advice to companies for progressing beyond the early market to enter the mainstream market. This study identified chasms that may occur between the early adopter market and the mainstream market of satellite DMB, one of the latest telecom-broadcasting convergence services in South Korea. To minimize chasms delaying the process of diffusion of satellite DMB, in addition to choosing niche markets and targeting early adopters, as Moore suggested, marketers must also develop a better understanding of consumers' behaviour across the entire market phases. Accordingly, in this study, we looked for causes to chasms and cracks in the lifestyle of the potential users of satellite DMB. Survey responses to lifestyle-related questions were analyzed using the grid of AIO (activity, interest, opinion, each gauging independent judgment, novelty seeking tendency and opinion leadership). AIO variables were measured for each

		Sum of Squares	df	Mean Square	F	Sig.
Independent Judgment (Activity)	Between Groups	13.73	8	1.72	2.57	0.01**
	Within a Group	258.90	387	0.67		
	Total	272.63	395			
Novelty Seeking (Interest)	Between Groups	14.44	8	1.80	1.78	0.08+
	Within a Group	392.72	387	1.01		
	Total	407.16	395			
Opinion Leadership (Opinion)	Between Groups	24.32	8	3.04	5.08	0.00**
	Within a Group	231.57	387	0.60		
	Total	255.89	395			

**p<0.001, +p<0.1

Table 5: Results of ANOVA Analysis of AIO Variables

point in the diffusion process where a crack or chasm was projected to occur. The measurement was performed per subgroup of samples through an ANOVA analysis. The analysis revealed that the differences between adopter groups were statistically significant at the 0.01 level in both 'opinion leadership' and 'independent judgment.'

The two chasms in the process of diffusion of satellite DMB were accompanied by the following changes in AIO. Chasm 1, in other words, between early adopters and the early majority, coincided with a sharp drop in the value of all variables including independent judgment (activity), novelty seeking (interest) and opinion leadership (opinion). Meanwhile, a sharp dip in opinion leadership was observed with Chasm 2.

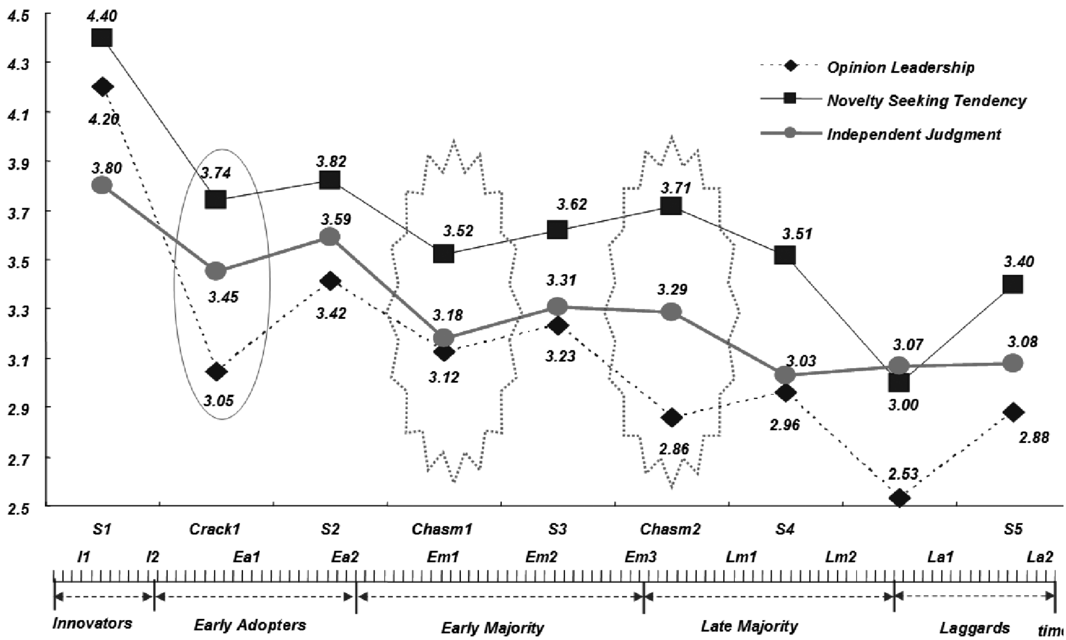


Figure 4: Causes of Chasms Based on AIO Measurements

These results suggest that opinion leaders should be the highest priority group in the strategy to cross the chasm, in stages including the bowling alley, the tornado, main street and total assimilation. At the bowling alley stage between the early market and the mainstream market, all three innovative attributes (independent judgment, novelty seeking, and opinion leadership) appear to be crucial for accelerating the diffusion process. This concretely means that satellite DMB service providers need to generate strong demand from the early adopter market by offering high-quality services and killer applications. In Chasm 2, occurring at the point of transition toward the mainstream market, satellite DMB will face competition from other similar services. In this stage, corresponding to the tornado and main street, it is important to retain existing customers, and especially opinion leaders, by adopting a customer lock-in strategy. To lock in customers, providers can increase both financial and relational switching costs (Burnham *et al*, 2003), to prevent them from switching over to a substitute or competing service (Jones and Sasser, 1995).

7. CONCLUSION

7.1 Summary

This study predicted market gaps that may occur in the process of diffusion of satellite DMB in South Korea, drawing on Moore's chasm model. The diffusion process was empirically analyzed at the level of consumer adoption, using points-in-time of adoption of the satellite DMB service. The results of our analysis confirmed the existence of demand gaps, lending support to Moore's theory.

We found three interruptions in demand for satellite DMB across its marketing cycle. Unlike Moore's model, where the typical process of high-tech marketing would involve two chasms and one crack, the process of diffusion of satellite DMB, according to our estimation, would be interrupted by two cracks and one chasm. Our results indicated that the demand gap between the early majority and the late majority, qualified as a crack by Moore, would take the form of a chasm. This discrepancy is explained by the fact that the gap in demand for satellite DMB appearing at this point of diffusion is not caused by consumers' learning curve, but by a combination of other factors such as the introduction of substitute or competing services, regulation and the market entry by other providers.

Our analysis of AIO to determine strategies for bridging the chasms revealed the existence of statistically significant differences at two points in the diffusion process at which the chasms were identified. The results suggested that opinion leaders were the target market for bridging both of the chasms. We offered practical advice for crossing the chasms in the early market and the mainstream market, such as the customer lock-in strategy.

7.2 Implications and Limitations

This study has the following theoretical and practical implications. We proposed a methodology for combining a demand prediction model and innovation adoption theories, to merge a market-centered approach with a consumer acceptance approach. Our estimation model for demand and adoption behaviour for satellite DMB, combining Bass's estimation model, a traditional demand prediction model, with Rogers' Innovation adopter model, provides a methodological alternative for a more comprehensive and holistic understanding of the process of innovation diffusion. Meanwhile, by applying the technology-centered chasm theory to this combined model, we located chasms occurring in the process of diffusion of this high-tech service, providing also strategies to bridge them. The single most important merit of our theoretical approach is its comprehensiveness, as it integrates three existing approaches that have previously never been used together, namely, demand prediction theories, innovation adoption theories and the chasm theory. On a practical level, we contributed to the marketing of satellite DMB by offering concrete advice to service providers as to how to formulate and implement a marketing strategy capable of generating long-term demand. Contrary to the widespread anticipation that innovative products and services born out of the telecom-broadcasting convergence will be met with an explosive demand, immediately upon their release, we found the evidence that their diffusion will follow a classical S-shaped curve. The number of subscribers to satellite DMB in Korea, as of March 2007, about two years after its initial roll-out (May 2005), has borne out our predictions (490,000 subscribers as of the end of Apr. 2006 and 1,110,000 as of the end of Mar. 2007, TU Media Corp statistics). Our study was intended to offer strategic suggestions for a long-term market growth, more important than a short-lived, explosive early growth; a direction also suggested by many recent surveys and forecasts. This study provides projections and advice that are crucial for the marketing success of satellite DMB, including when a chasm will occur and what type of chasm, and what this says about consumers' acceptance of satellite DMB and what strategy to adopt to cross the chasm. For example, with regard to the crack occurring in the early stage of marketing, we suggested that service providers should enhance consumers' attitude toward satellite DMB, by winning over opinion leaders to, thereby, elicit greater interest in the new service, and strengthen the roles and activities within the consumer market network. For Chasm 1 occurring at a later stage, after the diffusion process started to gain momentum, we recommended the bowling alley strategy, offering suggestions as to how to conduct technical and marketing-related promotion activities. The lock-in strategy we proposed for crossing Chasm 2, situated at the gateway to the mainstream market, is also a valuable tack which can importantly contribute to the marketing success of satellite DMB.

This study is limited in that, due to an absence of prior empirical literature on the subject, we were unable to clearly establish its methodological validity. However, as an empirical verification of the chasm theory, thus far discussed only conceptually, using concrete data, the study has the merit of providing a methodological framework and analytical methods for future research in related topics. Future research should verify the methodology proposed by this study and adopt an approach which can increase analytical rigor. Future research needs also to consider examining the process of diffusion of other services in a competing or substitute relationship with satellite DMB, such as DVB-H, MediaFLO and WiBro, so as to assess how changes in the competition structure of the market, caused by the commercialization of each of these services, affect the time of occurrence of chasms and how they manifest themselves, and to be able to provide more informed suggestions as to the strategy for crossing the chasm. Another limitation of this study is that, due to its micro-approach, focusing on the perspective of consumers, it has left out of consideration, important macro-variables such as market and economic variables, technological and industry structure-related variables. Accordingly, future research needs to extend its scope of consideration to market and economic variables like consumption and investment functions, competition factors and technological innovation factors (technological and industrial structure-related aspects) and institutional factors. Thirdly, the coefficient of diffusion for satellite DMB, developed in this study, does not take into account the coefficient of diffusion for CATV. The reason for this omission is that CATV is a broadcasting service whose adoption takes place at the level of households, quite the opposite of satellite DMB, an ultra-personal service, nicknamed "TV inside the palm," and, for this reason, has a very low coefficient of diffusion. We therefore decided to exclude it from our consideration in order not to erode the salience of the individual user-driven diffusion pattern of satellite DMB. Notwithstanding, satellite DMB being a converged telecom-broadcasting, future research should include the coefficient of diffusion of CATV in the calculation of the coefficient of diffusion for the former. In order to do this, future research should also find a way to balance mobile services and CATV, in other words, determine relative importance to assign to the two. Finally, the data used in this study were collected from a survey conducted at a point in time prior to the commercial launch of satellite DMB, and may not precisely coincide with consumers' current perception of and attitude toward the service. Hence, future research should address the changes in consumers' attitude that may have occurred after the service roll-out. It could be interesting to develop this topic, for instance, in relation to phenomena like cognitive dissonance in consumer behaviour, a cognitive and behavioural gap between before and after a purchase.

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APPENDIX 1: DEMAND PREDICTION FOR THE SATELLITE DMB SERVICE (UNIT: 10,000)

Time	Number of Net New Subscribers		Cumulative Total Number of Subscribers	
	Number of Subscribers	% of Total Subscribers	Number of Subscribers	% of Total Subscribers
T1	32.4	5.00%	32.4	5.0%
T2	24.9	3.85%	57.3	8.8%
T3	40.1	6.18%	97.4	15.0%
T4	61.5	9.49%	158.9	24.5%
T5	87.6	13.52%	246.5	38.0%
T6	110.4	17.04%	356.9	55.1%
T7	115.3 *(peak time)*	17.79%	472.2	72.9%
T8	91.8	14.17%	564.1	87.0%
T9	52.3	8.07%	616.4	95.1%
T10	21.5	3.32%	637.9	98.4%
T11	7.1	1.10%	645.0	99.5%
T12	2.1	0.33%	647.1	99.9%
T13	0.6	0.10%	647.8	100.0%
T14	0.2	0.03%	647.9	100.0%
T15	0.1	0.01%	648.0 *(market at saturation point)*	100.0%

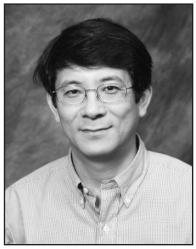
BIOGRAPHICAL NOTES


Yeong-Wha Sawng

Yeong-Wha Sawng is a senior researcher of the Service Strategy Research team at the Electronics and Telecommunications Research Institute (ETRI), Korea. He received an MIM in Management from Whitworth University, USA and a PhD in Technology Management from Hanyang University, Seoul, Korea in 1995 and 2006, respectively. He joined ETRI in 2000, and has been working in the areas of digital convergence, IT policy, mobile application, technology management and business strategy. His research interests also include high-tech. marketing, technology management strategy, e/m-Biz model and consumer behaviour. He has been published in several international and Korean journals.


Kiyong Om

Kiyong Om received his MS and PhD in Management of Technology from the Korea Advanced Institute of Science and Technology (KAIST) in 1993 and 1998, respectively. His research is focused on IT policy, R&D evaluation, innovation management and technology planning. For over five years, he has been actively involved with the formation and implementation of the technology policy of the Ministry of Information and Communication (MIC). He is currently with the Korea University of Technology and Education as an assistant professor. He has been published in several international journals including Research Policy, International Journal of Technology Management, Scientometrics, Technovation, and International Journal of Technology Marketing.



Bongsik Shin

Bongsik Shin is a professor at the Department of Information and Decision Systems at San Diego State University. He earned a PhD from the University of Arizona. His work has been published in many first-tier journals including Communications of the ACM, IEEE Transactions on Systems, Man, and Cybernetics, IEEE Transaction on Engineering Management, Journal of Association for Information Systems, Information Systems Journal, Journal of Management Information Systems, Decision Support Systems, Information & Management, Journal of Organizational Computing and Electronic Commerce, and Journal of Database Management.

Jungmann Lee

Jungmann Lee obtained his PhD in Economics from the City University of New York. His research has focused on the areas of technology policy, R&D management, and the economics of technology innovation at the Electronics and Telecommunications Research Institute. He has also served as an advisor for various projects (mid–long term IT technology policy, the technology roadmap of information and telecommunications and IT HRD Policy) of the Ministry of Information and Communication, Korea. He is an assistant professor at the Department of Digital Business at Hoseo University.