

A methodology for market segmentation using a two-level SOM and its application for online game industry in Korea

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Abstract

The purpose of our research is to identify the critical variables and to develop a new methodology for market segmentation of online game market. Our research tested the model with Korean online game users because Korean online game industry is the frontier of global online game industries.

Conclusively, the critical variables are the suitability of feedback, the reality of design, the precision of information and the involvement of virtual community. The analysis of segmentation shows that the primary target audiences are positively influenced by the reality of design and the involvement of virtual community. To attract the primary target audiences, online game companies should develop strategies depending on the effectiveness of the variables and the demographic and behavioral characteristics of target audiences.

Keywords; Marketing Segmentation, Marketing Strategy, Structural Equation Model, Self-Organizational Map, Online Game

1. Introduction

The global online game industry has been grown rapidly and has been developed into the core of the world cultural industries. In the center of those trends, Korean online game market is located. The primary platform in Korean game industry has been changed from arcade games (30.2%) to online games (36.1%) in 2002 and the scale of online game market was forecasted to increase to 41.7 % in 2005 (KGDI, 2003). However, the Korean online game industry encounters higher competition with the entrance of foreign online game competitors and substitution to video games (ICA, 2003; KGDI, 2003; Lee, 2000; Yu, 2002).

To survive in today's competitive online game markets, Korean online game companies need to determine who the target customers are and what motivates them. This process is called market segmentation, by which companies are able to understand their loyal customers and concentrate their limited resources into them. However, previous research didn't focus on identification of critical variables for market segmentation in online game

market. Additionally, the traditional clustering methodologies have not provided a unique clustering nor determined the precise number of clusters (Boudaillier & Hebrail, 1998; Buhmann & Kühnel, 1993; Maulik & Bandyopadhyay, 2002; Trevino & Webster, 1992).

The purpose of our research is to identify the critical variables and to develop a new methodology for market segmentation of online game market. Our research approach is categorized into two phases. The first phase is using a statistical approach to find the critical segmentation factors. The second phase is conducted by a two-level SOM to develop the actual clusters. Finally, we develop the marketing strategies to attract target audiences by identifying the profiles of their loyal customers.

2. Theoretical Background

2.1 The variables for market segmentation

2.1.1 The convenience of operator

Operators are characters and items which are used to play games. We identified the convenience of the operator as the manipulatability of operators to play games (Spector, 1999). The higher convenience of operator provides users the more positive influence to flow. Previous research indicated that operator is an important determinant of influencing interaction between users and games (Agarwal & Karahanna, 2000; Davis, Bagozzi & Warshaw, 1992; Webster & Martocchio, 1992).

2.1.2 The suitability of feedback

Feedback is the reaction from online games (Baron, 1999; Choi, Park & Kim, 2001). For example, when players kill a monster within NCsoft's Lineage, they receive feedback upgrading their level. A primary reason for playing online games is for gamers to achieve status in a virtual community by making their avatar (virtual character) wealthy and achieving a higher position. Therefore, the higher suitability of feedback provides users positive influence to flow.

2.1.3 The reality of design

Online games differ from previous computer games because users play with other humans in a virtual community rather than the computer. The computer is merely a mediating tool connecting among humans within cyber space. Therefore it is important to have gamers feel their space as real. To make an interface of a game site look like the real world, design is a primary factor. Therefore, the reality of design is defined as the design quality of interface making gamers feel online games as part of the real world. Technological researchers also consider design as an important determinant in developing

successful online games (Ackley, 1998; Woodcock, 1999).

2.1.4 The precision of information

Information is the contents from online game to achieve the stated goals. Gamers who received more precise information about how to play the games tended to achieve online game goals and experience flow easier (Choi, Park & Kim, 2001; Lewinski, 2000). Therefore, the higher precision of information provides users positive influence to flow.

2.1.5 The involvement of virtual community

Virtual community is defined as computer-mediated spaces with potential for integration of member-generated content and communication (Hagel & Armstrong, 1997). Online game users should solve problems together interacting with other users in virtual communities (Choi, Park & Kim, 2001). The higher level of involving in virtual community provides users positive influence to flow.

2.2 A Two-Level SOM

Hierarchical methods, which build a hierarchical clustering tree (i.e. dendrogram, can not provide a unique clustering because a partitioning to cut the dendrogram at certain level is not precise. This method ignores the fact that the within-cluster distance may be different for different clusters (Boudaillier & Hebrail, 1998; Vesanto & Alhoniemi, 2000). Partitive method (k-means), which predefines the number of clusters, before performing it, can not identity the precise number of clusters (Buhmann & Kühnel, 1993; Maulik & Bandyopadhyay, 2002; Vesanto & Alhoniemi, 2000). Additionally, these algorithms are known to be sensitive to noise and outliers (Bezdek, 1998; Blatt, Wiseman & Domany, 1996; Vesanto & Alhoniemi, 2000).

Vesanto and Alhoniemi proposed a two-level SOM combined SOM, K-means and DB Index to settle these problems. A two-level SOM was compared with SOM, where a large set of prototypes is firstly formed, instead of clustering the data directly. The prototypes can be interpreted as proto-cluster, which are in the next phase combined to form the actual clusters (Vesanto & Alhoniemi, 2000). Finally, DB index is used to determine the number of clusters and the validity of the clusters formed (Davies & Bouldin, 1979). The proper clustering is achieved by minimizing the DB index.

3. Research methods

3.1 Research Framework

To segment the online game market and develop marketing strategies, our research

approach is categorized into two phases. Firstly, the confirmatory factor analysis (CFA) and structural equation model (SEM) are used to identify the critical segmentation variables for clustering. Secondly, a two-level SOM is used to segment online game market. The first level develops the prototypes from large data set and the actual clusters are developed from the prototypes in the second level.

After segmentation of the markets, we use ANOVA to recognize the characteristics of sub-divided clusters. Finally, we target a segment market with the highest customer loyalty, and used those results as the starting point for the marketing strategies.

3.2 Data and Measurement

To test the model, a Web-based survey was employed. We developed the web-questionnaire page using a common gateway interface (CGI). We sent a mail to customer within OZ intermedia in Korea, which explained the objectives of the research and contained the link to the Web-Survey. Conclusively, the 703 complete data is available for analysis, after elimination of missing data.

We used CFA to evaluate convergent validity for six constructs, which included five determinant and a dependent factors. The results indicated that the chi-square of the model was 133.57 with d.f. of 75, the ratio of chi-square to d.f. was 1.781, GFI was 0.975, AGFI was 0.960, RMSR was 0.033 and NFI was 0.962. all the fit statistics of the measurement model were acceptable. Items which loaded on multiple constructs or had low item-to-construct loadings were deleted from the model. The results of CFA indicated that FB1 and FB4 were deleted from the suitability of feedback, IF3 from the precision of information, D5 and D6 from the reality of design, C5 and C6 from the involvement of virtual community, F3 and F4 from flow. Sequentially, D4 was deleted from the reality of design because of over ± 2.57 for SRC matrix. Therefore, 15 items remained within our model.

4. Results

4.1 Identification of critical factors

To find the critical factors for segmentation, we used AMOS 4.0 in structural equation modeling (SEM). The structural model was well converged. The results indicated that the chi-square of the model was 133.57 with d.f. of 75, the ratio of chi-square to d.f. was 1.781, GFI was 0.975, AGFI was 0.960, RMSR was 0.033 and NFI was 0.962; all the fit statistics were acceptable. Additionally, the squared multiple correlations (R^2) indicated that the present model explains 55 % of the variance in flow. Four of the five paths were statistically significant and the path from the convenience of operator to flow was insignificant, as shown in table 1. The critical variables for marketing segmentation are

the suitability of feedback, the reality of design, the precision of information and the involvement of virtual community.

Table 1. The results of SEM

Path		Estimate	S.E.	t	p
The convenience of operator(O)	-->	0.023	0.037	0.615	0.539
The suitability of feedback(FB)	-->	0.107*	0.049	2.180	0.029
The precision of information(IF)	-->	0.127*	0.052	2.423	0.015
The reality of design(D)	-->	0.305**	0.052	5.826	0.000
The involvement of virtual community(C)	-->	0.446**	0.052	8.626	0.000

* p<0.05, ** p<0.01

4.2 Market Segmentation

To segment the Korean online game market, our research was conducted using a two-level SOM. In the experiments, the first level was SOM training. 703 data samples of the Korean were collected using the test variables: the suitability of feedback, the precision of information, the reality of design and virtual community except the convenience of operator. A SOM was trained using the sequential training algorithm for Korean data samples. A neighborhood width decreased linearly 4 to 1 using the Gaussian function. A map was used by 15*9 matrix and 135 prototypes were developed.

The second level was SOM clustering. The partitive clustering of 135 SOM's prototypes was carried out using batch K-means algorithm. The K-means ran multiple times for each k. The DB index was used to select the best clustering (Figure 1). The analysis of the DB index resulted in the development of six market segments.

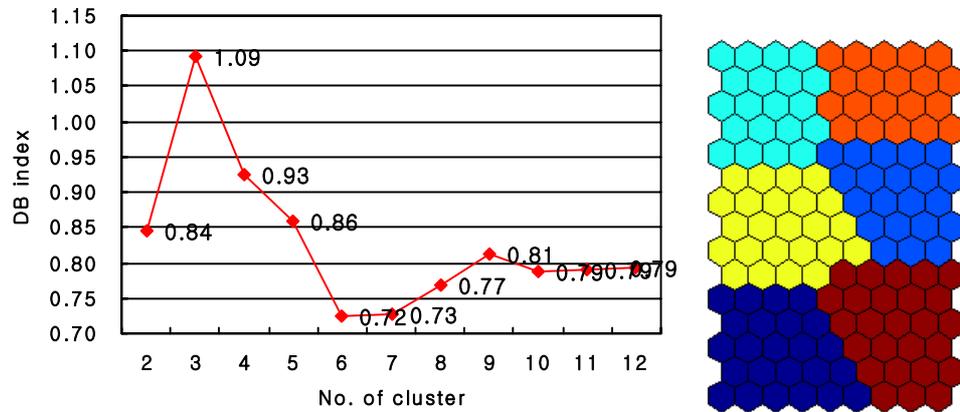


Figure 1. DB Index and visualization of clusters

4.3 Determination of target market

To identify the structure of the clusters, we conducted on the analysis of the demographic and behavioral variables: gender, age, income level, i_year (how long did gamers use the Internet), i_day (how many hours did gamer use the Internet per day), and g_day (how many hours did gamer play online games per day). The characteristics and structure of clusters are summarized in Table 2.

The analysis of customer loyalty indicated that cluster 6 was indicated as the primary target market. To attract the primary target audiences, companies should develop strategies depending on the effectiveness of the variables and the demographic and behavioral characteristics of cluster 6. The characteristics of target audiences indicate that the members are positively influenced by the reality of design and the involvement of virtual community.

The strategies of the reality of design proposed that companies should make an interface where the game site looks real. For example, the interface of recent games changed 2D such 'Lineage' into 3D such as 'MU', 'Lagnarok' and 'Laghaim'. For virtual community, companies need to provide a Role Playing Game (RPG) where the gamer cooperates with each other rather than shooting games where the gamer compete with each other. Furthermore, the different villages and guilds which were harmonized with customer needs were provided. For example, 'Lineage' provided 15 villages to satisfy the different gamers' needs.

Table 2. Profiles of clusters

	cluster1 (n=131)	cluster2 (n=85)	cluster3 (n=114)	cluster4 (n=102)	cluster5 (n=133)	cluster6 (n=138)
The suitability of feedback	3.36 (High)	2.09 (Low)	2.31 (Low)	2.98 (Middle)	1.54 (Low)	2.6 (Low)
The precision of information	3.61 (High)	2.75 (Middle)	2.49 (Low)	2.76 (Middle)	2.46 (Low)	3.21 (Middle)
The reality of design	3.32 (High)	3.22 (Middle)	2.48 (Low)	2.98 (Middle)	2.76 (Middle)	3.84 (High)
The involvement of virtual community	3.59 (High)	3.77 (High)	2.46 (Low)	3.14 (Middle)	3.25 (Middle)	3.72 (High)
gender	male	female	male	female	female	female
age	21-25	26-30	21-25	21-25	21-25	21-25
Income(1,000₩)	1,010- 2,000	1,010- 2,000	0	510- 1,000	1,010- 2,000	1,010- 2,000
i_year	3	4	2, 6-	3	3	6-
i_day	5	10-	0-2	3	10-	10-
G_day	1	5-	1	1	5-	5-
revisit	high	high	middle	middle	middle	high
WOM	high	high	middle	middle	middle	high
loyalty	2(3.74)	3(3.65)	6(2.99)	4(3.38)	5(3.14)	1(3.89)

Loyalty is estimated by average of revisit and WOM

5. Conclusion

The results of our research have the following implications for Korean online game companies and furthermore for global online game companies. Firstly, online game companies should develop diverse types of online games considering the extension of the age of online game users. The number of female users is growing fast and the needs of online game users become diversified (KGDI, 2003; Yu, 2002). To better satisfy their needs, online game companies should cluster similar customers into specific market segments with different demands and then develop marketing strategy based on their properties. Especially, our research shows that the middle-aged and female users are classified as target customers as well as adolescents. This finding is consistent with the statistics in the Korean Game White Paper, which indicates that female users increased from 31% of the game population in 2001 to 47% in 2003 and the middle-aged users increased from 2% in 2001 to 21% in 2003.

These implications were proven to be true through NCsoft's example, which is the

primary Korean online game company. They recognized that online game customers' needs have been changed and encountered higher competition with foreign online game competitors. To survive in this changing environment, they developed the games for male and female separately. For instances, the background of the recent game 'Lineage' was medieval, the type was combatable, and their target audiences were adolescents and younger male, while 'Shining Lore' is developed to target female customers who might be more interested in sweet and exciting stories (ICA, 2003).

The results of our study have several contributions to academia and business world. Our research identifies the new primary factors for online game markets which may not be found in the previous researches from the technological perspectives. Additionally, our research proposes a new methodology for market segmentation using a two-level SOM and marketing strategies for the survival in competitive online game market.

Even though our research is conducted on Korean online game market, these implications are able to be applied into those of other countries because Korean online game market is the frontiers of global online game market. And the research about Korean online game market is thought to be helpful for other countries to understand the change of their own online game markets. However, other countries are able to develop their own marketing strategies more exactly using our methods with considering and adjusting their market environment, instead of accepting the results of our research.

For further study, more demographic and behavioral variables might be necessary to segment the markets more precisely. Secondly, a cross-national analysis can be added to our research in order to better understand the loyal customers in different countries.

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