A cross-national market segmentation of online game industry using SOM

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Abstract

To compete successfully in today’s global online game markets, a cross-national analysis for market segmentation is becoming a more important issue, by which companies are able to understand their domestic and foreign loyal customers and concentrate their limited resources into the target customers. However, previous research methodologies for market segmentation were difficult to be conducted on a cross-national analysis because they were performed within a nation. Additionally, the traditional clustering methodologies have not provided a unique clustering nor determined the precise number of clusters.

The purpose of our research is to develop a new methodology for cross-national market segmentation. We propose a two-phase approach (TPA) integrating statistical and data mining methods. The first phase is conducted by a statistical method (MCFA: multi-group confirmatory factor analysis) to test the difference between national clustering factors. The second phase is conducted by a data mining method (a two-level SOM) to develop the actual clusters within each nation. A two-level SOM is useful to effectively reduce the complexity of the reconstruction task and noise. Especially, our research tested the model with Korean and Japanese online game users because they are the frontier of global online game industries.

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Keywords: Self-organizational map; Cross-national analysis; Online game; Market segmentation

1. Introduction

Since the early 2000s, global online game market has been grown rapidly and has been developed into the core of the world cultural industry. Online games once seen as a mere method of entertainment had proven potential for profitability and was a viable business model that guaranteed profit. Many global online game companies have been trying to penetrate other foreign markets. However, what was found is that they could fail to attract their foreign target audience, unless they understood and responded to the core needs of those customers (Hofstede, Steenkamp, & Wedel, 1999). Especially, this theory was proven through International Cooperation Agency for IT (ICA) in Korea, which indicated that many Korean online game companies failed to attract their foreign audience because they did not understand their foreign markets (ICA, 2003).

The competitive power of the Korean online game industry has become the second in the world, due in part by the high level online server technology, 3D design skill and online game contents (Lee, 2001). With the higher competitive power, Korean online game companies were trying to penetrate foreign markets such as Japan and Southeast Asian countries. Especially, the Korean online game companies have tried to penetrate the Japanese online game market since the Japanese game market is the second largest in the world and has changed video games into online games.

Korean online game companies hoped that it would be successful to penetrate Japanese game market and recklessly entered into that without understanding the core needs of those audiences. The lack of consideration has forced many Korean online game companies to fail to penetrate Japanese game market (ICA, 2003).

As we see from above, to compete successfully in today’s competitive business markets, companies need to determine who the target customers are and what motivates them (Webster & Martocchio, 1992). This process is called market segmentation, by which companies are able to

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0957-4174/$ - see front matter © 2004 Published by Elsevier Ltd.
doi:10.1016/j.eswa.2004.06.001
understand their loyal customers and concentrate their limited resources into them. Especially, in international marketing, a cross-national analysis for market segmentation is becoming a more important issue.

However, previous research methodologies for market segmentation were difficult to be conducted on a cross-national analysis and results of them were difficult to be generalized into other countries in that they were performed within a country (Calantone & Zhao, 2000). Additionally, the traditional clustering methodologies have not provided a unique clustering nor determined the precise number of clusters and the validity of the clusters formed (Boudaillier & Hebrail, 1998; Buhmann & Kühnel, 1993; Maulik & Bandyopadhyay, 2002; Trevino & Webster, 1992).

Therefore, the purpose of our research is to develop a new methodology of market segmentation for online game companies to find their target markets by identifying their loyal customers in domestic and international markets. Our research suggests a two-phase approach (TPA) as a new methodology for cross-national analysis. The first phase is using a statistical method with multi-group confirmatory factor analysis (MCFA) to analyze the differences between national clustering factors. A data mining method using two-level SOM is employed in the second phase in order to develop the actual clusters within each nation. A two-level SOM, which was proposed by Vesanto and Alhoniemi, is useful to effectively reduce the complexity of the reconstruction task and noise. Finally, we conduct comparative analysis between Korean and Japanese online game market by identifying the profiles of their loyal customers.

Especially, our research tested the model with Korean and Japanese online game users because they are the frontier of global online game industries. These implications are thought to be helpful for other countries to understand the change of their own online game markets.

2. Theoretical background

2.1. The variables for market segmentation

For market segmentation, online game companies need to identify the primary variables to recognize their customers' wants, attitudes and habits (Kotler, 1997). Through the review of the relevant literature, we identify the primary factors for online game from a business perspective as below: the convenience of operator, the suitability of feedback, the reality of design, the precision of information and the involvement of virtual community (Cho, Back, & Ryu, 2001; Choi, Park, & Kim, 2001; Hoffman & Novak, 1996; Kim, Lee, & Suh, 2003; Lee, Kim, & Suh, 2003). Our research hypothesizes that these determinants have a positive effect on flow.

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 et al., 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; Sanchez-Crespo, 1999; 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 et al., 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 et al., 2001). The higher level of involving in virtual community provides users positive influence to flow.

2.2. Multi-group confirmatory factor analysis (MCFA)

The results of previous online game research (Cho et al., 2001; Choi et al., 2001) were difficult to be generalized into...
other countries since they were performed within a country (Chin, Gopal, & Salisbury, 1997). Since each country is characterized by a unique pattern of socio-cultural behavior patterns and values, attitudinal and behavioral phenomena may be expressed in unique ways (ICA, 2003).

Multi-group confirmatory factor analysis (MCFA) was proposed to explore whether the phenomena under study would produce different results when the same measurement models were presumed to be operation in multiple samples (Mullen, 1995). In cross-national research, MCFA was used for evaluating the measurement equivalence or invariance, which addresses the question whether the same models hold true across different populations (Bagozzi, 1989). Tests of invariance, which addresses the question whether the same models hold true across different populations (Bagozzi, 1989; Irvine & Carroll, 1980; Mullen, 1995; Myers, Calantone, Page, & Taylor, 2000).

To diagnose measurement equivalence, the cross-national research needs to identify if a construct can be measured by the same questionnaire items in different countries (i.e. translation equivalence), if the units of measure are the same in different countries (i.e. calibration equivalence) (Buss & Royce, 1975; Irvine & Carroll, 1980; Mullen, 1995; Steenkamp & Baumgartner, 1998). Calibration equivalence independently checks conversions of measurement units. Translation equivalence used MCFA to evaluate measurement models for common form and invariance of factor loadings (λ) and correlations (ρ) among the factors (Bollen, 1989; Jöreskog & Sörbom, 1989).

The steps in our analysis are listed in Table 1. The method and procedures of our research are recommended by Calantone and Zhao (2000). Confirmatory factor analysis (CFA) is used to validate measures of constructs. The proposed structural model is evaluated after measurement unidimensionality and metric equivalence are satisfied. Finally, our research examines the equivalence of the measure and the relationships among the constructs at national level.

### 2.3. A two-level SOM

Clustering is generally used as the primary methodology for market segmentation. The previous clustering related researches have been conducted mainly based on hierarchical and partitive methods. Hierarchical methods, which build a hierarchical clustering tree (i.e. dendrogram), cannot provide a unique clustering since a partitioning to cut the dendrogram at a certain level is not precise (Boudailler & Hebrail, 1998; Vesanto & Alhoniemi, 2000). Partitive methods (K-means) pre-define the number of clusters, before performing it. It can be part of the error function and cannot identify the precise number of cluster (Buhmann & Kühl, 1993; Maulik & Bandyopadhyay, 2002; Vesanto & Alhoniemi, 2000). Additionally, these algorithms are sensitive to noise and outliers (Boudailler & Hebrail, 1998; Blatt, Wiseman, & Domany, 1996; Vesanto & Alhoniemi, 2000).

Vesanto and Alhoniemi (2000) proposed a two-level SOM combined SOM, K-means and DB index to settle these problems (Fig. 1). A two-level SOM was compared with SOM, where a large set of prototypes is first 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. The benefit of using SOM is to effectively reduce the complexity of the reconstruction task and noise, while extra abstraction levels yield higher distortion. The prototypes are less sensitive to random variations than the original data because the prototypes are local averages of the data (Vesanto & Alhoniemi, 2000). Finally, DB index is used to determine the number of clusters and the validity of the clusters formed (Davies & Bouldin, 1979). DB index is a function of

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**Table 1**

<table>
<thead>
<tr>
<th>Steps</th>
<th>Purpose</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perform CFA (confirmatory factor analysis) for Korean and Japanese samples individually</td>
<td>Evaluate construct validity: eliminate factors with low loadings or loadings on multiple constructs</td>
<td>Gerbing and Anderson (1988)</td>
</tr>
<tr>
<td>Perform MCFA for Korean and Japanese samples simultaneously</td>
<td>Assess unidimensionality and equivalence of measures across samples</td>
<td>Calantone and Zhao (2000)</td>
</tr>
<tr>
<td>Test the proposed structural model for Korean and Japanese samples individually</td>
<td>Validate the model for Korea and Japanese samples and obtain the single-model results</td>
<td>Calantone and Zhao (2000)</td>
</tr>
</tbody>
</table>

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![Fig. 1. A two-level SOM.](image)
the ratio of the sum of within-cluster scatter to between-cluster separation. The proper clustering is achieved by minimizing the DB index.

3. Research method

3.1. Research framework: a two-phase approach (TPA)

To segment the online game market and develop marketing strategies, our research proposed a two-phase approach (TPA) as follows (Fig. 2). The first phase is conducted by a statistical method to identify the critical segmentation factors and test the validity of cross-national analysis. The second phase is conducted by a data mining method using a two-level SOM to develop the actual clusters within each nation and identify the loyal customers.

First, the confirmatory factor analysis (CFA) is used to identify the critical segmentation variables for clustering. In cross-national analysis, multi-group confirmatory factor analysis (MCFA) is used to determine whether the same measurement model may be operating in different populations (Mullen, 1995; Myers et al., 2000). When the measurement equivalence is satisfied, structural equation model (SEM) is used to identify the primary clustering factors in each nation.

Secondly, 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 in the second level. The prototypes are less sensitive to random variations than the original data (Vesanto & Alhoniemi, 2000). After clustering, DB index is used to identify the best partitioning.

After segmentation of the markets, we use ANOVA to recognize the characteristics of sub-divided clusters and conduct cross-national analysis to compare Korean with Japanese markets. 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

Our research developed multi-item measures for each construct through the following process. First, a draft of the questionnaire was prepared in Korean was based on a review of the literature. We conducted field interviews with managers of company and then made modifications accordingly. The questionnaire was pre-tested on some managers within that company. They were asked to assess the terminology, the clarity of instructions and the response format. The instrument was modified and pre-tested on some customers (n = 50) so that further problems with the measures and response format could be detected. No significant problems were revealed. The Japanese versions of the questionnaire were then translated.

All measurements used in the questionnaire are improved based on the previous literature and field interviews. The measures reported in this study are those that survived a series of strict measurement unidimensionality and equivalence tests.

Twenty-one items for five discriminants are selected: the convenience of operator, the suitability of feedback, the precision of information, the reality of design, and the involvement of virtual community. The convenience of operator is measured by two items (O1, O2), the suitability of feedback by four items (FB1–4), the precision of information by 3 items (IF1–3), the reality of design by 6 items (D1–D6) and the involvement of virtual community by six items (C1–6). We then measured flow by three items (F1–3). We asked respondents to indicate on a five-point Likert scale to what extent the discriminants influence on flow in online game.

To test the model, a Web-based survey was employed. We developed the Web-questionnaire page using a common gateway interface (CGI). We sent an e-mail to customer within OZ intermediaries in both Korea and Japan, which explained the objectives of the research and contained the link to the Web-Survey. The Korean data was provided by 2499 participants and the Japanese data 674. Additionally, in Korea, 594 were eliminated for random missing data and 1202 were eliminated for comparative analysis using stratified sampling based on age, leaving 703 complete data cases available for analysis. In Japan, 72 were eliminated for random missing data, leaving 602 complete data cases available for analysis.

4. The results

4.1. The first phase

To test the cross-national model, we used AMOS 4.0 in MCFA and SEM. The validity of cross-national
measurement model was evaluated by investigating validity and reliability using CFA and measurement equivalence using MCFA. Sequentially, the proposed structural model was tested to examine the relationships among the constructs using SEM.

4.1.1. Validity of measurement model

The validity of the measurement model was evaluated by investigating convergent and discriminant validity. The purpose of convergent validity is to ensure unidimensionality of the multiple-item constructs and eliminate unreliable items (Bollen, 1989). The convergent validity was evaluated by investigating the value of standardized factor loadings, standardized residual covariance (SRC) and reliability. Items should load at least 0.60 on their respective hypothesized component and all loadings need to be significant (p<0.05, r≥2.0) (Bagozzi & Yi, 1998; Sujan, Weitz, & Kumar, 1994). Items with at least ±2.57 within SRC matrix should be deleted from the model (Calantone & Zhao, 2000; Kang, 1999; Salisbury, Parson, Pearson, & Miller, 2001). Reliability for all items of a construct should be evaluated jointly by investigating composite reliability (CR) and the average variance extracted (AVE). For a construct to possess good reliability, CR should be at least 0.60 and the AVE should be at least 0.5 (Bagozzi, 1994; Baumgartner & Homburg, 1996; Hair, Anderson, Norman, & Black, 1995; Kang, 1999; Steenkamp & van Trijp, 1991).

We used unconstrained CFA to evaluate convergent validity across the two nations for six constructs, which included five determinant and one dependent factors. Items which loaded on multiple constructs or had low item-to-construct loadings were deleted from the model (Table 2). The results of unconstrained 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

Table 2

<table>
<thead>
<tr>
<th>Factor</th>
<th>Item</th>
<th>Estimate</th>
<th>CR</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>The convenience of operator (O)</td>
<td>I can manipulate the characters and items to play game (O1)</td>
<td>0.805</td>
<td>0.855</td>
<td>0.746</td>
</tr>
<tr>
<td></td>
<td>With many function of the characters and items, I can play games easier (O2)</td>
<td>0.864</td>
<td>0.815</td>
<td>0.688</td>
</tr>
<tr>
<td>The suitability of feedback (FB)</td>
<td>The feedback is provided to me appropriately (FB2)</td>
<td>0.870</td>
<td>0.823</td>
<td>0.701</td>
</tr>
<tr>
<td></td>
<td>Suitable reaction is provided to me (FB3)</td>
<td>0.708</td>
<td>0.715</td>
<td>0.67</td>
</tr>
<tr>
<td>The precision of information (IF)</td>
<td>Games provide me with correct information what I do (IF1)</td>
<td>0.801</td>
<td>0.802</td>
<td>0.653</td>
</tr>
<tr>
<td></td>
<td>Games provide me with sufficient information how to play it (IF2)</td>
<td>0.715</td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td>The reality of design (D)</td>
<td>Avatar is similar to human (D1)</td>
<td>0.727</td>
<td>0.81</td>
<td>0.588</td>
</tr>
<tr>
<td></td>
<td>The interface of game is harmonious (D2)</td>
<td>0.708</td>
<td>0.777</td>
<td>0.538</td>
</tr>
<tr>
<td></td>
<td>Avatar and the interface of game is similar to real world (D3)</td>
<td>0.683</td>
<td>0.742</td>
<td></td>
</tr>
<tr>
<td>The involvement of virtual community (C)</td>
<td>When I play game, I believe that the members of games are my colleague (C1)</td>
<td>0.768</td>
<td>0.845</td>
<td>0.578</td>
</tr>
<tr>
<td></td>
<td>I believe that the members of games will help each other in emergency (C2)</td>
<td>0.669</td>
<td>0.737</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I communicate with members actively (C3)</td>
<td>0.679</td>
<td>0.679</td>
<td></td>
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<tr>
<td></td>
<td>I believe that I belong to the game site (C4)</td>
<td>0.685</td>
<td>0.686</td>
<td></td>
</tr>
<tr>
<td>Flow (F)</td>
<td>When I play game, I feel pleasure and fun (F1)</td>
<td>0.855</td>
<td>0.829</td>
<td>0.71</td>
</tr>
<tr>
<td></td>
<td>When I play game, I feel curiosity (F2)</td>
<td>0.685</td>
<td>0.812</td>
<td></td>
</tr>
</tbody>
</table>

Unconstrained model: X2 = 283.8 (df = 150), X2/df = 1.892, GFI = 0.971, RMRS = 0.026, AGFI = 0.954. Constrained model: X2 = 306.5 (df = 165), X2/df = 1.857, GFI = 0.955, RMRS = 0.026, AGFI = 0.957. All variables are significant. Kor, Korea; Jap, Japan.
deleted from the reality of design because of over $\pm 2.57$ for SRC matrix. Therefore, 15 items remained within our model.

The results of convergent validity and reliability across two nations were reported in Table 2. The results indicated that the value of standardized factor loading for each item to its respective construct was significant ($p<0.05$), and all loadings ranged from $0.660$ to $0.879$. CR was over $0.653$ and AVE was over $0.50$ expect $0.484$ for the precision of information within Japan. However, because it was acceptably close to the standards and it was acceptable with Korean model, we did not delete it. All the values demonstrated good reliabilities. The fit statistics of unconstrained CFA indicated that the chi-square of the model was $283.8$ with df of $150$, the ratio of chi-square to df was $1.892$, GFI was $0.971$, AGFI was $0.954$ and RMSR was $0.026$; all were acceptable.

The purpose of discriminant validity is to identify if the constructs differ from each other (Bollen, 1989; Chin et al., 1997). We conducted a chi-square difference test where the chi-square measurements with two analyses were compared. One analysis used constrained model in which the correlation between two constructs is set to $1.0$ and the other used unconstrained model in which the correlation was freely estimated (Bollen, 1989; Jöreskog & Sörbom, 1989). Thus, the difference in degrees of freedom between the two models was $1$. When a value of chi-square difference was over $3.84$ with df of $1$ ($p<0.05$), the two constructs were statistically different. The six constructs paired against one another were tested and all constructs were different ($p<0.05$).

4.1.2. Multi-group confirmatory factor analysis (MCFA)

When the individual measurement model was satisfied, we evaluated the equivalence of the measurement model across the Korean and Japanese samples. To diagnose measurement equivalence, calibration equivalence independently checked conversions of measurement units. Translation equivalence was used to evaluate measurement models for common form and invariance of factor loadings ($\lambda$) and correlations ($\phi$) among the constructs (Bollen, 1989; Jöreskog & Sörbom, 1989; Mullen, 1995). Measurement equivalence was basically satisfied through invariance of factor loadings ($\lambda$). To evaluate it rigorously, both factor loadings ($\lambda$) and correlations ($\phi$) were investigated simultaneously.

To evaluate measurement invariance, we conducted a chi-square difference test where the chi-square measurements with two analyses were compared. One analysis used constrained model in which factor loadings ($\lambda$) of all items and correlations ($\phi$) among the constructs were constrained to be equal across both nations. The other used unconstrained model in which no constraints are imposed across countries (Mullen, 1995; Steenkamp & Baumgartner, 1998). If the difference in degrees of freedom was insignificant ($p>0.05$), factor patterns and factor loadings should be equal.

According to the results that the factor loadings ($\lambda$) constrained to be equal, the fit statistics for model were acceptable to the standards: chi-square $= 290.6$ with $159$ df, GFI $= 0.971$, AGFI $= 0.956$, RMSR $= 0.030$ and NFI $= 0.960$ (Table 2). A value of chi-square difference was $6.769$ with df of $9$ ($p=0.66$) indicated that factor structure was indissimilar across samples. According to the results that both factor loadings ($\lambda$) and correlations ($\phi$) constrained to be equal, furthermore, the fit statistics for model were acceptable to the standards: chi-square $= 30.6.5$ with $165$ df, GFI $= 0.969$, AGFI $= 0.955$, RMSR $= 0.036$ and NFI $= 0.957$. All the fit statistics were acceptable. A value of chi-square difference was $22.627$ with df of $15$ ($p=0.09$) suggested that partial measurement invariance was satisfied. Therefore, we set the factor structure to be invariant in the constrained model.

4.1.3. Structural model

After the measurement model was satisfied, the structural model was evaluated for each of the two nations. The Korean structural model was well converged. Four of the five paths were statistically significant and the path from the convenience of operator to flow was insignificant, as shown in Table 3. The results indicated that the chi-square of the model was $133.57$ with df of $75$, the ratio of chi-square to df was $1.781$, GFI was $0.975$, RMSR was $0.033$ and NFI was $0.962$. The results indicated that 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.

The Japanese structural model was well converged. Four of the five paths were statistically significant and the path from the suitability of feedback to flow was insignificant, as shown in Table 6. The results indicated that the chi-square

<table>
<thead>
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<th>Table 3</th>
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<tbody>
<tr>
<td>The results of structural model</td>
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<td></td>
</tr>
<tr>
<td>X2 (df=75)</td>
</tr>
<tr>
<td>GFI</td>
</tr>
<tr>
<td>RMSR</td>
</tr>
<tr>
<td>NFI</td>
</tr>
<tr>
<td>Path</td>
</tr>
<tr>
<td>The convenience of operator $\rightarrow$ Flow</td>
</tr>
<tr>
<td>The suitability of feedback $\rightarrow$ Flow</td>
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<tr>
<td>The precision of information $\rightarrow$ Flow</td>
</tr>
<tr>
<td>The reality of design $\rightarrow$ Flow</td>
</tr>
<tr>
<td>The involvement of virtual community $\rightarrow$ Flow</td>
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**p<0.01, *p<0.05.
of the model was 150.26 with df of 75, the ratio of chi-square to df was 2.00, GFI was 0.967, RMSR was 0.041 and NFI was 0.959. The results indicated that all the fit statistics were acceptable. Additionally, the squared multiple correlations ($R^2$) indicated that the present model explains 57% of the variance in flow.

The results indicated that the significant variables for market segmentation were different for each nation. The variables of Korean market were the suitability of feedback, the precision of information, the reality of design and the involvement of virtual community, while in the Japanese ones, the convenience of operator, the precision of information, the reality of design and the involvement of virtual community. The convenience of operator has neither influence on flow in Korea nor the suitability of feedback on flow in Japan. It is interpreted that Korean online gamers prefer to achieve status in virtual community while Japanese do not. This hypothesis was proven through Korean Game White Paper, which indicated that the primary reason for playing online games in Korea is for gamers to achieve status in a virtual community (KGDI, 2003). Conversely, the Japanese gamers prefer to grow their characters at their convenience. This hypothesis was proven in the case of ‘Vandai’s damakuchi’, which is the game growing animal characters for a long time. KGDI indicated that it was sold a total of 15 million until 1997 (KGDI, 2003).

4.2. The second phase

To segment both the Korean and Japanese online game market, our research was conducted by two-level SOM. In the experiments, the first level was SOM training. The 703 Korean data samples were collected using the test variables: the suitability of feedback, the precision of information, the reality of design and the involvement of virtual community except the convenience of operator. The 602 Japanese data samples were collected using the test variables: the convenience of operator, the precision of information, the reality of design and the involvement of virtual community except the suitability of feedback.

A SOM was trained using the sequential training algorithm for Korean and Japanese data samples. A neighborhood width decreased linearly 4 to 1 using the Gaussian function. A map was used by 15×9(Korea: Kor)/15×8(Japan: Jap) matrix and 132(Kor)/120(Jap) prototypes were developed.

The second level was SOM clustering. The partitive clustering of 135(Kor)/120(Jap) SOM’s prototypes was carried out using batch K-means algorithm. The K-means was run multiple times for each k. The DB index was used to select the best clustering. The analysis of the DB index resulted in the development of six (Kor)/seven (Jap) market segments (Fig. 3).

5. Implementation of market segmentation

5.1. Identification of variables within clusters

After segmenting the markets, we used ANOVA to recognize the variable characteristics of each cluster. According to results of ANOVA, all variables (components) were significant; $F=75.56–270.1$ and $p<0.01$ for both Korean and Japanese data (Tables 4 and 5).

Of the six clusters in Korean market, cluster 6 was the largest with 138 samples (16.6%), and cluster 2 was the smallest with 85 samples (12.1%). Of the seven clusters in Japanese market, cluster 2 was the largest with 109 samples (18.1%), and cluster 6 was the smallest with 50 samples (8.3%).

To precisely recognize the variable characteristics of clusters, we categorized the effectiveness of the variables into 3 levels; high, middle and low. The middle level ranged...
between 3-2.5, our research measurement was used on a five-point Likert scale. The high score suggested that the cluster was influenced by the variables positively, the middle score was normal, the low score was negative. For example, the variable characteristics of cluster 6 in Korean samples indicated that the reality of design and the involvement of virtual community were positive but the suitability of feedback was negative.

Conclusively, companies should develop strategies depending on the effectiveness of the variables within each cluster. The strategies for the clusters, which were influenced by the convenience of operator positively, proposed that companies should provide the diverse characters (Avatar) and items, which are harmonized with customers’ needs and were manipulated conveniently. For example, ‘Lineage’ provided knight, wizard, elf, dark elf for male and female and prince/princess, total 10 Avatars and 1150 items to play games.

For the suitability of feedback, when gamers completed their mission, companies should provide gamers with a higher level faster, items and more cybermoney. However, in recent Korean online game markets, gamers tried to buy items illegally to upgrade their levels because of deficiency of the suitability of feedback. Therefore, companies should try to react to gamers appropriately and faster when gamers completed their missions.

For the precision of information, companies should provide manual playing games, manage help desk, and manage the guild to communicate with each gamer through a game homepage. For example, ‘Lineage’ provided the background story for users to understand the game, the introduction of episode, manual to setup within PC and how to upgrade level.

For the reality of design, companies should make an interface where the game site looks real. For example, the interface of recent games changed 2D such as ‘Lineage’ into 3D such as ‘MU’, ‘Lagnarok’ and ‘Leghaim’.

For the involvement of 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 need to be provided. For example, ‘Lineage’ provided 15 villages to satisfy the different gamers’ needs.

5.2. The analysis of the characteristics of the clusters

To identify the structure of the clusters, we conducted the analysis on 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 Tables 6 and 7.

For example, the characteristics of cluster 1 in Korean market indicated that all variables had positive influence, the gender was male, ages ranged from 21 to 25, income level ranged from 1,010,000 to 2,000,000, the members used the Internet for 3 years, used the Internet for 5 h per day, and g_day (how many hours did gamer play online games per day) was 3.72.
played online games for 1 h per day, with the intention to revisit and WOM (word of mouth) was high. Online game companies need to develop marketing strategies which correspond to properties of cluster 1. To attract audiences of the cluster, companies should provide 3D RPG games to customers who include the demographic and behavioral characteristics of this cluster. Furthermore, they should react to gamers appropriately and faster and manage the villages and guilds to communicate with each gamer through a game homepage.

5.3. The cross-national analysis

To compare between the Korean and the Japanese online game markets, cross-national analysis was conducted by selecting a primary target market. The analysis of customer loyalty within Korean market indicated the ranking of clusters as follows: cluster 6 (3.89 for average) > cluster 1 (3.74) > cluster 2 (3.65) > cluster 4 (3.38) > cluster 5 (3.14) > cluster 3 (2.99). The analysis of customer loyalty within Japanese market indicated the ranking of clusters as

### Table 6: Profiles of Korean clusters

<table>
<thead>
<tr>
<th>Cluster</th>
<th>(n=131)</th>
<th>Cluster 2 (n=85)</th>
<th>Cluster 3 (n=114)</th>
<th>Cluster 4 (n=102)</th>
<th>Cluster 5 (n=133)</th>
<th>Cluster 6 (n=138)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The suitability of feedback</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Middle</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>The precision of information</td>
<td>High</td>
<td>Middle</td>
<td>Low</td>
<td>Middle</td>
<td>Low</td>
<td>Middle</td>
</tr>
<tr>
<td>The reality of design</td>
<td>High</td>
<td>Middle</td>
<td>Low</td>
<td>Middle</td>
<td>Middle</td>
<td>High</td>
</tr>
<tr>
<td>The involvement of virtual community</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Middle</td>
<td>Middle</td>
<td>High</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>Female</td>
<td>Female</td>
</tr>
<tr>
<td>i_year</td>
<td>3</td>
<td>4</td>
<td>2–6</td>
<td>3</td>
<td>3</td>
<td>6–10</td>
</tr>
<tr>
<td>i_day</td>
<td>5</td>
<td>10</td>
<td>0–2</td>
<td>3</td>
<td>10</td>
<td>10–20</td>
</tr>
<tr>
<td>g_day</td>
<td>1</td>
<td>5–1</td>
<td>1</td>
<td>1</td>
<td>5–5</td>
<td>5–5</td>
</tr>
<tr>
<td>Revisit</td>
<td>High</td>
<td>High</td>
<td>Middle</td>
<td>Middle</td>
<td>Middle</td>
<td>High</td>
</tr>
<tr>
<td>WOM</td>
<td>High</td>
<td>High</td>
<td>Middle</td>
<td>Middle</td>
<td>Middle</td>
<td>High</td>
</tr>
<tr>
<td>Loyalty</td>
<td>2 (3.74)</td>
<td>3 (3.65)</td>
<td>6 (2.99)</td>
<td>4 (3.38)</td>
<td>5 (3.14)</td>
<td>1 (3.89)</td>
</tr>
</tbody>
</table>

Loyalty is estimated by average of revisit and WOM.

### Table 7: Profiles of Japanese clusters

<table>
<thead>
<tr>
<th>Cluster</th>
<th>(n=106)</th>
<th>Cluster 2 (n=108)</th>
<th>Cluster 3 (n=109)</th>
<th>Cluster 4 (n=67)</th>
<th>Cluster 5 (n=76)</th>
<th>Cluster 6 (n=50)</th>
<th>Cluster 7 (n=86)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The convenience of operator</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>Middle</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>The precision of information</td>
<td>High</td>
<td>Low</td>
<td>Middle</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Middle</td>
</tr>
<tr>
<td>The reality of design</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Middle</td>
<td>Low</td>
<td>Middle</td>
<td>Low</td>
</tr>
<tr>
<td>The involvement of virtual community</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Male</td>
<td>Female</td>
<td>Female</td>
<td>Male</td>
<td>Male</td>
<td>Male</td>
</tr>
<tr>
<td>Age</td>
<td>36–60</td>
<td>31–35</td>
<td>20s</td>
<td>36–60</td>
<td>26–30</td>
<td>26–30</td>
<td>26–30</td>
</tr>
<tr>
<td>i_year</td>
<td>1</td>
<td>5</td>
<td>6–10</td>
<td>2</td>
<td>7–10</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>i_day</td>
<td>6–9</td>
<td>0–2</td>
<td>6–10</td>
<td>6–10</td>
<td>3</td>
<td>0–2</td>
<td>5</td>
</tr>
<tr>
<td>g_day</td>
<td>4–6</td>
<td>0–1</td>
<td>4–6</td>
<td>4–6</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Revisit</td>
<td>High</td>
<td>Middle</td>
<td>High</td>
<td>High</td>
<td>Middle</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>WOM</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Middle</td>
</tr>
<tr>
<td>Loyalty</td>
<td>1 (4.01)</td>
<td>6 (2.84)</td>
<td>3 (3.61)</td>
<td>2 (3.84)</td>
<td>5 (2.94)</td>
<td>7 (2.18)</td>
<td>4 (3.57)</td>
</tr>
</tbody>
</table>

Loyalty is estimated by average of revisit and WOM.
follows: cluster 1 (4.01 for average) > cluster 4 (3.84) >
cluster 3 (3.61) > cluster 7 (3.57) > cluster 5 (2.94) >
cluster 2 (2.84) > cluster 6 (2.18) (Tables 6 and 7). The
other analysis of the intention of revisit and WOM indicated
the same results. As a result, the cluster 6 within Korean
markets and the cluster 1 within Japanese markets were
indicated as the primary target market.

The results indicated that the characteristics of loyal
customers were different for each nation. Gender of the
Korean primary target market was female while that of the
Japanese markets was male. Age of the Korean target
markets was 20–25 years while the Japanese market over 36
years. Income level was similar. The members of the
Japanese markets used the Internet for more years, while
those of the Japanese were beginners. Time of Internet
usage and playing games were over 10 h and over 4 h per
day, respectively and made little difference between the two
countries.

This implies that diverse marketing strategies based on
properties of their target national audiences should be
developed. To attract the primary target audiences in Korea,
companies should provide 3D RPG games to customers who
include the demographic and behavioral characteristics of
cluster 6. The characteristics of cluster 6 indicated that the
members were influenced by the reality of design and the
involvement of virtual community positively, gender was
female, ages ranged from 21 to 25, monthly income level
ranged from ¥1,010,000 to ¥2,000,000, the members used
the Internet for over 6 years, used the Internet for over 10 h
per day, played online games for over 5 h per day, with the
intention to revisit and WOM was high.

To attract the primary target audiences in Japan,
companies should provide 3D RPG games to customers
who include the demographic and behavioral characteristics
of cluster 1. The characteristics of cluster 1 indicated that all
variables had positive influence, gender was male, ages
ranged over 36, monthly income level ranged under
¥200,000, the members used the Internet for 1 years, used
the Internet for over 6 h per day, played online games for
over 4 h per day, with the intention to revisit and WOM was
high. Furthermore, the companies should consider provid-
ing the diverse characters (Avatar) and items, which are
harmonized with customers’ needs and manipulated con-
veniently. They should consider managing the different
villages and guilds to communicate with each gamer
through game homepage.

5.4. Business implications

The results of our research have the following impli-
cations for Korean and Japanese online game companies
and furthermore for global online game companies. For
Korean online game market, online game companies should
develop diverse types of online games considering the
extension of the age of online game users, the growth of
female users, and the diversification of online game user
needs. To better satisfy these needs, online game companies
should cluster similar customers into specific market
segments with different demands and then develop market-
ing strategies which correspond to their properties.
Especially, the middle-aged and female users should be
considered as well as adolescents. 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 custo-
mers’ 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).

For Japanese online game market, online game compa-
nies need to develop marketing strategies considering the
middle-aged users as target audiences. The results of our
research indicated that the members of target markets used
the Internet for at most 1–2 years and their age is over
36 years. The online game companies should provide them
with manuals to play games and manage the help desk in
Internet game homepage.

6. Conclusion

6.1. Summary and contributions

The purpose of our research is to develop a new
methodology for cross-national market segmentation. We
propose a two-phase approach (TPA) for online game
companies to their loyal customers in domestic and foreign
markets. The first phase is conducted by a statistical
approach to test the validity of cross-national analysis and
analyze the difference between national clustering factors.
The second phase is conducted by a data mining approach
using two-level SOM to develop the actual clusters within
each nation and identify the loyal customers.

The results indicated that the critical segmentation
variables and the characteristics of loyal customers were
different for each nation. The first phase indicated that the
significant variables for the Korean market segmentation
were the suitability of feedback, the precision of infor-
mation, the reality of design and the involvement of virtual
community. For the Japanese market, the convenience of
operator, the precision of information, the reality of design and the involvement of virtual community were selected.

Secondly, the cross-national analysis indicated that gender of the Korean primary target market was female, while that of the Japanese markets was male. Age of the Korean target markets was 20–25 years, the Japanese market over 36 years. Income level was similar. The loyal members of the Korean markets have used the Internet for more years, while those of the Japanese were beginners.

Time of Internet usage and playing games were over 10 h per day in Korea, while they were only over 4 h per day in Japan.

Conclusively, the results imply that online game companies should develop diverse marketing strategies based on characteristics of their target national markets. For Korean markets, they should develop different types of online games based on the diversification of online game user needs and focus especially on the middle-aged and female users. For Japanese markets, they should focus more on the beginners and the middle-aged users.

The results of our research have several contributions and implications to academia and business. In academic arena, our research proposes a new market segmentation methodology for cross-national analysis and identifies the primary factors for online game market. From business perspective, our research gives some suggestions to online game companies so as to compete successfully in today’s volatile and competitive game markets.

6.2. Limitations and future works

Even though the results of our research have several contributions and implications to academia and business, it has also several limitations, which should be dealt with in future works.

First, since our research was conducted only on Korean and Japanese online game market, results of our research might not be generalized and directly applicable to other countries. Countries with different cultural and industrial background might have to be very careful about developing their own marketing strategies using our methods due to the difference in gaming population and perception of people toward games. However, these implications might be helpful for other countries to understand and predict the changes in their own online game markets, because those two countries are considered to be the frontiers of global online game market.

Secondly, our research was conducted based on the analysis of a group of demographic and behavioral variables to identify the structure of the market clusters. However, they are only a part of many variables that might affect the whole market environments. It is suggested that more demographic and behavioral variables be necessary to segment the markets more precisely. It is argued that the reason for the difference in playing style between American and Japanese game is the difference in cultural preferences. Americans prefer the simple, stimulus and 3D-graphic games, while Japanese like the 2D-graphic and exciting games (GameMeca, 2002). Lifestyle and socio-cultural characteristics might be necessary to be added as other critical variables in analyzing markets of culture-bound products such as online games (Cateora & Graham, 2002).

Thirdly, our research was conducted based on the analysis of the six demographic and behavioral variables such as gender, age, income level, the period of Internet usage, the time of Internet usage per day, and the time of playing game per day of the two countries. The macro socio-economic variables such as a national GDP, cultural variables like western and oriental belief, religion, politics, races might be used to segment the countries and further generalizes the model based on the country segments. Comparing the country segments rather than simply comparing the neighboring two countries can further enhance the scope and validity of the study.

Acknowledgements

This research was supported by the 55th Kyung Hee University Anniversary Research Promotion Fund in 2003.

References


American and Japanese game is the difference in cultural


