Competitiveness Analysis of GDSs in South Korea by Using Niche Theory: Focusing on User Gratification

Hyo-Jeong Byun 1, Jeong-Joon Kim 2,* and Byeong-Cheol Lee 3

1 Department of Tourism Industry Research Center, Kyonggi University, Seoul 03746, Korea; hjbyun@kyonggi.ac.kr
2 Department of Airline Services, Seowon University, Cheong-ju 28674, Korea
3 Department of Tourism and Event Management, Kyonggi University, Seoul 03746, Korea; 2bclee@kyonggi.ac.kr
* Correspondence: tourism@seowon.ac.kr

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Abstract: The purpose of this study is to analyze the competitive relationships among the four major Global Distribution Systems (GDSs), which are representative reservation systems in the tourism industry by using niche theory. To that end, niche theory, which presents the three core concepts of niche breadth, niche overlap, and niche superiority, was combined with gratification in the uses to apply the gratification niche analysis technique. Based on an extensive literature review, four factors (core functions, system functions, service functions, and additional functions) to measure user satisfaction levels by function with GDSs were extracted. Online/offline questionnaire surveys were conducted with travel agencies’ airline counter staffs who had experience using all four GDSs, and in total, 324 copies of the questionnaire were used in the analysis. The analysis results confirmed that Sabre had a competitive edge in general over the other three GDSs, while TOPAS (Amadeus) and Galileo had a comparative competitive edge in certain functions. This study suggested concrete implications that can help individual GDSs in terms of their development of functions or the establishment of marketing strategies by verifying user satisfaction by the function of individual GDSs.

Keywords: niche theory; GDS/CRS; competitiveness; gratification

1. Introduction

Over the past several decades, the growth of the aviation industry has been one of the best-recorded successful cases of industry growth [1,2], and the introduction of the Computer Reservation System (CRS), which began in the 1950s, has been one of the major catalysts for changes in the aviation market as well as improved efficiency and competitiveness within the aviation sector [3–6].

The Global Distribution System (GDS), one of the CRSs used in the tourism industry, began with the automation of transactions between airline ticket selling agencies and airlines in airlines such as American Airlines (AA) with the aim of enhancing efficiency through the computerization of airline reservations [7,8]. In addition to airline reservations, the GDS has become an efficient means of simultaneously providing access to other travel industry services such as hotels, car rentals, tourism, ships, and railroads [9–12]. The GDS, one of the most effective information technologies used in travel agencies, is a distribution system that connects airlines and travel agencies; it plays an essential role in the aviation industry as well as in the travel industry by enabling travel agencies to provide value-added travel services to potential customers, and it is one of the most important tools for the sales of goods by all airlines and travel agencies [13–16].
Following the global trend, in the 1980s, the Korean travel industry also began to efficiently utilize mutually necessary information while using customer information and ticket sales performance data through linkage with the GDS, and the competitive composition between global GDS companies (Amadeus, Worldspan, and Galileo) and national airline-based domestic CRSs/GDSs (TOPAS, Asiana-Abacus) began to show signs of intensifying in the early 2000s. Since more than 60% of the profits of CRS/GDS companies come from booking fees and ticketing by travel agencies, existing domestic airline-based GDS companies have been developing new systems to maintain their market shares in the domestic market, and they have been making efforts to maintain their competitive advantages through cooperation with overseas GDS companies.

Korean Air’s TOPAS, which had been at the forefront of the domestic GDS market share, has been reborn as TOPAS SellConnect by completely changing its existing system to the Amadeus system, but Asiana-Abacus merged with Sabre and has made a new appearance as Asiana-Sabre, showing significant changes starting in 2015. This means that domestic GDS companies that had been in the domestic airline-based CRS system, which was a special situation in South Korea, have completely entered the global GDS competition market, which has brought the expectation that higher quality services will be provided to travel agency users.

However, the GDS update may not only lead to reduced sales of the system but may also enable companies to switch from one reservation system to another [17]; similarly, the changes and efforts of GDS companies are not unconditionally positive for travel agency personnel, who are the major users. As TOPAS changed into TOPAS SellConnect (Amadeus), the users of the existing system had trouble completing training on the use of new entries, and travel agency personnel experienced difficulties due to various errors caused by the unstable operating system. The Global Travel News [18] reported that with these system changes, TOPAS users are predicting that the demand will be distributed to certain other GDSs right after the system transition and that the domestic GDS market composition will change in the future [19,20].

With the South Korean GDS market changing in this way, it is judged to be necessary to identify the responses of major users and what the competitive advantages of individual GDS functions in the newly changed environment are, and to conduct studies that will provide a broad understanding of the competitive relationships among individual GDSs in the competition system for the world’s four largest GDSs. However, most of the existing GDS-related studies simply suggest directions for management strategies or compare GDS functions. That is, the competition in the GDS market is expected to intensify further, as the world’s four largest GDSs will compete with each other in the market, and the gratifications with functions by GDS felt by actual users are compared. In such a competitive situation, it is necessary to analyze what competitive edges a certain GDS will need to lead the market, and also analyze the differential competitive edges of individual GDSs.

Therefore, this study intends to identify the competitive relationships among the four largest GDSs (TOPAS SellConnect (Amadeus), Asiana-Sabre, Worldspan, Galileo) in the South Korean market according to user gratifications by applying the niche theory. Concretely, this study aims to: (a) derive items to evaluate the competitive relationships among the GDSs from actual users of the GDSs, (b) identify the degrees of competition by function among the GDSs (niche breadth, niche overlap, and niche superiority), and (c) predict the possibility of coexistence and substitution among GDSs in terms of the aforementioned factors. The results of this study are expected to provide each GDS customized-practical guidelines and strategies for competitive advantage and a new approach to analyze relative competitiveness among tourism or hospitality-related systems.

2. Theoretical Background

2.1. GDS and its Functions

The Computerized Reservation System (CRS) was first developed by major airlines in the 1960s as an in-house system for airline seat reservation and management, and it mainly began to be used by US
airlines because it enabled the processing of airline seat reservation-related business in real-time [15,21]. Since it began to be distributed to travel agencies, it has played a major role in enhancing business efficiency and has thereby played an essential role in the travel industry [13,22]. Thereafter, the CRS did not simply stay with the flight reservation function, as its functions were reinforced to include automatic ticketing and the automatic calculation of fares as well as reservation functions for hotels, rental cars, and railways, and it became a form of a Valuable Area Network (VAN) that can also perform travel information searches, accounting treatment work, and customer management tasks of travel agencies; in other words, it transformed into a comprehensive travel online system that supports the entire travel industry [11,12,17,23–25].

In the late 1980s, professional CRS operators entered the market, and they improved the functions of the CRS following the development of IT, and the intensified competition led to the era of global distribution systems (GDSs) that form global tourism networks through system integration in the form of the collaboration and alliance of many CRS companies [15,26].

In South Korea in 1984, the Total Passenger Service System (TOPAS) developed by Korean Air began to be distributed to travel agencies for the first time, and in 1991, Asiana Airlines launched a full-scale CRS operation by jointly investing with Abacus, the largest GDS company in the Asia-Pacific region at the time. Thereafter, Worldspan and Galileo, which are global GDSs, entered the Korean market in the late 1990s. Meanwhile, in 2015, as TOPAS changed into TOPAS SellConnect (Amadeus) and Asiana-Abacus changed into Asiana-Sabre, full-scale competition among the world’s four largest GDSs began in the South Korean market. These changes also affected the market shares of Abacus, TOPAS, Galileo, and Worldspan, which in 2009 were 40%, 51%, 5.5%, and 6%, respectively, and changed to about 43% (Sabre), 45% (TOPAS SellConnect), and 15% (Travelport) in 2015 [19,27].

Among the reservation services provided through GDSs in the field of tourism, the most popular ones are airline tickets, hotels, and car rental reservation services. Specifically, the GDS is an automated system that provides flight information and interacts with air carriers’ systems for flight schedules, airfares, etc., as well as the inventory reservation systems of other systems. It also provides non-air transportation-related services (including the possibility of automatic processing of documents), provides services to thousands of companies around the world, and enables these companies to access resources regarding almost all aspects of air transportation [26,28,29].

Currently, the GDSs represent the electronic market that connects travelers, travel agencies, airlines, hotels, etc., and they have functioned for decades as platforms for e-commerce in the travel industry to provide virtual real-time connections among thousands of travel inventory providers and several hundred thousands of travel product retailers [12,15,30]. Specifically, they have such an important position in each travel agency that running a travel agency without using one of the GDSs is rare [31,32].

2.2. Niche Theory

2.2.1. Concept of Niche Theory

Niche theory is an analytic frame that explains and describes, based on the common environmental resource patterns for a certain period of time and originating from the theory of population ecology, how each entity adapts to its environment for survival [33]. While the niche theory was developed from ecology and evolution, it has developed into human ecology after being combined with social science, and it has been widely used in media economy research to investigate competition among mass media after Dimmick et al., introduced it into social science from a media economic standpoint (e.g., [34–36]).

Dimmick and Rothenbuhler [37] introduced niche theory into the field of communicology to begin research on the niche in the media industry, and Freeman and Hannan [18] applied niche theory to histology to conduct studies on creation, changes, and adaptation within an organized group. In this
case, the word “niche” has a dictionary meaning of “right place”, which means “a position where an entity is maintained and acts in a space” [38,39].

Niche theory applies the three concepts of niche breadth, niche overlap, and niche superiority to examine how two or more populations coexist and compete when there are limited resources in their environment [40–43]. The concepts of breadth and overlap in ecological niche theory are similar to the concepts of complementary goods and substitutional goods in economics [40,44]. That is, both groups of concepts indicate that companies attempt to secure market dominance by increasing the resources used or diversifying their market activities and that in major sectors, they also strengthen their market dominance through direct competition with other competitors [42]. In niche theory, populations differ conceptually according to academic fields, where populations become certain species in ecology, but in social science, populations are assemblies of unique entities, and they can be interpreted as communities that maintain relatively optimal homogeneity according to the goals of the groups [37,39]. Resources are environmental factors that are directly related to the survival of a certain population and must be acquired for the survival of the organization [37].

Katz [45] made a substantial contribution to the understanding of the structure and interrelationships of the use of motivation, use patterns, and gratifications obtained after the use of diverse media users through the use and gratification approach. The theory of uses and gratifications views it as a process of selecting the object that best meets the user’s motivation for use among several alternatives that may be chosen [35,46]. However, the use and gratification approach elucidates the entities through which the user’s basic needs are gratified, but it has limitations in showing the degree to which the needs are gratified compared to other entities, and it can be said to be unable to show the direction and degree of gratification in the relationships with other entities.

Meanwhile, niche theory can be seen as having borrowed the concept of “gratification” from the theory of uses and gratifications [47], and since it borrowed the concept of gratification from the theory of uses and gratifications, it can subdivide gratifications into multiple dimensions so that competitive relationships can be analyzed by the subdivided category. While the theory of uses and gratifications mainly focuses on motivation, which is included in the stage before using a certain object, niche theory is different in that it mainly focuses on gratifications, which are included in the stage after using a certain object [48]. In addition, whereas the theory of uses and gratifications has a problem in that it can be difficult to apply to the analysis of competitive relationships among populations, niche theory can be regarded to have overcome this limitation to an extent [34].

This study applies niche breadth, niche overlap, and niche superiority, which are the three concepts of niche theory, to measurement and analysis, and the concrete contents are as follows:

1. Niche Breadth

The niche breadth is calculated according to the individual dimensions of gratifications, and it is obtained by standardizing the average values of the gratifications of respondents for individual dimensions of gratifications into scores in a range from 0 through 1 after removing the effects of the number of questions along with the highest scores and the lowest scores of the questions. Score 1 means that the respondent gave the highest score to the question, while score 0 means that the respondent gave the lowest score to the question, while values closer to 1 indicate larger niche breadths. Therefore, entities with scores closer to 1 are specialist entities and those with scores closer to 0 are generalist entities [33,40,42].

\[
B = \frac{\sum_{n=1}^{N} \left[ \left( \sum_{k=1}^{I} GO_n \right) - K_I \right]}{K(n-1)}
\]

\(u, l\) = the upper and lower bounds of a scale,
\(GO\) = a gratification obtained rating on a scale
\(N\) = the number of respondents using a medium
ONiche Overlap

Niche overlap shows the degree to which two populations are similar to each other [42]. That is, whereas niche breadth shows how differently a certain entity can use limited resources, niche overlap shows the degree to which the uses of resources are overlapping. It refers to the degree to which two populations compete with or rely on each other through the same resources and enables the estimation of the degree of competition between those two populations [38].

\[
O_{i,j} = \frac{\sum_{n=1}^{N} \sqrt{\frac{(GO_i - GO_j)^2}{k}}}{N}
\]

\(i, j = \) entities i and j

\(GO = \) a gratification obtained rating on a scale for i and j

\(N = \) the number of respondents using an entity

\(n = \) the first respondent

\(K = \) the number of scales on a dimension

\(k = \) the first gratification scale

ONiche Superiority

Niche superiority is a concept that indicates which population is superior in competition; that is, the direction and degree of superiority. Although niche overlap elucidates the degree of competition between populations according to the degree of similarity of the gratifications provided to the user by two populations, it does not include information about which population is superior. Therefore, competitive superiority should be measured to analyze which population is relatively superior in which sub-dimensions of gratifications.

The calculation formula for the niche superiority of entity i over entity j:

\[
S_{i > j} = \frac{\sum_{n=1}^{N} \sum_{k=1}^{K} (M_i > j)}{N}
\]

The calculation formula for the niche superiority of entity j over entity i:

\[
S_{j > i} = \frac{\sum_{n=1}^{N} \sum_{k=1}^{K} (M_j > i)}{N}
\]

\(i, j = \) entities i and j

\(M_i > j = \) the value of a respondent’s rating for those scale items on which i is rated greater than j (the sum of the actual values)

\(M_j > i = \) the value of a respondent’s rating for those scale items on which j is rated greater than i (the sum of the actual values)

\(N = \) the number of respondents who use both i and j,

\(n = \) the first respondent

\(K = \) the number of scales on a dimension

\(k = \) the first gratification scale
2.2.2. Analysis of Competition Among GDSs and Application of Niche Theory

In South Korea, although CRS/GDS-related studies have been conducted steadily, most of the existing studies have been at the level of suggesting fragmental directions of CRS/GDS management strategies [49–51] or comparing the functions of two systems (TOPAS, Abacus) [52,53], and they have limitations that they did not properly analyze actual competition in the domestic (South Korean) market. Therefore, it was judged that now is the time when additional studies that will provide a broad understanding of the competitive relationships among individual GDSs under the full-scale competition system for the four largest GDSs in the world, and niche theory will be applied in this study.

The populations used in this study were classified into four types, TOPAS SellConnect, Sabre, Worldspan, and Galileo, which will compete with each other in the travel industry. Currently, most domestic travel agencies use more than one GDS, and it is not difficult to find agencies that use all four GDSs, such as BSP (Billing Settlement Plan) agencies. In addition, even if multiple GDSs are installed, the actual use is determined by the active selection by users. There are a variety of reasons (motives) for users to select and use a certain GDS, and it should be natural for users to select and use a GDS that gives them gratifications. However, as shown in media-related studies (e.g., [33,42]), even if a certain entity has a competitive advantage, the inferior entities do not become extinct, but it is possible that the entities will show functional substitution to move toward coexistence through the process of strategic functional differentiation centering on superior functions. Therefore, it is considered possible to predict which functions of individual GDSs will undergo the steps of substitution and coexistence with each other, and suggest the directions for individual GDSs to go.

Applying niche theory to this study shows that populations can represent the four largest GDSs, gratifications can represent resources, and niche dimensions can represent the functions provided by individual GDSs. From this perspective, the suitability of the ecological discussion on competition in the GDS industry can be identified through an analysis of characteristics such as the degree of utility of and gratifications with the functions provided by individual GDSs in using and selecting GDSs.

In other words, to analyze the overall competitive relationships in the domestic GDS market, this study will extract the element termed gratifications through the theory of uses and gratifications and graft it onto niche theory to proceed with the gratification niche analysis. The core concepts of the gratification niche theory that will be used in this study are as shown in Table 1.

| Concept     | Definition in the Niche Theory                                                                 |
|-------------|---------------------------------------------------------------------------------------------|
| Population  | A group of distinct entities (GDSs) that interact with each other while sharing different characteristics.  
- TOPAS SellConnect, Asiana-Sabre, Worldspan, and Galileo. |
| Environment | It refers to everything that exists outside of each population.  
- Environments of airlines and the travel industry that have installed and are using more than one GDS.  
- Environments where users can select and use GDSs among installed GDSs. |
| Resource    | Environmental factors essential for the maintenance of the population.  
- The functions provided by individual GDS companies and the gratifications obtained by users after using each GDS. |

Source: Prepared by the researcher based on previous studies.

3. Methodology

3.1. Research Questions

In this study, the niche breadth, niche overlap, and niche superiority based on user gratifications with the four largest domestic GDSs (TOPAS SellConnect, Asiana-Sabre, Worldspan, and Galileo) will be compared and analyzed, and the differences in travel agency users’ gratifications with GDS
functions will be analyzed. Therefore, based on the above discussion, the following research questions were established.

- **Research question 1:** What are the differences in niche breadth among individual GDSs (TOPAS SellConnect, Aisana-Sabre, Worldspan, Galileo) in terms of user gratifications?
- **Research question 2:** What are the differences in niche breadth among individual GDSs (TOPAS SellConnect, Aisana-Sabre, Worldspan, Galileo) in terms of user gratifications?
- **Research question 3:** What are the differences in competitive advantages among individual GDSs (TOPAS SellConnect, Aisana-Sabre, Worldspan, Galileo) in terms of user gratifications?

### 3.2. Research Design

#### 3.2.1. Derivation of GDS Competition Evaluation Items through DELPHI

In niche theory, the niche is a characteristic of the environment that provides essential resources to the population, and each entity needs a niche to maintain its life. When considered from an industrial point of view to corporate populations, spaces can be expressed as communities and markets. Using a methodology incorporating such a viewpoint, Dimmick [42] suggested that, to analyze the different dimensions of a niche, several niche dimensions should be constructed depending on the purpose of the study, and relevant measurement tools should be developed. Therefore, to apply niche theory, the factors of competition evaluation in the dimension of gratifications should first be derived. Therefore, in this study, to derive competition evaluation variables, previous studies related to existing CRS/GDSs from various perspectives (e.g., [54–58]) and studies related to the computerized reservation system used in the tourism sector were examined. Based on primary competitive evaluation items obtained, Delphi surveys were conducted with an expert group to supplement the limitations of the previous studies, and final evaluation items were drawn. Given that there is little consensus about criteria to measure GDS competitiveness, the Delphi technique is considered as an effective way of obtaining a collective view from users and experts with experience in use [59,60].

The participants were selected from groups with expertise, such as experts who were currently using GDSs with at least five years of work experience in travel agencies, airlines, or GDSs, as well as professors with practical experience, who had a deep understanding of GDSs and could steadily participate in questionnaire surveys to apply the Delphi technique. That is, the participants were composed of 25 experts (academia, industry) equipped with various theoretical backgrounds and experiences in relation to GDSs, such as academic, research, and practical experiences. Questionnaire items were obtained from two Delphi surveys with selected experts. In this study, in the first round, the Delphi survey method was modified to derive appropriate factors with which to analyze the competition among individual GDSs through an open/closed mixed questionnaire, and the second round questionnaire survey was then conducted before terminating the Delphi survey. Table 2 shows the final GDS competition evaluation items.

#### 3.2.2. Study Procedure and Data Collection

In this study, Delphi surveys were initially conducted with a group of experts from 20 June to 25 July 2016 to derive the importance of the competition evaluation items, and a questionnaire for niche analysis was prepared based on these derived items. This questionnaire survey was conducted online/offline through a self-administered questionnaire with the users of GDSs of domestic travel agencies. A preliminary survey was conducted from 10 to 16 August 2016 to verify and correct any errors in the questionnaire items, and the main survey was conducted from 20 August to 20 September 2016.

This study was conducted to analyze the competitive relationships among the four largest domestic GDSs applying the niche theory. Concretely, a niche breadth analysis was conducted to determine the degree of resource utilization of the four largest GDSs, and a niche overlap analysis examining the
degree of similarity of functions was conducted. In addition, t-tests were conducted to determine the competitive advantages by function among the four largest GDSs.

### Table 2. Final GDS competition evaluation items.

| Large Items                      | Middle Items                                                                 |
|----------------------------------|-------------------------------------------------------------------------------|
| System function                  | 1. System stability                                                          |
|                                  | 2. System reaction (response) speed                                          |
|                                  | 3. Familiarity with the system being used                                    |
|                                  | 4. Extensibility of functions                                                |
|                                  | 5. System update                                                             |
|                                  | 6. Fast and accurate A/S                                                     |
| Service function                 | 7. Smooth communication with GDS staff                                        |
|                                  | 8. Friendliness of GDS staff                                                 |
|                                  | 9. Prompt response by sales representatives in charge                         |
|                                  | 10. Promptness and accuracy of helpdesk                                       |
| Reservation function             | 11. Convenience of use                                                       |
|                                  | 12. Accuracy of availability                                                  |
|                                  | 13. Availability of diverse airlines                                         |
|                                  | 14. Quick response (reply) after booking                                      |
|                                  | 15. Ease of securing seats                                                   |
|                                  | 16. Easy command                                                             |
|                                  | 17. Convenience of creating GRP PNR                                           |
| Fare/ticketing function          | 18. Possibility of inquiry into the fares of diverse airlines                |
|                                  | 19. Fare accuracy (guarantee)                                                |
|                                  | 20. Possibility of ticketing for diverse airlines                            |
|                                  | 21. Reliability of the results of ticketing                                  |
|                                  | 22. Convenience of refund and change                                         |
|                                  | 23. Easy ticketing command                                                   |
|                                  | 24. Convenient settlement function                                           |
| Additional information inquiry   | 25. Accuracy of other information (hotel, rental car, tourist information, etc.) |
| and convenience functions        | 26. UMS (fax, email, SMS, etc.) function                                      |
|                                  | 27. Shortcut key (mask, J-key, etc.) function                                 |
|                                  | 28. Smartphone interlocking function                                         |

### 4. Results

#### 4.1. Demographic Characteristics

In this study, online/offline questionnaire surveys were conducted with domestic travel agencies’ airline ticket counter staff who either had experience in using all four GDSs or knew how to use the four GDSs based on the ultimately derived measurement items. In total, 343 copies were collected out of 357 copies distributed. Of these 343 copies, 19 with missing responses or responses judged to be unfaithful were removed, ultimately leaving a total of 324 copies for analysis for this study (see Table 3).
A frequency analysis was conducted to determine the demographic characteristics of the survey subjects. Regarding gender, there were 270 females (83.3%) and 54 males (16.7%). The difference between the ratios of males and females was found to be largely due to the high ratio of female employees, which is a common characteristic of travel agencies’ airline ticket counters. In addition, reviewing the present situation regarding the use of GDSs by the respondents showed that in the case of BSP agencies, TOPAS (300 persons) was the most frequently used GDS, followed in order by Sabre (280 persons), Galileo (168 persons), and Worldspan (78 persons). Among the respondents, 50 respondents (15%) were using all four GDSs, 116 (36%) were using three GDSs, 127 (39%) were using two GDSs, and 31 (10%) were using one GDS.

### 4.2. Reliability and Validity Tests

A factor analysis and reliability analysis was conducted to verify the reliability and validity of the measurement items developed for this study through a Delphi survey with a group of experts. In the factor analysis, the Varimax rotation was performed as a principal component analysis, the number of factors was analyzed based on an eigenvalue of 1.0, and the Cronbach’s Alpha value was used for reliability verification. A seven-point Likert scale was used for measurement in the questionnaire. The mean values of the questions for each of the four largest GDSs were used for the analysis in this study, and four factors (core, system, service, and additional functions) were extracted from the questions. Among the questions, those for shortcut key convenience and UMS convenience were doubly loaded in factors 1 and 2, but they were included in factor 2 based on previous studies and the judgment of this researcher. The KMO value of the extracted factors was shown to be high at 0.914 (Standard, at least 0.6), indicating that the validity of the factor analysis was significant ($p < 0.001$). Convergent validity was also secured as the factor loading value was found to be at least 0.5, and the suitability was verified because the Cronbach’s Alpha value was found to be 0.823–0.960 (Table 4).
### Table 4. Reliability and Validity Analysis (N = 324).

| Factor          | Variable                                      | Factor Loading | Eigenvalue | Variance Explained (%) | Cronbach’s alpha |
|-----------------|-----------------------------------------------|----------------|------------|-------------------------|------------------|
| **1. Core functions (14)** | Fare accuracy                                 | 0.864          | 12.080     | 31.429                  | 0.960            |
|                 | Responsiveness after reservation              | 0.848          |            |                         |                  |
|                 | Easy ticketing command                        | 0.823          |            |                         |                  |
|                 | Reliability of the results of ticketing       | 0.818          |            |                         |                  |
|                 | Availability of diverse airline tickets       | 0.806          |            |                         |                  |
|                 | Accuracy of inquiry into available flights    | 0.782          |            |                         |                  |
|                 | Diversity of bookable airlines                | 0.774          |            |                         |                  |
|                 | Diversity of fare information inquiry         | 0.772          |            |                         |                  |
|                 | Ease of securing seats                       | 0.756          |            |                         |                  |
|                 | Convenience of reservation                   | 0.736          |            |                         |                  |
|                 | Convenience of refund                        | 0.698          |            |                         |                  |
|                 | Convenient settlement function                | 0.660          |            |                         |                  |
|                 | Easy reservation command                     | 0.574          |            |                         |                  |
|                 | Convenience of group reservation             | 0.447          |            |                         |                  |
| **2. System functions (6)** | Stability                                     | 0.864          | 4.876      | 47.691                  | 0.821            |
|                 | Responsiveness (reactivity)                   | 0.821          |            |                         |                  |
|                 | Fast and accurate a/s                        | 0.782          |            |                         |                  |
|                 | Extensibility of functions                   | 0.758          |            |                         |                  |
|                 | Familiarity (convenience)                    | 0.702          |            |                         |                  |
|                 | Recency(up-date)                              | 0.655          |            |                         |                  |
| **3. Additional functions (4)** | Mobile phone interoperability                 | 0.770          | 1.401      | 60.199                  | 0.897            |
|                 | Non-air information inquiry                   | 0.698          |            |                         |                  |
|                 | Shortcut key convenience                     | 0.620          |            |                         |                  |
|                 | UMS convenience                               | 0.593          |            |                         |                  |
| **4. Service functions (4)** | Rapid response of employees                   | 0.814          | 1.294      | 70.184                  | 0.904            |
|                 | Communication with employees                  | 0.781          |            |                         |                  |
|                 | Staff friendliness                            | 0.738          |            |                         |                  |
|                 | Quick and accurate helpdesk                   | 0.666          |            |                         |                  |

Total balance: KMO = 0.914. Bartlett’s Sphericity Verification: $X^2 = 8247.696$, df = 378 ($p = 0.000$).

In this study, one-way ANOVAs were conducted to examine the differences among the four GDSs by factor, and a post-hoc analysis was conducted using Tukey’s method to verify the concrete differences among the individual GDSs by factor. As a result, the differences in gratification levels among the individual GDSs by factor were found and are shown in Table 6 below. Regarding the system functions, the gratification with TOPAS (TOPAS SellConnect) was shown to be higher than that with other GDSs, that with Worldspan was shown to be the lowest, and no statistically significant difference was shown between Sabre (formerly Asiana-Abacus) and Galileo. In addition, no statistically significant difference in service functions was shown between Sabre and Galileo, while statistically significant differences were identified between TOPAS and Worldspan.

In core functions, no statistically significant difference was found between TOPAS and Sabre, but the averages were shown to be the highest in TOPAS and Sabre followed in order by Galileo and Worldspan in terms of precedence. In the additional functions, no statistically significant difference appeared between TOPAS and Sabre, or between Worldspan and Galileo, but differences between the two pairs were found (Table 5).

### 4.3. Niche Breadth Analysis

- Research question 1: What are differences in niche breadth among individual GDSs in terms of user gratifications?
Table 5. Verification of differences among the four largest GDSs by factor.

| Division | System | Service | Additional | Others |
|----------|--------|---------|------------|--------|
|          | M      | SD      | M          | SD     |
| TOPAS (a)| 4.78   | 1.095   | 4.69       | 1.346  |
| Sabre (b)| 4.21   | 0.812   | 5.00       | 1.091  |
| Worldspan (c)| 3.89 | 0.765   | 4.40       | 0.795  |
| Galileo (d)| 4.32  | 0.892   | 4.95       | 1.022  |
| F-value (p) | 54.458 * | 21.521 * | 66.554 * | 31.672 * |

Turkey
- a > d = b > c
- b = d > a > c
- b = a > d = c

Note 1: p * < 0.001. Note 2: Referred to as TOPAS (TOPAS SellConnect), Sabre (previously, Abacus).

Niche breadth is the degree to which a certain entity satisfies the user’s dimension of gratifications by sub-dimensions of gratifications, which indicates how diversely the entity utilizes individual dimensions of characteristics. Niche breadth is standardized into a value between 0 and 1. When the value of niche breadth approaches 1, the breadth of the utilization of resources becomes wider, so the likelihood of acquiring general users becomes relatively higher. By contrast, when the value of niche breadth approaches 0, the breadth of the utilization of resources becomes narrower, so only specialized users can be obtained. Table 6 shows the results of niche breadth analyses for the four largest domestic GDSs by factor.

Table 6. Niche Breadth.

| Division | Core | System | Additional | Service |
|----------|------|--------|------------|---------|
| TOPAS    | 0.664(2) | 0.633(2) | 0.583(2) | 0.618(3) |
| Sabre    | 0.673(1) | 0.673(1) | 0.604(1) | 0.670(1) |
| Worldspan| 0.530(4) | 0.484(4) | 0.507(4) | 0.569(4) |
| Galileo  | 0.576(3) | 0.555(3) | 0.532(3) | 0.662(2) |

Note: 0 = smallest niche breadth, 1 = largest niche breadth, () is the rank of niche breadth by relevant factor.

The results of niche breadth analysis for the four largest domestic GDSs by factor indicate that in terms of core functions, the niche breadth of Sabre (0.672) was the largest, followed in order by those of TOPAS (0.663), Galileo (0.576), and Worldspan (0.530). Regarding system functions, the niche breadth of Sabre was the largest at 0.673, followed in order by those of TOPAS (0.633), Galileo (0.555), and Worldspan (0.484). For factor additional functions, the niche breadth of Sabre (0.603) was the largest, followed in order by those of TOPAS (0.583), Galileo (0.531), and Worldspan (0.507). In terms of service functions, the niche breadth of Sabre (0.670) was the largest, followed in order by Galileo (0.661), TOPAS (0.618), and Worldspan (0.568), in contrast to the other three factors.

When these results were put together, it could be seen that the niche breadth of Sabre was the largest in all four factors, indicating that users were using Sabre the most widely. In other words, users were using Sabre the most generally. These results can be attributed to the fact that users felt somewhat inconvenienced in the process of the change of TOPAS into its new version TOPAS SellConnect and viewed Sabre as a GDS that could be used relatively more conveniently. Meanwhile, since a large breadth of the utilization of resources may be interpreted to be due to the inefficient utilization of resources, which means that the risk of decline of users’ loyalty cannot be ruled out, efforts to find and magnify the strengths of Sabre may be necessary.

On the other hand, the niche breadth of Worldspan was shown to be the smallest in all functions. Therefore, Worldspan can be regarded to have specialized users. In addition, one thing that stands out is that the niche breadth of Galileo is the second largest in service functions, thereby showing a
relatively high rank in service functions compared to other functions. Therefore, the service functions of Galileo can be regarded to be evaluated better than other functions. By contrast, the service functions of TOPAS, which has the highest market share, are evaluated to be somewhat inferior compared to other functions. In fact, in the industry, complaints about the friendliness of TOPAS’ helpdesk staff or communication with the staff in charge can be heard from time to time. The results of the present analysis are interpreted to have reflected such voices, and this area is thought to be an area of TOPAS that must be improved.

4.4. Niche Overlap Analysis

- Research question 2: What are the differences in niche breadth among individual GDSs in terms of user gratifications?

Niche overlap refers to the degree to which two entities depend on the same resource and compares the similarity of functions between entities to directly elucidate the competitive relationship between entities. If the niche overlap is low, it means that the two entities are in a complementary alternative relationship because they depend on different resources. If the niche overlap is high, it means that the two entities are in a competitive alternative relationship because they use similar resources. In this regard, niche overlap is an index of substitutability or complementarity between two entities, which best shows the functional alternative relationship in a narrow sense. Since the value of niche overlap is expressed by an inverse number, it can be interpreted that the lower the value, the higher the degree of niche overlap, and the higher the value, the lower the niche overlap. As this study used seven-point scales, the closer the niche overlap value is to 0, the more resources being utilized are completely overlapping so that the two entities are in intense competition, and when the niche overlap value is close to 6, the two entities can be said to be in an independent symbiotic relationship. The results of an analysis of niche overlap among TOPAS, Sabre, Worldspan, and Galileo by factor are shown in Table 7.

| Division                      | Core    | System  | Additional | Service |
|-------------------------------|---------|---------|------------|---------|
| TOPAS–Sabre                   | 1.379(1)| 1.398(5)| 0.814(2)   | 1.188(1)         |
| TOPAS–Worldspan               | 3.611(6)| 2.835(6)| 1.404(6)   | 2.120(5)         |
| TOPAS–Galileo                 | 2.934(4)| 0.950(3)| 1.262(3)   | 2.179(6)         |
| Sabre–Worldspan               | 3.542(5)| 1.234(4)| 1.336(5)   | 1.845(4)         |
| Sabre–Galileo                 | 2.875(3)| 0.940(2)| 1.262(3)   | 1.750(3)         |
| Worldspan–Galileo             | 1.689(2)| 0.664(1)| 0.000(1)   | 1.552(2)         |

Note: 0 = smallest niche overlap, 6 = largest niche overlap, () is the rank of niche overlap by relevant factor.

In the core functions, the niche overlap (3.542) of TOPAS–Worldspan was shown to be the largest, followed by that (3.542) of Sabre–Worldspan. On the other hand, the niche overlap value (1.379) of TOPAS–Sabre was the lowest, indicating that the competition between the two systems is fiercer than those of other GDSs. In addition, the core functions are the most important functions among the functions of GDSs, and the competition between the two GDSs which occupy the first and second places in the domestic GDS market shares (Asiana-Sabre internal data, 2015) can be considered a natural result.

In the system functions, the niche overlap (2.835) of TOPAS–Worldspan was the largest, while the niche overlap (0.664) of Worldspan–Galileo was the smallest. This can be interpreted as indicating that the resource utilization for the system functions of Worldspan and Galileo is the most overlapping and that the competition for those functions is fierce. Along with the foregoing, the value of the niche overlap of TOPAS–Sabre (1.398) was the largest, followed in order by those of Sabre–Worldspan
(1.234) and TOPAS–Galileo (0.950). In terms of additional functions, the value of the niche overlap of Worldspan–Galileo was shown to be 0.000, indicating that the resources were completely overlapping, and the value of the niche overlap (0.814) of TOPAS–Sabre was the next lowest. In addition, the value of the niche overlap of TOPAS–Worldspan (1.404) was the largest, followed in order by those of Sabre–Worldspan (1.336), and TOPAS–Galileo and Sabre–Galileo, which had the same value of niche overlap (1.262). In the factor service functions, the value of the niche overlap of TOPAS–Sabre (1.188) was the smallest, indicating that the two GDSs were in a fiercely competitive relationship. Meanwhile, TOPAS–Galileo (2.179) had the largest value of niche overlap. In addition, the value of the niche overlap of Worldspan–Galileo (1.552) was the smallest, followed in order by Sabre–Galileo (1.750), Sabre–Worldspan (1.845), and TOPAS–Worldspan (2.120).

When the degrees of competition among GDSs examined through niche overlap were combined, the degree of niche overlap (additional functions: 0.000) of Galileo–Worldspan was the lowest among all factors by function, while the degree of niche overlap (core functions: 3.611) of TOPAS–Worldspan was the highest. It was also identified that the competition in the core functions and the service functions between TOPAS–Sabre was fiercer than that between other GDSs and that the competition between Worldspan–Galileo in system functions and additional functions was fiercer than the competition between other GDSs. Meanwhile, since all the values of niche overlap were below the average (three points), except for those of TOPAS–Worldspan and Sabre–Worldspan, it was reconfirmed that the values of niche overlap were generally high, indicating that the GDSs are in competitive relationships. Further, when only niche overlap was considered, the domestic GDS market can be summarized to be in the state of competition between TOPAS and Sabre and between Worldspan and Galileo.

4.5. Analysis of Niche Superiority

- Research question 3: What are the differences in competitive advantages among individual GDSs in terms of user gratifications?

While the index niche overlap is an index indicating the functional similarity and the degree of competition between two entities, niche superiority is an index indicating which of the competing entities is relatively superior. Although the degree of competition between two entities can be seen through niche overlap, which of the two entities is superior cannot be seen through niche overlap. Therefore, niche superiority is measured to analyze which entity is superior. This analysis develops the results of the analysis of niche overlap, which were only presented as the exchangeability of entities in the use and gratification approach, into the judgment of the superiority of the functions of entities by the subjective evaluation of the user to provide explanations about the condition and the direction of substitution between entities with a high possibility of functional substitution [41].

Niche superiority is expressed by individual respondents by directly comparing the levels of satisfaction between two entities by dimension and summing up and averaging the values of the items that are evaluated to be superior. In addition, the paired t-test is used to determine whether the competitive advantage values between the entities are significant. In other words, the fact that the results of t-tests are significant can be interpreted as indicating that one system (GDS) is superior to the other system in terms of gratifications. The comparison of competitive advantages among the four largest GDSs in this study is conducted with a total of six combinations, as shown in Table 8.

The analysis found that Sabre was more competitive than other GDSs in all functions, while Worldspan fell behind in competition with other GDSs. Reviewing the contents concretely yielded that, first, in the comparison of competitive advantages between TOPAS and Sabre, statistically significant differences were identified in system functions, additional functions, and service functions excluding the core functions, and that Sabre was more competitive than TOPAS in all three functions. This shows a similar pattern to the results of the previous analysis of niche breadth. The gap in the niche superiority of service functions was found to be the largest, while that of additional functions was found to be the smallest. Although there was no statistically significant difference in core functions, which can be said to be the most important functions of GDSs, Sabre was identified to be more competitive in all
remaining functions, indicating that when users intend to selectively use GDSs, they are more likely to use Sabre. In other words, the booking fees of GDS companies are affected by how frequently the relevant GDSs are used, along with the dissemination (use fee) of GDSs. Given that users are more likely to use GDSs that are considered to be more convenient, it seems that TOPAS should make more efforts developed from the perspective of actual users. That is, it is considered to be necessary for TOPAS to constantly conduct refresher training to address the problems facing users due to system changes, ensure friendly and active responses by helpdesk and sales staff, and develop systems aimed toward diverse convenience functions (shortcut keys, error minimization, etc.).

### Table 8. Superiority.

|       | T:S | T:W | T:G | S:W | S:G | W:G |
|-------|-----|-----|-----|-----|-----|-----|
| Core  | 9.23| 11.04| 39.5| 5.51| 30.3| 7.79|
|       | 10.70*| 18.95*| 11.98*| 6.96*| 16.72*|
| System| 3.99| 7.12| 19.28| 2.76| 13.86| 5.19|
|       | 13.86*| 21.1| 11.55*| 8.64*| 22.75*| 10.77*|
| Additional| 2.34| 3.96| 7.81| 2.23| 6.81| 2.89|
|       | 8.86*| 22.75*| 11.55*| 8.64*| 10.77*| 8.44*|
| Service| 1.77| 5.01| 9.48| 5.03| 5.98| 8.60|
|       | 10.39| 3.57| 6.36| 7.19| 1.85| 8.43|
|       | 5.89*| 5.54*| 3.26*| 7.84*| -1.04| 10.25*|

Note: $p^* < 0.001$ (T: TOPAS Sell, S: Sabre, W: Worldspan, G: Galileo).

Second, in the comparison of competitive advantages between TOPAS and Worldspan, statistically significant differences were found in all factors. TOPAS was found to be more competitive than Worldspan in all four factors, and specifically, the gap of niche superiority was found to be the largest in core functions. Meanwhile, since niche overlap was found to be the smallest in general, the competition between them can be said to be relatively weak. Third, the competitive advantages of TOPAS and Galileo were analyzed, and the results indicated that there were significant differences in all factors. TOPAS was more competitive than Galileo in the factors of core functions, system functions, and additional functions, while Galileo was more competitive than TOPAS in the factor service functions. Service functions are the item where the largest difference was found in the earlier comparison of competitive advantages between TOPAS and Sabre. Therefore, it seems that TOPAS should particularly supplement service functions. By contrast, Galileo should make constant efforts to improve competitiveness, centering on functions not yet occupied by other systems. Fourth, the comparison of competitive advantages between Sabre and Worldspan showed that there were statistically significant differences in core functions, system functions, additional functions, and service functions. In addition, Sabre was found to be more competitive than Worldspan in all four factors, and specifically, the difference in competitiveness was shown to be the largest in system functions. Meanwhile, since the niche overlap analyzed earlier was relatively small, the competition between these two GDSs can be regarded to be relatively weak. Fifth, the comparison of competitive advantages between Sabre and Galileo identified that there were statistically significant differences in core functions, system functions, and additional function factors excluding service functions, while Sabre was substantially more competitive than Galileo in the three factors.

Finally, in the comparison of competitive advantages between Worldspan and Galileo, it was identified that there were statistically significant differences in all factors. Galileo was more competitive than Worldspan in all four factors, and the gap in niche superiority values was shown to be the largest in additional functions and the smallest in service functions. The niche overlap between the two GDSs was also shown to be large, indicating that they were in a competitive relationship, and in the end, between the two GDSs, Worldspan is analyzed to be more competitive than Galileo. When only the two GDSs are examined, it can be seen that they are in a competitive relationship in the niche breadth.
and the niche overlap of service functions and additional functions. In addition, when free travels are increasing, it can be expected that the importance of additional functions will increase, and in such a situation, the competition and supplementation relationships between two GDSs can be said to be indispensable.

5. Conclusions and Implications

This study analyzed the competitive relationships among the four largest domestic GDSs by function. In particular, this study examined the cross-relationships in terms of niche breadth, niche overlap, and competitive advantages in an attempt to comprehensively examine the competitive structure. Based on the findings, this study suggested several practical and theoretical implications.

First, with regards to practical aspects of each GDS, when the competitive relationships among the four largest domestic GDSs were comprehensively reviewed based on the results of the analyses set forth above, it could be seen that TOPAS was more competitive than Worldspan in all functions and that it could replace Worldspan in core functions. Meanwhile, it could be seen that TOPAS was more competitive than Galileo in system functions, additional functions, and core functions, but less competitive than Galileo in service functions. It could also be seen that TOPAS was less competitive than Sabre in service functions, system functions, and additional functions, but no statistically significant difference was found in core functions. It was identified that although TOPAS occupied first place in market share, it was falling behind Sabre in actual user gratifications and was less competitive than Galileo in service functions. This suggests that TOPAS should make further efforts to improve user gratifications rather than for marketing focused on system distribution (market share).

Second, it could be seen that Sabre was generally more competitive than the remaining three GDSs, that a relationship for substitution was being formed between Sabre and Worldspan in core functions, and that no statistically significant difference was identifiable between Sabre and Galileo in service functions. Although Sabre was identified to be more competitive compared to other GDSs, no statistical difference could be seen between Sabre and TOPAS in core functions or between Sabre and Galileo in service functions. Although Sabre is judged to satisfy a wide range of users, it is believed to be necessary for Sabre to implement more active and subdivided marketing strategies to gain an advantage in core and service functions as well.

Third, although Galileo was not found to be more competitive than Sabre, it was found to be more competitive than Worldspan in all functions, and it could be seen that the conditions for replacement were being formed. However, it should be noted that Galileo was not found to be more competitive than TOPAS in core functions, system functions, or additional functions, but it was found to be more competitive than TOPAS in service functions. The fact that Galileo was found to be more competitive than TOPAS with the largest market share in the domestic market underscores the potential of Galileo and has great implications for both TOPAS and Galileo. Therefore, Galileo should maintain its competitiveness through the constant management of service functions, and joint marketing plans may be considered through business cooperation with Worldspan, which has the same parent company (Travelport) for other functions. Galileo should attract users through a variety of promotions (e.g., incentives), make efforts to change users’ perceptions and improve their gratifications through system upgrade and education, and accurately set target markets to conceive strategies differentiated from those of TOPAS or Sabre.

Fourth, Worldspan was not identified to be more competitive than any other GDS, and it was identified to have already been replaced by some GDSs. This suggests the direction of strategies that should be established for Worldspan to survive in the competitive GDS competition market. Specifically, it is believed that the results of the analysis of Galileo, which is in a competitive relationship with Worldspan in terms of market share, should be taken meaningfully. Whether the results are attributable to the market share, which is still low, or the actual functional problems, should be well grasped to conceive differentiated marketing strategies accordingly.
Fifth, TOPAS was identified to be more competitive than Galileo and Worldspan in core functions and system functions. However, TOPAS was identified to be less competitive than Galileo in the service functions. According to the results of the analysis of relative importance, some service functions (quickness and accuracy of the helpdesk, communication with employees) were shown to be ranked with higher importance than the ticketing function, indicating that if TOPAS does not make the effort to improve service functions, TOPAS may not be able to maintain its overall competitiveness steadily. Whereas Galileo was identified to be more competitive than Worldspan in both core functions and system functions, Worldspan was identified to be the least competitive of the four largest GDSs in core functions and system functions, indicating that Worldspan should first supplement core functions and system functions when improving its functions.

Finally, as global GDS companies and various foreign airlines entered the domestic aviation market due to the expansion of routes, foreign airline reservation and ticketing functions became important. Besides, the change in travel patterns has increased the number of air reservations and tickets for individual travelers, and the importance of additional functions such as hotels and rental cars is growing. In addition, various changes are taking place in the aviation and travel markets, including the expansion of the online travel market and the development of real-time aviation search engines.

These changes indicate that Korean GDS companies’ technology development or marketing strategies focusing on the reservation and issuance functions of national airlines are no longer effective. Therefore, it is crucial to design the development of technologies for various additional functions based on stable systems. Furthermore, there should be more efforts to respond to market diversification with customized system configurations tailored to travel agencies’ business patterns such as B2B, B2C, commercial, and Wholesale, and to specialize other GDSs as non-replaceable systems.

Regarding the theoretical contribution of this study, since the domestic GDS market is in the stage of making change and forming new growth, this study can be meaningful in that it analyzed the directions of the development of individual GDSs as well as the competitive advantages among the GDSs according to user gratifications in terms of marketing. The theoretical implications obtained in this study are as follows.

First, this study conducted a Delphi survey with a group of experts to derive items for analysis of the competitive relationships among the four largest domestic GDSs. The first meaningful contribution of this study is that it derived evaluation items for the competitive relationships among the GDSs, and the priorities obtained through the foregoing provide basic data for related studies to subsequent researchers. Second, since GDSs are important reservation systems that are indispensably used in the tourism industry, particularly by travel agencies, studies related to the functions of GDSs, user gratifications, and competitive relationships can be said to be important. However, most of the studies conducted thus far have limitations in that they have mainly been conducted with limited domestic airline-based CRSs (e.g., Abacus, vs. TOPAS), and among CRS functions, they have only dealt with airline reservation services. Therefore, this study can have major implications in that it is the first competitive relationship study conducted with all four of the largest domestic GDSs (TOPAS SellConnect, Asiana-Sabre, Worldspan, and Galileo).

Third, this study conducted analyses differentiated from existing competitive relationship studies by analyzing competitive and complementary relationships by function by applying the niche theory and gratification factors. The primary theoretical contribution of this study is that, while quite a few studies related to competitiveness evaluation in the tourism and hospitality industries have conducted absolute-level evaluations of certain criteria, the niche theory introduced in this study is a competitiveness evaluation focusing on the dual relationships between certain resources existing in the market. Although the application of the niche theory in the tourism industry is still in its infancy, this study attempted to apply the theory as a framework useful for the analysis of relationships among groups competing for similar resources in the same market (e.g., low-cost airlines). The results suggested the expansion of the theoretical background of research in the field of tourism and suggested new research directions to future researchers. Fourth, by understanding the resource utilization of
each GDS and the degree of overlap of resources through niche analysis, rather than simply showing the degree of competition, this study concretely presented what positions individual GDSs occupy in the market and in which directions they should proceed hereafter.

Despite study contributions, this study analyzed only the functional competition of each GDS and did not reveal the causal relationship of how each factor affects user satisfaction. Therefore, it will be necessary to empirically test the influential relationships between each function's perceived performance and user satisfaction in future studies.

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