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Market Share Forecast Reflecting Competitive Situations in the Telecommunication Service Industry

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통신서비스산업에서 경쟁상황을 반영한 시장점유율 예측

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Most demand forecasting studies for telecommunication services have focused on estimating market size at the introductory stage of new products or services, or on suggesting improvement methods of forecasting models. Although such studies forecast business growth and market sizes through demand forecasting for new technologies and overall demands in markets, they have not suggested more specific information like relative market share, customers' preferences on technologies or service, and potential sales power. This study focuses on the telecommunication service industry and explores ways to calculate the relative market shares between competitors, considering competitive situations at the introductory stage of a new mobile telecommunication service provider. To reflect the competitive characteristics of the telecommunication markets, suggested is an extended conjoint analysis using service coverage and service switching rates as modification variables. This study is considered to be able to provide strategic implications to businesses offering existing service and ones planning to launch new services. The result of analysis shows that the new service provider has the greatest market share at the competitive situation where the new service covers the whole country, offers about 50% of existing service price, and allows all cellphones except a few while the existing service carrier maintains its price and service and has no response to the new service introduction. This means that the market share of the new service provider soars when it is highly competitive with fast network speed and low price.

Keywords : Demand Forecasting, Telecommunication Service Industry, Market Share

1. Introduction

Almost all businesses are eager to develop and offer new products or services that fit customer needs and rapidly changing business environments [12]. Such endeavors are crucial for survivals of businesses, and it is more crucial to companies in the rapidly expanding service sector [4].

Demand forecast before product launch is especially important when it needs a huge investment in R&D and other initial expenditures (e.g., the launch of a mobile telecommunication service requiring high-end technologies and facilities). Outcomes of demand forecast can be important basic data for strategic decision making such as when to introduce a new service, service design, price structure, price, capacity planning, and sales channels.

Most demand forecasting studies for telecommunication service have been based on diffusion theory and the Bass model [2]. However, the previous studies have not retrieved more strategic information from the forecasting like delivering

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potential market share or service attributes customers prefer, and they have offered no more than forecasting or improvement methods of forecasting models. It is important for a company preparing a new product/service launch to know information on marketability such as expected demand, revenues, and earning rate as well as the size of new product market.

This study tries to predict market share in each competitive situation coming from a new service launch in the mobile telecommunication service market. Conjoint analysis is used to construct optimal service features, decide optimal prices, and predict market shares, where the customer preferences on each attribute of new service is analyzed [13].

2. Theoretical Background

2.1 Telecommunication Service Demand Forecasting

Most demand forecasting studies in information and communication technologies have adopted the product diffusion model developed in the marketing area. Such studies including Bass model [2] focused on developing diffusion models to forecast the market size changes over time [17].

Especially, the Bass model [2] has been extended by many researchers in various ways because its conceptual interpretation to population is easily mixed with marketing-based variables such as potential market sizes, effects of voluntary intention to subscribe service (innovation effects), and effects of existing subscribers (imitation effects).

Diffusion model targeting single product was advanced to multi-generation diffusion models to explain the phenomena in which two or more products are competing and replace each other. Fisher and Pry [6] and Norton and Bass [14] are exemplary studies of multi-generation diffusion models. As attributes or technologies around a service industry advance, the multi-generation diffusion model better explains an S-shape curve of new service substituted by that of the previous services with combination of two or more non-linear curves [11].

2.2 Conjoint Analysis

Conjoint analysis is a leading method analyzing consumers' utilities. Conjoint analysis compares similar products and predicts their demand by estimating consumer's utility of each attribute on the product. As a marketing research method, conjoint analysis, in other words, evaluates consumers' composite preference on service/product or ideas on it by measuring relative importance of each attribute and predicts what products consumers actually choose. Conjoint analysis is utilized for various purposes such as new product development, decision-making on attributes of product through positioning, analysis of competitive structure, pricing, market segmentation, and forecasting market share and sales volume [15].

Green and Wind [7] introduced conjoint analysis as a tool measuring new consumers' decisions. Conjoint analysis evaluates combinations of various levels of product attributes and then relative importance of the attributes. Cattin and Winttink [3] investigated utilization of conjoint analysis and found that it was used most for consumer products (59 %), followed by industrial products (18 %), the financial area (9%), and the service sector (9%). They also found it used new product development, competitive analysis, pricing, market segmentation, re-positioning, and advertisement. According to Hair et al. [8], conjoint analysis is defined as a multivariate technique particularly used to understand how to represent respondents' preferences to products or service. That is, conjoint analysis is a mathematical method comparing attributes of products or service the most suitable for customer wants, and often adopts the experimental design with virtual products [13].

The first step of using conjoint analysis for an industry is to select attributes of products/service, which are the results of strategic positioning and technological possibility. After the selection, combinations of attribute levels are formed using prototypes or concept cards. Consumer respondents express their preferences on the profiles by ordinal scale or else, and the data are used to set up the level of product attributes and to forecast market the response from the market [19]. Utilizing conjoint analysis, this study conjectures market share of 5G mobile telecommunication service market when the service is launched, grasping importance and preferences of service attributes.

3. Estimating Preferences for Telecommunication Service Attributes

3.1 Service Attributes and Attribute Levels

We selected service attributes and attribute levels, which will be used for conjoint analysis, as shown in <Table 1>.

<Table 1> Attributes and Attribute Levels for Conjoint Analysis

Attribute	Levels of Attribute
Download Speed	①500Mbps (LTE or 5G). ②1Gbps (Data-Advanced).
Cellphone	①Only particular cellphones are applicable. ②All cellphones except a few are applicable. ③All cellphones are applicable.
Price	①The same as existing service price. ②About 75% of existing service price. ③About 50% of existing service price.
Coverage	①The capital region and 6 metropolitan cities. ②The capital region, 6 metropolitan cities, and 76 cities. ③The whole country.

Using stimulus (attribute levels), ordinary data should be gathered from respondents for conjoint analysis. The data can be gathered by the profile design, where the numbers of attributes and attribute levels should be controlled. In the profile design, appropriate profile sets (pseudo products) are chosen by considering main effects of service attributes. This study utilizes a SPSS statistical tool, ORTHOPLAN procedure that can generate the minimum number of pseudo products appropriate for analyzing product attributes. Using orthogonal arrays and statistical methods, ORTHOPLAN procedure offers the same effects on further analyses as selecting all combinations of pseudo products [1, 20]. The orthogonal arrays chose 9 combinations of pseudo products from 4 attributes out of 54 combinations (2×3×3×3 = 54) for this study, which is enough to analyze customer preferences.

3.2 Measuring the Relative Importance of Attributes

Utility of respondents from each attribute level, that is, part-worth estimates can be discovered through the regression where the preference order is set as a dependent variable and the dummy variable coded by product attributes is set as an independent variable. Also, the preference order is inverse-coded to make its relationship with part-worth estimates (utility) positive [5].

<Table 2> shows the results of conjoint analysis, the utility value of each level and the relative importance of each attribute. The importance means an amount of utility change over levels within an attribute, thus the difference between the greatest and the least utilities. The sum of the 4 relative importance values are 100. In case an analysis uses ordinal data, Kendall's tau represents reliability of analysis results through a correlation coefficient between the input preference order and its estimate.

<Table 2> Results of Conjoint Analysis

Attributes		Utility	Significance
Speed	LTE or 5G Data-Advanced	-.4543 .4543	16.92
Cellphone	Only particular All except a few All cellphones	-.4533 -.0383 .4917	17.60
Price	The same About 75% About 50%	-1.3167 .4437 .8730	40.78
Coverage	Capital and 6 Capital and 82 Whole country	-.6080 -.1103 .7183	24.70

4. Estimating Market Share

4.1 Initial Market Share

In this step, a market share of each service product according to competitive situations is predicted. To do this, expected competitive situations are derived by scenarios and preference values should be applied.

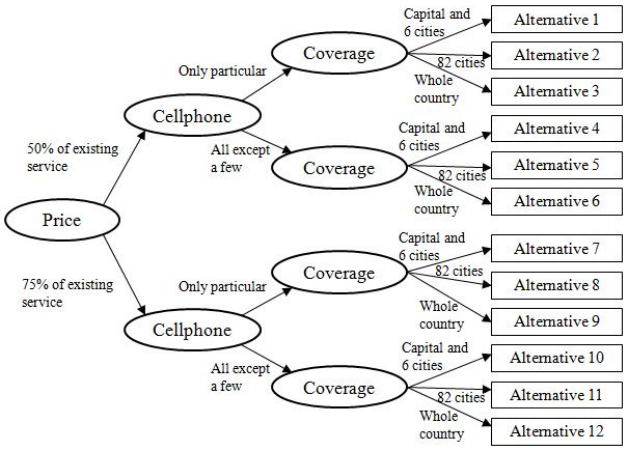
4.1.1 Expected Competitive Situations

Credible competitive situations are constructed by combinations of existing and the new pseudo service products. <Table 3> shows a competitive situation example where the two products with different attributes compete with each other. Even though there are 54 (2×3×3×3 = 54) possible options for new service from 4 attributes, some of the options that are not credible are ruled out from the analysis.

<Table 3> A Competitive Situation Example

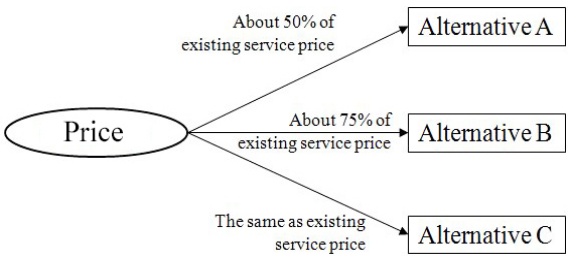
Attribute	New Service	Existing Service
Coverage	The Capital and 6 metropolitan cities	Whole country
Price	About 50% of existing service	The same as existing service
Cellphones	Only particular cellphones	All cellphones
Speed	Data-Advanced	LTE or 5G

It is assumed that new mobile service carriers (1) offer hypothetical Data-Advanced networks, (2) set the service prices cheaper than existing service's (50% or 75%), (3) expand the coverage over product lifecycle, and (4) may not offer their service applicable to all cellphones at first as new entrants. Therefore, it is assumed that "price" and "cellphone" attributes have 2 options each and "coverage" has 3 options for further analysis as shown in <Figure 1>.



<Figure 1> Possible Alternatives of New Mobile Service(Data Speed Option is Set to Data-Advanced.)

It is also assumed that the existing mobile service carrier builds a nationwide network (coverage) with LTE (or 5G) networks (data speed) and high compatibility (cellphones) (see <Figure 2>). It is reasonable that price attribute only has multiple options for existing service.



<Figure 2> Possible Alternatives of Existing Mobile Service (Data speed is set to LTE, Cellphone Option is Set Applicable to all Devices, and Coverage is Set to the Whole Country.)

Since the new service carrier has 12 alternatives and the existing carrier has 3, total 36 competitive situations are constructed. After excluding 6 situations where the existing service is cheaper than the new one, 30 situations are decided to be the subject of analysis.

4.1.2 Prediction of Initial Market Share

There are two steps to predict initial market share. The first step is to calculate probability of selecting service through simulation based on the results of conjoint analysis. Second, a market share estimate is actually calculated by additional analysis with the probability of selecting service calculated in the first step. After the data are added and the raw file for consumer preferences is loaded to the simulation program, the program can measure the preferences to the two hypothetical service products, the existing service and the new one. We applied Bradly-Terry-Luce (BTL) model to predict the initial market share based on the simulation results in second step. That is BTL model can deduce the market share by calculating from products' utility values and product selection probabilities

For instance, assume that the simulated values are 5.4 for new service provider adopting alternative 1 and 4.6 for existing service provider with alternative A. The initial market shares for both new and existing service providers can be generated as follows.

Initial market share of new service provider :

$$BTL_{new} = \frac{5.4}{5.4+4.6} \times 100(\%) = 54.1\%$$

Initial market share of existing service provider :

$$BTL_{existing} = \frac{4.6}{5.4+4.6} \times 100(\%) = 45.9\%$$

4.2 Revised Market Share

Market shares of existing and new service products, which were predicted in the previous stage, are results based on consumers' preferences. However, such measures may not be very realistic since there is an assumption that the two service carriers have the same level of brand image, coverage, competitive stage and surrounding, and service choice rate. Market share values need to be revised to reflect such variables for more objective and practical prediction of market shares. Therefore, this study applies regional coverage rate (G_n) and service switching rate (F) to initial market share (BTL_i) drawn from conjoint analysis for the revised market share.

4.2.1 Regional Coverage Rate

Regional coverage rate is calculated by service coverage that means the area where physical service is available. To reflect regional coverage rates to market shares by competitive situations with initial market shares of BTL values, this study establishes three different stages along the expansion plan of mobile communication service coverage, introduction (G_1 = 0.692 : the capital region and 6 metropolitan areas), growth (G_2 = 0.956 : 82 cities), and maturity (G_3 = 1.000 : nation-wide) phases.

This coverage classification is what three major mobile carriers generally apply in new service launches and each phase usually lasts from six to twelve months. This study sets the duration of each phase to one year.

4.2.2 Service Switching Rate

It would be convenient if purchase probability is drawn by preferences. It is because the multiple attribute preference model is generally utilized in the product development phase. On assumption that each respondent chooses purchasing the product preferred to others may not true in many cases. For example, customers consider switching costs when they change mobile service to a new one [10, 16]. Switching costs include nonmonetary costs such as emotional endeavor and individual habits as well as monetary costs such as transaction and learning costs.

Such possibility can be taken into consideration by preference-rank translation that is a method drawing different purchasing probability values over customers' priorities on product preferences [19]. Silk and Urban [18] found in the soap market that 83% of respondents who preferred a new product the most, 15% of respondents who secondly preferred the product, and 2% who thirdly preferred actually purchased it. Hauser et al. [9] found that the percentages are 76%, 16%, and 8% in the public transportation service industry.

This study adopts the percentages in the conference call system market, which are 80% of respondents mostly preferred and 20% of respondents secondly preferred. That is, the service switching rate (F) is calculated with the assumption that 80% of the respondents who strongly agreed to switch to the new mobile telecommunication service in survey and 20% of the respondents who moderately agreed would actually switch to the new one.

4.2.3 Revised Market Share

To calculate the revised market share, the variables previously discussed in this section are applied. A calculation formula of revised market share of a new service provider at a competitive situation of new service with alternative 1 and existing one with alternative A in the first year (MS_{rev}) is as follows :

$$MS_{rev} = BTL_{new} \times G_1 \times F,$$

where MS_{rev} : Revised market share in the 1st year,
BTL_{new} : Initial market share from simulation,
G_1 : Coverage rate (introductory period), and
F : Service switching rate.

Market shares of the new and existing services after simulation (BTL_i) for the assumed competitive situation are 54.1% and 45.9%, respectively. The initial service coverage (G_1) which is the capital region and 6 metropolitan cities, is calculated by the rate of respondents who live in those areas, 69%. The service switching rate used 0.197 which is calculated previously in this section. As a result, the revised market share of the new service in the 1st year (MS_{rev}) is 7.37%.

$$\begin{aligned} MS_{rev} &= BTL_{new} \times G_1 \times F \\ &= 54.1(\%) \times 69.0(\%) \times 0.2 \\ &= 7.5(\%) \end{aligned}$$

The revised market share of the existing service, thus, is 92.5%. Using this formula, revised market shares with all combinations of competitive situations can be calculated.

5. Result

First, we calculated the initial market shares of new and existing service providers assuming market shares of the two service providers are not dependent on the competitive situation. Then the revised market shares were obtained by considering the oligopoly state of mobile telecommunication service market and expected barriers to entry. The initial and revised market shares for competitive situations formed from the strategies new and existing service providers are assumed to adopt are shown in <Table 4>.

The range of new service market shares over situations is from 6.0% to 12.0%, which seems realistic since the market share of LGU+, that is in the third out of three major mobile carriers of South Korea, is less than 15%.

Compared to the existing service, the new service has the greatest market share at Competitive Situation 24 in which the new service covers the whole country, offers about 50% of existing service price, and allows all cellphones except a few while the existing service carrier maintains its price and service and has no response to the new service introduction. This means that the market share of the new service provider soars when it is highly competitive with fast network speed and low price.

Therefore, a business that plans to enter the mobile communication service market may need to lay out a scheme offering high-speed networks, low price, broad coverage, and high compatibility with devices in no time. On the other

<Table 4> Initial and Revised Market Shares over Competitive Situations

No	Service Provider	Competitive Situation	Market Share(%)	
			Initial	Revised
1	New	Alternative 1	45.9	7.4
	Existing	Alternative A	54.1	92.6
2	New	Alternative 2	43.7	10.6
	Existing	Alternative A	56.3	89.4
3	New	Alternative 3	40.5	11.7
	Existing	Alternative A	59.5	88.3
4	New	Alternative 4	47.9	7.1
	Existing	Alternative A	52.1	92.9
5	New	Alternative 5	45.6	10.2
	Existing	Alternative A	54.4	89.8
6	New	Alternative 6	42.1	11.4
	Existing	Alternative A	57.9	88.6
7	New	Alternative 1	54.0	6.3
	Existing	Alternative B	46.0	93.7
8	New	Alternative 2	51.8	9.1
	Existing	Alternative B	48.2	90.9
9	New	Alternative 3	48.5	10.1
	Existing	Alternative B	51.5	89.9
10	New	Alternative 4	56.0	6.0
	Existing	Alternative B	44.0	94.0
11	New	Alternative 5	53.7	8.7
	Existing	Alternative B	46.4	91.3
12	New	Alternative 6	50.1	9.8
	Existing	Alternative B	49.9	90.2
13	New	Alternative 7	44.0	7.6
	Existing	Alternative B	56.0	92.4
14	New	Alternative 8	42.0	10.9
	Existing	Alternative B	58.0	89.1
15	New	Alternative 9	39.1	10.1
	Existing	Alternative B	60.9	89.9
16	New	Alternative 10	45.9	7.4
	Existing	Alternative B	54.1	92.6
17	New	Alternative 11	43.8	10.6
	Existing	Alternative B	56.2	89.4
18	New	Alternative 12	40.6	11.7
	Existing	Alternative B	59.4	88.3
19	New	Alternative 1	52.1	6.5
	Existing	Alternative C	47.9	93.5
20	New	Alternative 2	50.1	9.4
	Existing	Alternative C	49.9	90.6
21	New	Alternative 3	47.0	10.4
	Existing	Alternative C	53.0	89.6
22	New	Alternative 4	54.0	6.3
	Existing	Alternative C	46.0	93.7
23	New	Alternative 5	51.8	9.1
	Existing	Alternative C	48.2	90.9
24	New	Alternative 6	48.6	12.0
	Existing	Alternative C	51.4	88.0
25	New	Alternative 7	55.6	6.0
	Existing	Alternative C	44.4	94.0
26	New	Alternative 8	53.4	8.8
	Existing	Alternative C	46.6	91.2
27	New	Alternative 9	50.1	9.8
	Existing	Alternative C	49.9	90.2
28	New	Alternative 10	53.8	6.3
	Existing	Alternative C	46.2	93.7
29	New	Alternative 11	51.7	9.1
	Existing	Alternative C	48.3	90.9
30	New	Alternative 12	48.6	10.1
	Existing	Alternative C	51.4	89.9

hand, Competitive Situation 10 gives the new service the least market share. In the situation, the service covers the capital region and 6 metropolitan cities and allows only particular cellphones while the existing service provider lowers its price to neutralize the competitive edge of the new service.

Since existing service providers that usually have vast amounts of funding and distribution channels could overcome price attacks from new service providers without difficulty, new businesses need to look out for such a defense of competitors.

6. Conclusion

This study predicted through analyzing market shares demand changes in the mobile communication service industry after a new service launch. Most demand forecasting studies analyze demands of new technologies and overall demands in markets, and forecast business growth and market sizes. However, the previous studies have not suggested more specific information like market shares and customers' preferences on individual providers, technologies, and services. To overcome these limitations, this study measured preferences of new mobile communication services though conjoint analysis, and drew revised market shares of the services reflecting competitive situations and customers' intentions to switch. The revised market shares were drawn since these are believed to better explain the competitive environment of the mobile service market and weaknesses of its new entrants.

The fact that revised market shares reflecting consumers' preferences to service attributes help practitioners to make strategic decisions is of great significance. Combined with market size, such information can be used as important data to estimate the number of subscribers, revenues, and ARPU. Also, this study added coverage expansion plans of service providers and service switching rates of customers to the estimation to increase practicality and validity, making up for weak points of conjoint analysis.

A prediction of the size of the overall market could not be done since this study placed major emphasis on compensating for the weak points of previous studies and estimating the market share of an individual service, which would be meaningful data especially to practitioners. If market shares are drawn with market size prediction using diffusion model, more objective and practical data are considered to be given.

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