

[Field Research]

A study on the evaluation of and demand forecasting for real estate using simple additive weighting model:

The case of clothing stores for babies and children in the Bundang area

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Abstract

Purpose - This study was conducted under the assumption that brand A, a store of company Z of Pangyo, with a new store at Pangyo station is targeting the Bundang-gu area of the newly developed city of Seongnam.

Research design, data, methodology - As a result of demand forecasting using geometric series models, an extrapolation of past trends provided the coefficient estimates, without utilizing regression analysis on a constant increase in children's wear, for which the population size and estimated parameter were required.

Results - Demand forecasting on the basis of past trends indicates the likelihood that sales of discount stores in the Bundang area, where brand A currently has a presence, would fetch a higher estimated value than that of the average discount store in the country during 2015. If past trends persist, future sales of operational stores are likely to increase.

Conclusions - In evaluating location using the simple weighting model, Seohyun Lotte Mart obtained a high rating amongst new stores in Pangyo, on the basis of accessibility, demand class, and existing stores. Therefore, when opening a new counter at a relevant store, a positive effect can be predicted.

Keywords : Locational Assessment, Demand Forecast, Demand forecasting method, Entropy.

JEL Classifications : M11, M16, M31.

1. Introduction

The market of children's wear is constantly changing keeping pace with buyer's desire changing quickly while accepting diverse social-economic impact such as specialty depending on birth frequency and zodiac sign, low childbirth, and economic recession. Especially since children's wear which has a dualized structure separating user and buyer has a specialty to have to meet the desire of both of them at

the same time, the product composition and distribution differentiated from adult wear is needed. Also specialization, upgrading quality, age segmentation of existing brand, reorganization of market, feature of market polarization of super-low price and high price became remarkable in the product. In case of children's wear, while the share of traditional market was overwhelming with 95% in 1970s, the proportion of department store and outlet increased in 1980s and in 1990s, as proportion of traditional market declined, it started to be diverse by appearance of new type of distribution like special outlets, permanent discount stores. (Hee-Sook Kim 1994)

Recently, diversification of distribution form such as high quality imported edition shop, outlet, discount store, and internet shopping mall is being accomplished more actively and they are maximizing the efficiency through complex distribution form supplementing merit and demerit mutually each distribution form has through diverse distribution rather than sticking to one distribution form. Among them, as customers pursue one stop shopping, counters entering into large shopping facilities(department store and discount store) paying commission are prevalent. In the situation the change of this distribution environment and form is proceeding quickly, this study would predict location and demand of children's wear counter targeting children brand of Z company(A brand, F brand, S brand) focusing on Bundang-gu, Seongnam city, a new city which has a high population density because the change and prediction of commercial power within region are needed.

Meanwhile, this study is aimed to provide basic material which can measure distribution environment within the region and be used for a material which can predict the change of commercial power through it to provide materials to be use for policy material of self-governing body in charge of regional economy. The study method to realize this goal is largely divided into two things, one is simple weighting model for location evaluation section, and another is straight line model and geometric series increase model for demand forecasting section.

2. Theoretical consideration and present condition

2.1. Precedented study consideration

Although diverse studies carried out before this study, author would consider studies related to this study among studies similar to this. First considering studies related to location evaluation or demand forecasting, Yung-Woo Hwang-Tae-Chang Ryu(2005) implemented lo-

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cation evaluation and demand forecasting targeting theaters located in 16 basic counties-districts in Busan. They deduced quantitative result value using direct-indirect DATA. Seung-Ha Lee(2011) grasped how commercial power formed through use and purchase form of consumers using UEC(Urban Entertainment Center) and compared and analyzed use behavior of consumers, consumer behavior about large discount store choice, residence distribution of customers using UEC, commercial power range differentiation factor, and management strategy and location to grope a plan of competitiveness improvement. Hyung-Sook Baek(2010) measured sum sales of 2007 and 2008 as dependent variable targeting 173 Hyundai Motor-operated stores in Seoul and Gyeonggi regions and determined number of furniture, number of population density company, number of company employees, population increase rate, local tax, subway station distance, cross-walk distance, number of one way, business period, size of sale exhibition hall, number of parked cars, and estimations representing location feature of these sale exhibition halls as a dependent variable and analyzed the impact location feature gave to sales through present condition and empirical analysis on these materials.

Second, for the study on choice impact of department store and large discount store, Chang-Moo Lee-Yong-Kyung Kim-Jae-Hong Min(2007) analyzes that features like brand value, number of product, operation time is working as choice factor about factor of choosing large discount store focusing on Bundang, Seongnam in Gyeonggi. Jae-Poong Jeon(2010) determines that impact factor of department store choice derives from location difference among regions regarding station commercial power, residence, and school as background. Finally, for the other studies, Yong-Cheon Lee(2010) analyzes that parking facility, chain size, and consumed distance(location) should be considered as an important variable particularly to found foreign food company in a study of foreign food company foundation variables.

This study would evaluate through quantitative method and model based on more objective materials rather than existing studies on location evaluation. Also it can be said that it is a big difference from other studies to have acquire objectiveness and scientific nature by inspected item through diverse methods and researches to calculate this result.

2.2. Present condition and size of domestic children’s wear market

As society develops and sense of value changes, women are likely to attach importance to social activity or success rather than marriage or child care. Hereupon many women defer marriage time for stable social life or avoid delivery even after getting married to cause reduction of childbirth rate and children population consequently. The constant reduction of children population led to downturn of domestic children’s wear market with intensified competition among companies, low understanding of quickly changing purchaser behavior, bankruptcy and M&A due to 2004 recession. Although temporary growth was shown as marriage rate and delivery rate jumped due to the effect of always spring year and golden pig year in 2006 and 2007, as aftermath of global finance anxiety in 2007 led to real economy recession in 2008, overall clothing consumption expenditure decreased and the growth of children’s wear market shriveled largely.

The size of children’s wear market in domestic clothing market started to increase from 2006 and is showing a little rise constantly <Figure 2>. The size is 1 trillion 200 billion won in 2007, 1 trillion 500 billion won in 2008, and about 1 trillion 800 billion won which increased by around 20% compared to last year in 2009 making us expect a constant growth <Figure 3>. This growth of children’s wear market can be said as a result that the increase of children-related

<Figure 1> Precedented study consideration

Researcher	Research contents	Research results
Yung-Woo Hwan Ryu, Tae-Chang (2005)	Forecasted demand using geometric curve form and line form targeting 16 counties-districts in Busan location of theaters on plan currently and used entropy and estimated weight to analyze location evaluation through point model (HAW), a decision-making method.	Looking at result value of point model, the place where inner city businesses and accessibility were higher than other theaters was evaluated the highest and the place where low result value was calculated in traffic(number of bus stop, subway connection) part got a low rating in synthetic evaluation.
Hyung-Sook Baek (2010)	Suggested competitiveness plan through location analysis through diverse analysis materials by study which implemented development of UEC in Dong-gu, Daegu and commercial power analysis.	As a result of analyzing Lotte shopping mall and E-mart in Dong-gu, Daegu, commercial power impact of Lotte Plaza appeared to be much bigger and as seen in this result, she suggested entertainment which can meet consumption desire of consumers should be developed constantly.
Seung-Ha Lee (2011)	Suggested impact location feature gave to sales targeting 173 Hyundai Motor-operated stores in Seoul and Gyeonggi regions.	As a result of empirical analysis, it was analyzed 4 location factors such as number of furniture, number of company employees, estimations, and size of sale exhibition hall influenced sales.
Chang-Moo Lee Yong-Kyung Kim Jae-Hong Min (2007)	Analysis of choice factor of large discount stores – focusing on commercial areas near Bundang new city	They showed that accessibility of large discount store is the most important factor in choosing large discount store of purchaser and operational features like brand value of large discount store, number of handled product, and operation time is working as an important choice factor
Jae-Poong Jeon (2010)	Analysis of store choice impact factor of department store customers – focusing on department store in Suwon city	It was shown that use frequency, consumed amount, main goal, purchased objects, transportation, starting place, and consumed residence time were different depending on department stores. It can be said it derives from location difference among regions which regard surrounding commercial power, station commercial power, residence, and schools as a background.
Yong-Cheon Lee (2010)	Study on foundation variables of foreign food company by stochastic store choice model	Store choice likelihood model – parking facility, chain size, consumed distance(location), and variable on open sea which are most powerful should be considered particularly to found foreign food company

product and children consumption was supported due to 2 consecutive years feature of always spring year and golden pig year. Furthermore, it is also because the demand for high quality children's wear increased as intensive investment on small number of children increased due to increase of income level and low delivery rate.

they are examining mother company uses it for a bridgehead. Diverse foreign food businesses are the strategy for making synergy in manufacturing, mother company's original business, by rearing solid brand.

3. Study method

3.1. Demand forecasting method

Although demand forecasting on commercial facilities should be accomplished based on diverse materials like regional economic feature, change of commercial power, and demand class, this study predicted using only the most fundamental item considering limit of material collection, average change of demand class, and users. This study forecasted through exponential model.

$$P_{t+n} = P_t(1+r)^n$$

$$r = \frac{1}{n} \sum (P_{t+n} - P_t) / P_t$$

P herein means population t = time, n = time unit number, b = time unit average increase amount.

3.2. Commercial power analysis model

3.2.2. Simple Additive Weighting method

In simple additive weighting method(SAW), decision-maker must provide relative weight on each element as simple number and each element should be able to be compared among each element. Total score on each alternative should be obtained by multiplying standardized valuations of each element by weight of elements.

When relative weight is $w = (w_1, \dots, w_n)$, A^* of which preference is highest is evaluated as follows.

$$A^* = \left\{ A_i \text{ Max}_i \left(\frac{\sum_{j=1}^n w_j v_{ij}}{\sum_{j=1}^n w_j} \right) \right\}$$

Herein v_{ij} is a comparable estimate that alternative I measured by simple number scale in element j.

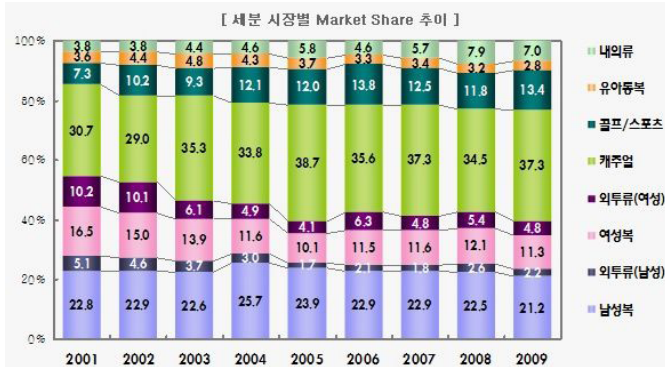
3.2.2. Outline of weight used for analysis

Weight in this study used entropy. Concept of entropy is used in physics information theory, entropy in information theory becomes an uncertain scale shown as separate probability distribution P_i . The scale on uncertainty introduced by Shannon is

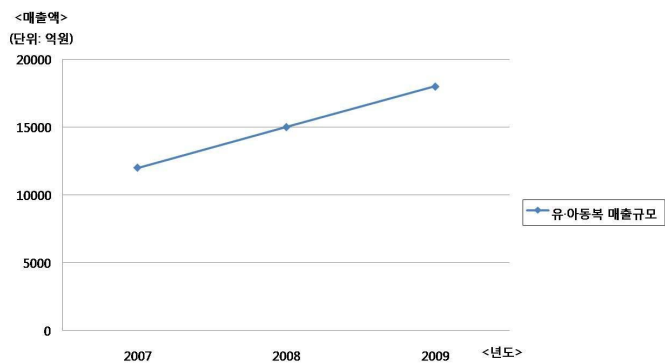
$$H(p_1, p_2, \dots, p_n) = -k \sum_{i=1}^n p_j \log p_j$$

$k = \text{counting number}$

At this time, all P_j have the same value, in short if $P_j = 1/n$, value of $H(p_1, p_2, \dots, p_n)$ becomes the maximum. Since P_{ij} , a weight on element j of alternative I contains some information, information



<Figure 17> Size by segmented clothing market (Samsung Design Net)



<Figure 3> Size of children's wear market sales (fashion channel - market analysis)

2.3. Present condition of targeted company

Z company had displayed 'F brand' in 2007, 'S brand' in 2008 following children brand 'A brand' launching in last 2004. They have expanded power by showing even children skin care brand in 2008 and is showing a growth rate of yearly average 40.1% while recording sales of 62.2 billion won in 2007, 120.4 billion won in 2008, 152 billion in 2009, and 186.1 billion in 2010. Z company is aiming at sales of 210 billion won this year and expanded number of stores from around 490 last year to 518 in September currently continuing growth each year. Number of A brand is 252, F brand 166, S brand 100. Company is predicting that it will continue sales increase for a while by aggressive store expansion and favorable sale of new brand children skin care. Z company doing children's wear business is going well. They are developing joint marketing through strategic partnership as mother company and customer base are same. They want to create synergy by providing children supplies and service including dry milk and milk for children and provide customers with synthetic solution. Also Z company is constantly expanding Chinese counters,

amount of weight on element j can be measured by entropy.

When decision-making procession D which has m things alternative and n things elements, P_{ij} , the weight on element j of alternative I, is as follows.

$$P_{ij} = \frac{v_{ij}}{\sum_{i=1}^m v_{ij}}$$

Herein V_{ij} about all Is and js is each procession value.

Also in element j, entropy E_j about estimate P_{ij} is $E_j = -k \sum_{i=1}^m p_{ij} \log p_{ij}$, herein about all js k is a constant and $1/\log m$, d_j , level of diversity of information estimate suggests in element j is $d_j = 1 - E_j$ it is determined for all js. Herein W_j (regularized weight) is determined as follows.

$$w_j = \frac{d_j}{\sum_{j=1}^m d_j} \quad (j=1,2,\dots,n)$$

If decision-maker has h_j , a subjective weight in advance, W^{*j} , a weight to be evaluated is as follows.

$$w^{*j} = \frac{h_j w_j}{\sum_{j=1}^m h_j w_j} \quad (j=1,2,\dots,n)$$

4. Demand forecasting

$P_{t+n} = P_t(1+r)^n$, geometric series increase model, was used among past trend extending method (non-limit model) which can estimate figures although not utilizing regression analysis for constant increase of discount store-using population and parameter to be estimated currently.

In case of demand forecasting, author estimated based on sales of A brand that it passed the longest time after Z company launched brand to raise accuracy of materials more. Author estimated yearly sales, number of counters, and counter average from 2007 to 2011 when brand was launched based on the result of materials such as sales, business expense, business profit, and expense except for business by geometric series manner. As a result of predicting result value by using this method, geometric curve form was calculated by figure similar to past real sales, and as a result of implementing demand forecasting, sales of 2010 and 2011 deduced result value similarly with geometric curve form. Result value of demand forecasting can be seen in <Table 2> which calculated based on discount stores across the nation in which A brand entered and <Table 1> which calculated based on discount stores in which A brand entered in Bundang. Looking at sales of 2013 by discount stores, \sqsupset discount store was estimated to show the most yearly sales being estimated as around 381 million won followed by \sqsubset discount store(371 million won), \sqcap discount store(389million won). Case of 15 years was also estimated in order of \sqsupset discount store(420 million won), \sqsubset discount store(405 million won), and \sqcap discount store(393 million won). 3

discount stores were estimated to show sales over 400 million won averagely in 15 years. Also as a result of forecasting the number of discount store by year, it was expected the number would exceed 200 first in 2014 and yearly sales of discount store would exceed around 78 billion won.

<Table 1> Value of estimated result of yearly sales of A brand counter in Bundang

(unit: million won)

A brand counter	2011	2012	2013	2014	2015
\sqsupset discount store	345	367	381	402	420
\sqsubset discount store	309	349	371	386	405
\sqcap discount store	280	238	365	389	393

<Table 2> Forecasting yearly sales of discount store that used geometric series model

(unit: million won)

Year	Yearly sales of discount store	Number of counters	Average number of store
2010	40,560	130	312
2011	56,376	162	348
2012	66,060	180	367
2013	72,930	195	374
2014	78,692	206	382
2015	83,850	215	390

5. location evaluation

Bundang, one of 5 new cities of metropolitan, has been growing at a fast rate since development started in 1989. Bundang-gu has a size of 69.40km and 120 thousand households and 400 thousand population, and consists of 18 administrative dong. Apartment rate of Bundang is very high and income per household, rate of car possession, lifestyle, and consumption level are similar with Gangnam, Seoul. Also its traffic accessibility is very good as express way between Guri and Pangyo with Gyeongbu Express Way and Jungbu Express Way are connected to Bundang directly, and urban express way of round 6-lane between Bundang and Naegok and Olympic highway-connected express way are adjacent. Like this, due to high consumption level and good traffic accessibility of Bundang, great-sphere commercial power formation is possible so that there are many distributing companies in Bundang¹⁾. Bundang-gu is formed focusing on principal road and subway lane stretching out toward north and south according to Tanchon penetrating through Seongnam city and lattice road is facilitating connection within the region focusing on it. According to this feature of road connection, commercial district is developed focusing on subway stations in Bundang-gu. All

1) Bundang has as many number of large discount stores are open compared to population number as it can be expressed as exhibition hall of large discount store, it is a place where competition among other companies is more intensive than any other region. E-mart, Newcore, Lotte Mart, and Homeplus, domestic large distributing companies, are on operation in Bundang currently.

large discount stores other than Jeongja E-mart are located near subway station. Since large discount stores located near subway station have large unit of apartment complex as a background within station commercial power, they belong to typical location form of apartment close district. The reason this study conducted demand forecasting and location evaluation targeting Pangyo new store is because it is a region where high purchase power demand is abundant and upgrading of commercial power is expected as it became the maximum benefited region as new Bundang line was opened.

This study would look around good condition children's wear counters can established targeting Bundang-gu, Seongnam through researcher's evaluation item and evaluate location of children's wear counters having plan(development) possibility henceforth by using result value on it. It considered evaluation variable of study as a variable matched with study goal and tried to acquire trust and objectiveness through many-sided inspection using all kinds of literature, internet material, and expert interview considering comparing variables of all kinds of literature and internet materials considering precededent study of domestic/overseas commercial facility location.

The variable was set by 3 things of representative variable, complementary variable, easiness of material acquisition to correspond to study goal. The index in charge of complementary role to correspond to representative variable was selected as variable in complementary variable. Finally, for easiness of material acquisition, it set as a standard to entirely exclude when material acquisition is not easy.

<Table 3> evaluation variable-selecting standard

Selecting standard	Contents	Detailed items	note
Representative variable	Selecting basic item variable necessary for children's wear counter location	Traffic(accessibility) - consumed distance and time, number of bus connection	-
		Demand class - using population, school/nursery/ kindergarten	-
Complementary variable	Selecting index variable of complementary role except for representative variable	Counter size	-
Easiness of material acquisition	Excluding when material acquisition is not easy		-

Author set 5 categories and 12 variable group first through all kinds of literature and similar studies, internet materials for index selection. After that author chose variables not proper for this study through interviews of experts and corrected as 4 items 9 variables considering material acquisition and association of study. This study chose 3 items and 5 variables to inspect possibility of material acquisition.

Author conducted location evaluation with total 5 variables. Author conducted targeting distance and time to counter in traffic section, in case of demand class, conducted targeting using population and number of school. Although conducting targeting counter size in complementary variable finally, author omitted it as there were opinions that it was not related to counter size when using final variable. Weight

is calculated using entropy method based on each item. Procession value like below is calculated after going through standardization work of each item's material. Procession was expressed by $5X7$. The value of each procession was calculated by a value that divided sum of each line by each item.

<Table 4> Variable group-selecting stage

Stage	Number of variable group	Selecting method	note
1st stage	5 items and 12 variables	Selecting comparing items	Using all kinds of literatures, internet materials, and expert interview considering comparing variables of domestic/overseas similar studies
2nd stage	4 items and 9 variables	Selecting comparing variable	Inspecting possibility of material acquisition
3rd stage	3 items and 5 variables	Selecting final comparing variable	Inspecting possibility of material acquisition

<Table 5> Procession value

X1	X2	X3	X4	X5
0.041	0.023	0.019	0.082	0.013
0.041	0	0.032	0.065	0.039
0.069	0.071	0.039	0.092	0.032
0	0.033	0.048	0.035	0.047
0.120	0.129	0.116	0.115	0.143
0.041	0.122	0.094	0.096	0.078
0.082	0.018	0.010	0.054	0.084

footnote) X1(population), X2(distance), X3(time), X4(school), X5(number of bus stop)

w_j , a weight, was obtained by obtaining d_j , a diversity level of entropy and information of each element using p_{ij} . Using population 1.226, distance 1.192, time 0.853, number of school 0.193, number of bus stop 1.104, counter size 1.197 were calculated in E_j by each item. d_j , diversity level of information, was calculated based on E_j and weight value by each item was calculated. The result of each item was X1 0.162, X2 0.135 X3 0.144 X4 0.101 X5 0.112, using population and distance were calculated by high value. Relatively very low value was calculated in counter size. Refer to <Table 6>. Therefore the highest evaluation value was calculated in order of Pangyo, Yatap-dong, and Seohyun-dong if calculating value of location evaluation by county, district using weight value by each evaluation item by 5 variables except for counter size element, and the lowest evaluation value was calculated in order of Sunae-dong, Imae-dong. Refer to <Table 7>.

It represented final result value in <Table 9> based on result of weight calculated after conducting standardization work of materials of each item like above.

<Table 6> weight value by county/district using entropy

	X1	X2	X3	X4	X5
E_j	1.226	1.192	0.853	0.193	1.104
h_j	0.226	0.192	0.147	0.193	0.104
d_j	0.5	0.4	0.3	0.3	0.3
weight value	0.162	0.135	0.144	0.101	0.112

<Table 7> Result value of location evaluation by dong

	X1	X2	X3	X4	X5	Total
Pangyo new city	0.00036	0.00074	0.00340	0.00108	0.00300	0.00858
Yatap-dong	0.00030	0.00068	0.00285	0.00054	0.00300	0.00737
Imae-dong	0.00021	0.00064	0.00180	0.00030	0.00120	0.00415
Seohyun-dong	0.00024	0.00091	0.00360	0.00027	0.00270	0.00772
Soonae-dong	0.00028	0.00027	0.00124	0.00025	0.00154	0.00358
Jeongja-dong	0.00035	0.00068	0.00280	0.00087	0.00189	0.00659
Gumi-dong	0.00034	0.00080	0.00250	0.00025	0.00149	0.00538

<Table 8> Z-score value

	X1	X2	X3	X4	X5
Pangyo store	1.31358	-0.83116	0.19781	1.82807	-1.86203
Migeum 2001 outlet (A brand opening)	-0.98388	0.35866	0.64863	-0.99469	0.87354
Yatap New Core (A brand opening)	0.2271	0.20584	0.45542	-0.05377	0.87354
Yatap Homeplus (A brand opening)	0.2271	0.70797	-0.0276	-0.05377	-0.09195
Seohyun Lotte Mart	-0.95246	-1.35512	0.63252	-0.43013	-0.25287
Ori Homeplus	-0.98388	1.54848	0.29441	-0.99469	-0.41378
Jeongja E-mart	1.15245	-0.63467	-2.20119	0.69897	0.87354

<Table 9> Final result value

	X1	X2	X3	X4	X5	Total
Pangyo store	0.00036	0.00074	0.00340	0.00108	0.00300	0.00858
Migeum 2001 outlet (A brand opening)	0.00034	0.00080	0.00250	0.00025	0.00149	0.00538
Yatap New Core (A brand opening)	0.00030	0.00068	0.00301	0.00054	0.00300	0.00753
Yatap Homeplus (A brand opening)	0.00030	0.00068	0.00285	0.00054	0.00300	0.00737
Seohyun Lotte Mart	0.00024	0.00091	0.00360	0.00027	0.00270	0.00772
Ori Homeplus	0.00034	0.00080	0.00280	0.00025	0.00189	0.00608
Jeongja E-mart	0.00035	0.00068	0.00280	0.00087	0.00189	0.00659

6. Conclusion

This study conducted demand forecasting based on A brand which passed over 5 years after being launched among three brands of Z company in Bundang, Seongnam, Gyeonggi which had a high population density. Demanding forecasting was conducted targeting only discount store except for agencies or company-operated stores and store average sales was calculated which divided yearly sales, relevant sales of discount store across the country by number of store, and besides, the demanding forecasting on discount store in Bundang was conducted.

As a result of conducting demand forecasting through geometric series model among past trend extending way which could estimate coefficient even though not using regression analysis on constant increase of demand population for children's wear and parameter to be estimated, it was estimated demand forecasting of discount stores around the country was yearly sales of 84 billion, number of counters was 215 and yearly store average sales per counter was expected to be around 390 million. Also yearly store average sales of A brand counters in discount stores being operated currently in Bundang was

around 400 million and the higher value of estimated result than store average of discount stores around the country was deduced.

In location evaluation conducted as second, as a result of calculating weight through entropy model first, author could know while using population and distance largely influenced, size of counter did not influence largely on the contrary. As a result of conducting evaluation by county/district using weight value by each evaluation item by 5 variables, the highest evaluation value was deduced in order of Pangyo, Yatap-dong, and Seohyun-dong, and the lowest evaluation value was deduced in order of Sunae-dong, Imae-dong. Also as a result of discount stores location evaluation with a result of location evaluation by county-district, Pangyo new store got a high score in location evaluation besides three discount stores where A brand is located in main station commercial power of Bundang, besides when opening new counter in Seohyun Lotte Mart that got a high rating which received high result value in bus connection and distance-time to discount store among existing discount stores, a positive effect is expected to happen.

Nevertheless, the limit of this study is that at first author did not grasp sales trend compared to competitors exactly as not having sales figure of competitive children's wear counters. Also since it was analyzed focusing on limited specific region of Bundang and surrounding region of it, it has a limit this result is applied to entire market as it is. And since it was conducted based on children's wear counters located in discount stores not company-operated stores or agencies, it was estimated based on discount store. Because the shopping goal of visiting customers puts discount store visit before children's wear counter visit, the study was conducted targeting discount stores as there were many errors to evaluate location of children's wear counter open in discount store.

Afterward author will be able to arrange more specific index on variables influencing purchasers in choosing children's wear counter after complementing these limits and if measuring non-quantitative variables based on diverse materials, author will be able to suggest more accurate model and its result.

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