

**A STUDY ON THE UTILIZATION ANALYSIS IN BICYCLE
AND ESTABLISHMENT ON DISCRIMINANT CLASSIFICATION
MODEL AT PUSAN METROPOLITAN CITY**

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Abstract: This study establish the evaluation and classification models on the influential factors and the analysis of the bicycle use state, the results of the analysis based on Quantification II Theory, CHAID analysis, and ALSICAL method. The Quantification II Theory show that the interrelation rate is 0.90596 and sexuality, age, jobs, kinds of car, income a month, types of housing, educational background, and the possession of driver's license in the order named have an effect on the bicycle use. The CHAID method show that while the objects that usually uses bicycles is the women before 30 years, the objects that does not usually use them is the women after 40 years or men. The PCA and ALSICAL method show that in the satisfaction degree model the rest aspects except for the economic aspect such as travel cost are higher in the man before 30 years and in the importance degree model the rest aspects except for maintenance and cleanliness are higher in them.

Key Words: Bicycle, Quantification II Theory, CHAID analysis, PCA, ALSICAL method

1. INTRODUCTION

1.1 Backgrounds and Purpose

Three major problems caused by the traffic in big cities are the traffic congestion, the illegal parking and stopping, and the traffic accidents. In addition to the three problems, recently the air pollution from many kinds of vehicles has been giving rise to some terrible social problems. Consequently, today, most countries all over the world have researched many alternatives to settle these traffic and pollution problems. The bicycle, one of them, is noticed as a useful traffic means, called the green mode traffic means, which little brings about the problems.

In consideration of this point, Korean government established the goal to heighten the transportation share of the bicycle to 10% until 2010. As a result, all cities and provinces are setting up plans for the bicycle use and expanding the facilities for bicycles

At this point, however, without the further researches concerned with the bicycle, many kinds of plans suggest only the guesswork of the demand and the expansion of its facilities. Especially because the results of the further analysis to the citizens' opinions of the bicycle use are not reflected in the real life, we have a lot of trouble to build the exclusive lane for bicycles and to activate the use of bicycles by increasing their demand.

Therefore, this study, as a way of a basic research on the bicycle use, is to show the analyses of the questionnaires based on Quantification II Theory, Chi-squared Automatic Interaction

Detector (CHAID), Principal Component Analysis(PCA), Chi-square analysis and Alternating Least Square Scaling (ALSCAL), one field of Multidimensional Scaling (MDS). And we hope that our study will contribute to the future policy establishment for bicycle use.

1.2 Method and Scope

In this study, first, we tried to analyse the present state and problems of the bicycle use in Pusan. Next, on the ground of the questionnaires that were responded by the people living in Pusan, we made an evaluation model for the usual bicycle use.

Also, we created a model to classify the factors that have an effect on the usual bicycle use in terms of The Quantification II Theory and CHAID method. And finally, we made the models for the importance and satisfaction degree of the usual bicycle use, and to evaluate the appropriateness of the degrees we annualized their tendency by using PCA, and made and illustrated the importance degree and satisfaction degree models by ALSCAL method.

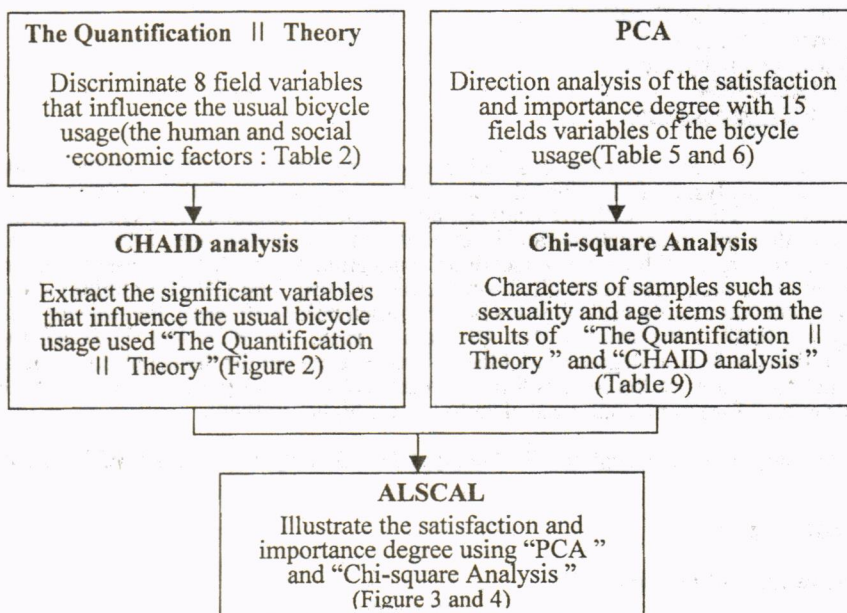


Figure 1. Flow Chart of Analysis

2. BICYCLE USAGES AND PROBLEMS AT PUSAN METROPOLITAN CITY

The state of the bicycle usage is like to at Pusan in table 1. It shows that the length of the bicycle lanes is 57.9kms, the figure of their retention is 86,877, and the number of parking lots for them is 158 places but the bicycle trip is 4000 per day, and the their transportation share rate is only 0.4%.

Especially, because there are lots of mountains in the north of Pusan, and the city is bordered on the south by the sea, because of this conditions, in Pusan about 30.2% of the roads are slanted in the 7% and more, and the roads in Pusan which are less than 2m wide are about 46.1% of the whole roads. So it is too difficult to activate the bicycle use because there are a lot of cars that are illegally parking, stopping, and piling-up on the roads.

Most of the already used bicycle lanes have been built as the facilities for leisure outside the cities. So it is too difficult to approach the public transportation. Most of bicycle parking lots have also been constructed around the subway stations and government and public offices that don't have the bicycle lanes. The inconvenience of the bicycle use has been caused by the problems. Due to these reasons, in the primary policies of city traffic rearrangement for Pusan

in 2011, the target figure of the transportation share is fixed up at much less 3.0% than the target ratio of the government.

Table 1. Bicycle State at Pusan Metropolitan City

Bicycle lane	Bicycle retention	Bicycle parking lot	Bicycle trip	Bicycle share ratio
57.9km	86,788	158 places 1,961 lot	39,789trip/day	0.4%

Source : Pusan Metropolitan City, Maintenance Plan of Bicycle Usage Facility, 1998. 1

3. USUAL BICYCLE USAGE OF DISCRIMINANT MODEL

The Quantification II Theory as a method which classifies the external standard from each category of the qualitative description variable item is a model that interprets the problems which judge whether each individual is included in any places in the group T by putting the knowledge about the R qualitative properties to practical use. Especially, this method gives each category some score to be best able to explain the external standard about the data extracted from an infinite universe. The score is Category Score and Partial Correlation makes us judge that the wider the Range is, the more it has an effect on the external criterion.

This study used the Quantification II Theory by establishing the evaluation model to investigate the composite action of influential factors about the usual bicycle use.

For the Quantification II Theory analysis, the Outside Variable adopted "yes" and "no" as answers for whether bicycles are usually used or not. 8 variables such as sexuality, age, educational background, income per month, kind of housing, kind of car, and the possession of driver's license were taken up as descriptive variable items. As for them, the results of the analysis based on the Quantification II Theory show that all hit ratio is very high as 98.0%. Also the axes consist of the combination of items for the outside variables in the judgement models, and the Correlation Ratio indicates whether they show the outside variables well. The result to make the ratio is, as shown in table 2, denoted to be high as 0.90596. So this judgement model is judged as a very valid one.

The Partial Correlation indicating the contribution degree for the outside variables has an effect on sexuality, age, job, kinds of cars, income per month, types of housing, educational background, and the possession of driver's license in the order named. To put this model in more detail, the result is as follows:

First of all, it is shown that the categories of the items which had an effect on putting "yes" to the usual bicycle use, an outside variable, includes women under the sexuality, before 40 years, and students, housewives, salespersons, the unemployed and the other jobs, and mini bus and freight cars under the kinds of cars, and less than \$834 under the income per month, and monthly rent, rent with a deposit under the types of housing, and high school graduation and less under the educational background, and "no" under the possession of driver's license.

On the other hand, it is shown that the categories of the items which had an effect on putting "no" to the usual bicycle use includes men, after 40 years, and engineers, the white-collar workers, the management staff, service employees, transport drivers, laborers, and production workers for the manufacturing industry under the jobs, and private cars, taxies, and cases without car under the kinds of cars, more than \$883 under the income per month, private houses and etc. under the types of housing, and more than university graduates under the educational background, and "yes" under the possession of driver's license

4. CLASSIFICATION MODEL OF THE INFUENTIAL FACTORS ON THE USUAL BICYCLE USE BASED ON CHAID METHOD

The decision tree illustrates the decision rule and is an analysis method that predicts or classifies related groups into some small groups. There are CHAID, Exhaustive CHAID, Classification and Regression Tree (CART), Quick Unbiased Efficient Statistical Tree (QUEST) and so on in accordance with algorithm. The CHAID algorithm is composed of classification tree when the target variable is dispersion type and, at this time, for it raises the

Table 2. Discriminant Model of Usual Bicycle Use by the Quantification II Theory Analysis

Item	Category	Frequency	Quantification Index	Range	Par. Corr
Sexuality	Man	73	0.69288	2.30960	0.94143(1)
	Woman	30	-1.61672		
Age	Before 10 years	18	-0.25791	1.57371	0.81643(2)
	20~29 years	45	-0.26984		
	30~39 years	17	-0.06709		
	40~49 years	11	0.56282		
	After 50 years	9	1.30387		
Educational background	Middle school	3	-0.20992	0.28986	0.19722(7)
	High school	58	-0.04289		
	Above college	39	0.07994		
Job	Students	40	-0.04398	1.61016	0.64035(3)
	Housewives	17	-0.35040		
	Engineers	4	0.10.44		
	Management staff	5	0.50946		
	White-collar workers	16	0.15660		
	Salespersons	6	-0.12101		
	Service employees	2	0.39997		
	Transport drivers	3	1.03348		
	Production workers	4	0.16290		
	Unemployed	1	-0.42312		
	Other jobs	2	-0.57668		
Income per month	~\$417	13	-0.19002	0.64035	0.32301(5)
	\$418~\$834	30	-0.07796		
	\$835~\$1,252	23	0.02465		
	\$1,253~\$1,669	22	0.12126		
	\$1,670~\$2,500	10	0.07266		
Types of housing	\$2,500~	2	0.42383	0.37220	0.22414(6)
	Own house	61	0.05071		
	Deposit rent	34	-0.06823		
	Monthly rent	3	-0.30358		
Kinds of cars	Others	2	0.06861	0.54033	0.34175(4)
	Private cars	37	0.05318		
	Mini bus	5	-0.45755		
	Freight car	4	-0.22753		
	Taxi	2	0.08278		
Driver's license	None	52	0.02047	0.09619	0.12804(8)
	Possession	43	0.5483		
Outside Variables	Not possession	57	-0.04136	Correlation ratio	0.90596
	Yes	20	-1.90363		
	No	80	0.47591		

Note : \$1 = 1,200won

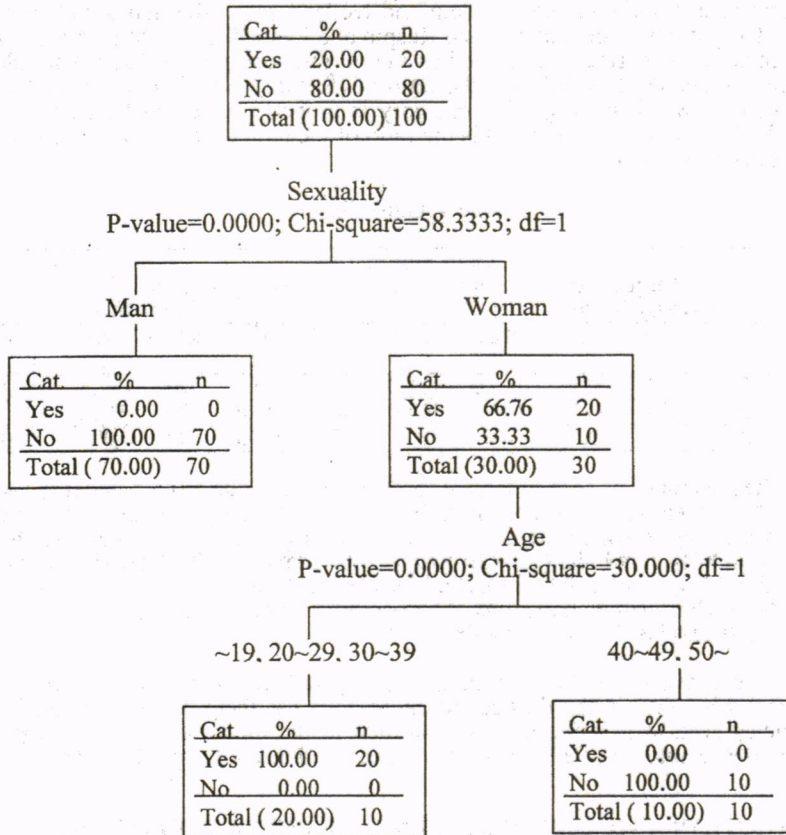
discrimination based on the frequency belonging to each category of the variables, the least P value of Chi-square statistic quantity is statistically significant and this is used as the discrimination criterion.

This study uses the CHAID algorithm when analyzing, as it is useful to discriminate the influential factors related with the individual status of the respondents who answer with "yes" or "no" to the usual bicycle use.

First, the data to analyze them are composed of one hundred observed objects, one target variable, and eight predicted variables and the variables are classified into nine items and forty categories as shown in table 2. It is as shown in figure 1 below to make the above variables into the decision tree according to the CHAID algorithm. As have been seen above, two predicted variables, sexuality and age, are statistically significant because their P value in the

significant level of Chi-square statistic volume of 1 % is 0.0000 lower than 0.01

In particular, the children nodes are formed only under these two predicted variables, and in the frequency of the usual bicycle use, the target variable coming under the root nodes, the respondents to "No" (80%: 80 persons) are about four times as many as the respondents to "Yes" (20%: 20 persons). This means that most respondents do not use their bicycles because they usually use their private cars as means of transportation. Moreover, because the post-probability of the "no" in the root node is 60% more than that of the "yes", all the 100 respondents is classified into the post-probability of the "no". So the "no" node is blackened because it is the most categories within the nodes.



Note : Node number give 0 to 4, upper through below, left through light
Figure 2. Usual Bicycle Usage in Classification Model of Influence Factor

However, in this case in order to examine whether the objective variables are properly classified, we have to see the misclassification matrix table which represents by the matrix pattern the number of the individuals (frequency in the diagonal) which are consistent with the actual category and the predicted category and the number of them (frequency in the off-diagonal) which are incorrectly predicted. Accordingly, looking into the misclassification matrix on the root node risk chart in table 3, the risk estimate shows that in the usual bicycle use the 20 observed objects discriminate "yes" into "yes" and the 80 observed objects discriminate "no" into "no". On the other hand, because there are no observational objects that confused "yes" with "no" or "no" with "yes", the misclassification ratio shows 0 percent. So the data are perfectly classified in the decision tree analysis.

Also, because the appropriateness for each node has to be evaluated, we can understand by seeing the gain chart that shows whether the data on the relevant nodes are properly classified. This is as shown in table 4.

Table 3. Risk Chart of Root Node

		Actual Category		
		Yes	No	Total
Predicted Category	Yes	20	0	20
	No	0	80	80
	Total	20	80	100
		Resubstitution		
Risk Estimate		0		
SE of Risk Estimate		0		

The Node here means node number, Node:n and Node:% mean the number of data and the percentage in the relevant node number, and Resp:n and Resp:% mean the number of data and the percentage which is correctly classified as the original category of target variables in the relevant node number. And Gain(%) as the ratio of (Resp:n)/(Node:n), stand for the ratio of the number of data which the objective category is properly separated from in the relevant node. and Index(%) means that Gain(%) is the ratio of the target category and the comparative measurement in the whole data.

Table 4. Gain Chart

Gain Summary												
Target variable : Usual usage, Target category : No												
Node-by-Node							Cumulative					
Node	Node: N	Node: %	Resp: n	Resp: %	Gain (%)	Index (%)	Node: N	Node: %	Resp: n	Resp: %	Gain (%)	Index (%)
1	70	70.0	70	87.5	100.0	125.0	70	70.0	70	87.5	100.0	125.0
4	10	10.0	10	12.5	100.0	125.0	80	80.0	80	100.0	100.0	125.0
3	20	20.0	0	0.0	0.0	0.0	100	100.0	80	100.0	80.0	100.0

Considering the meanings, as seen in table 4, because on the node 1 (men under the sexuality) and the node 4 (women under the sexuality, the forties and more under the age) there are not "yes" to the usual bicycle use in the data, Gain value shows 100%. Also because the "no" in all the data shows 80%, it is $\text{Index}(\%) = (100/80) \times 100 = 125\%$. On the other side, because node 3 (women under the sexuality, the thirties and less under the age) is "yes" to the usual bicycle use as the whole, Gain value shows 0%. Also, as 80% of all the data are "no" to the usual bicycle use, it is $\text{Index}(\%) = (0/80) \times 100 = 0\%$.

According to the above survey, we can judge that the women in the thirties and less usually use their bicycles but they in the thirties and more don't use them. Consequently, first of all, the new policies need to lead the men and women in the forties and more to change their transportation means into bicycle because they make good use of the public traffic means.

5. CONSTRUCTION AND APPROPRIATENESS EVALUATION OF THE SATISFACTION AND IMPORTANCE MODELS ON THE BYCICLE USAGE

5.1 Direction analysis based on the Principal Component Analysis

The variables used in the Principal Component Analysis for an direction analysis of the satisfaction and importance degree on the bicycle use are as in table 5 and 6.

In all the satisfaction and importance degrees, the Ricardo's 5 level standardized data are in common used for all 15 variables such as travel time, travel cost, safety, continuity, straightening, convenience, precision, security, proper grade, road pavement, atmospheric quality, noise, maintenance and cleanliness, and attraction and interest. When the variables is analyzed by the Principal Component Analysis, the method to artificially divide the number of the principal components into two groups is used to easily analyze them by ALSICAL method.

First, to investigate whether the variables collected in the Principal Component Analysis are appropriate as samples, they are checked according to the KMO value, the verified value of Bartlett's unit matrix, and the significant level value. Consequently, it was proved that it is

meritorious that in case of the satisfaction degree the KMO value is 0.857 and in case of the importance degree it is 0.852. And as it was also verified that because the significant level of the test value of the Bartlett's unit matrix is meaningful in all the significance and the importance degrees, all the variables were evaluated as proper samples. The cumulative contribution ratio is formed into two concerned variable groups in the levels of 52.4% in the satisfaction degree and about 49.1% in the importance degree, and each the Component Loading is as shown in table 5 and 6.

Table 5. Component Loading of Satisfaction Degree Model

	Factor 1	Factor 2
Protective facilities	0.860	0.039
Noise	0.781	0.055
Proper grade	0.762	-0.047
Road pavement	0.738	0.021
Security	0.734	0.280
Maintenance and cleanliness	0.662	0.311
Atmospheric quality	0.657	0.108
Precision	0.621	0.354
Safety	0.591	0.390
Attraction and interest	0.532	0.257
Convenience	0.487	0.439

Travel time	0.083	0.683
Travel cost	-0.327	0.683
Straightening	0.253	0.676
Continuity	0.291	0.578
Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.857(Meritorious)		
Bartlett's Test of Sphericity Approx. Chi-Square = 698.415, df = 105, Sig. = 0.000		
Note : Kaiser-Meyer-Olkin Measure of Sampling Adequacy		
0.90 ~ 1.00 : Marvelous, 0.80 ~ 0.89 : Meritorious, 0.70 ~ 0.79 : Middling		
0.60 ~ 0.69 : Mediocre, 0.50 ~ 0.59 : Miserable, ~ 0.49 : Unacceptable		

Table 6. Component Loading of Importance Degree Model

	Factor 1	Factor 2
Maintenance and cleanliness	0.740	-0.026
Protective facilities	0.716	0.258
Noise	0.683	0.249
Security	0.679	0.245
Atmospheric quality	0.657	0.252
Road pavement	0.645	0.307
Precision	0.545	0.513
Proper grade	0.525	0.240
Attraction and interest	0.510	0.212

Straightening	0.137	0.731
Continuity	0.136	0.721
Travel cost	0.187	0.669
Convenience	0.399	0.610
Travel time	0.199	0.605
Safety	0.379	0.575
Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.852(Meritorious)		
Bartlett's Test of Sphericity Approx. Chi-Square = 613.016, df = 105, Sig. = 0.000		

As have been seen above, the variables of the satisfaction degree include eleven variables such as protective facilities, noise, proper grade, road pavement, security, maintenance and cleanliness, atmospheric quality, precision, safety, attraction and interest, and convenience in the first factors. And four variables such as travel time, travel cost, straightening, and continuity in the second factors.

The variables of the importance degree include nine variables such as maintenance and cleanliness, protective facilities, noise, security, atmospheric quality, road pavement, precision, proper grade, and attraction and interest in the first factors and six variables such as straightening, continuity, travel cost, convenience, travel time, and safety in the second factors.

5.2 Appropriateness Evaluation of the Models Based on the ALSCAL Method

The results of the application of the ALSCAL method, a kind of ideal-point model, to the data for the satisfaction and the importance degree, which are made the respondents of this study, have got the indices of the explanation ability as shown in table 7 and 8.

As the appraisers have a lot of individual differences between them on evaluating the appropriateness, when the results of the satisfaction degree model and the importance degree model are interpreted, the Young's S-stress value is used as the standard value which evaluates whether the generally appraised data estimate the real input data well. This value becomes the perfect fitting when it is 0.0 between 0.0 and 1.0, and, to the contrary, 1.0 is the worst possible fit. Therefore, as have been seen in the results of this analysis. It is proved that they are all satisfactory because the satisfaction model shows that Stress value is 0.18054, and the importance model shows that it is 0.19229, that is, all these two Stress values are close to 0.0.

A decision calculation R^2 value as another evaluation standard shows the explanatory ability of models. On applying this value to each model, it is 87.0% explanatory ability in the satisfaction model, and 87.5% explanatory ability in the importance model. Therefore they are all satisfactory

Table 7. Explanatory Ability of Satisfaction Degree by ALSCAL Method

Iteration	S-stress	Improvement
1	0.25139	.
2	0.19217	0.05922
3	0.19032	0.00185
4	0.19015	0.00017
S-stress = 0.18054, $R^2 = 0.87014(87.0\%)$		
Note : S-stress(Young's S-stress) : 1 (Worst possible fit) ~ 0 (Perfect fit)		
R^2 (the squared correlation coefficient, r-squared) : 0.0 (0%) ~ 1.0 (100%)		

Table 8. Explanatory Ability of Importance Degree by ALSCAL Method

Iteration	S-stress	Improvement
1	0.30440	.
2	0.20015	0.10424
3	0.19314	0.00701
4	0.19217	0.00097
S-stress = 0.19229, $R^2 = 0.87014(87.0\%)$		

5.3 Appropriateness Verification of Dimension-Related Property

In order to interpret the dimensions of the evaluated satisfaction and importance models by means of the Coordinate Configuration, the appropriateness of properties related with each dimension, first, has to be investigated. Let us illustrate them by the evaluation criteria based on the combinations between Categories for the important explanatory variables such as

sexuality and age items from the results of the Quantification II Theory and CHAID analysis in the previous chapter, based on. In particular, in order to simultaneously grasp whether this consideration is appropriate, whether the degrees are discriminatory according to the samples and whether the discriminations between the satisfaction and the importance degree are related with the characters of the samples in the satisfaction and the importance degree models, an χ^2 examination of the samples was made in the respective dimensions.

According to the sample scale value as the discriminative method of the samples, the mean values which are divided into two groups, one which is more than the value and the other which is less than the value, after they are evaluated. The satisfaction degree shows that the case number of the each discriminated group is 45 and 55 persons in the first dimension and 49 and 51 persons in the second dimension. The importance degree shows that it is 39 and 61 persons in the first dimension and 53 and 47 persons in the second dimension. The results of χ^2 examination based on the above classification of the sample groups, are as shown in table 9.

Table 9. The Results of χ^2 Examination by the Characters of the Samples

Model Characters of the Samples	Satisfaction degree				Importance degree			
	1 dimension		2 dimension		1 dimension		2 dimension	
	Less than mean	Above mean	Less than mean	Above mean	Less than mean	Above mean	Less than Mean	Above Mean
Man before 30 years	0.111	0.091	0.494*	0.475*	1.313*	0.839*	0.185	0.209
Man after 40 years	0.389**	1.136*	0.165	0.159	0.310	0.198	0.545*	0.615*
Woman before 30 years	0.000	0.000	0.005	0.005	0.827*	0.529*	0.247	0.278
Woman after 40 years	0.500*	0.409	0.165	0.159	0.003	0.002	0.017	0.019

Note : 1) Degree of Freedom is 1, 2) * is significant on significance level 0.5, 3) ** is significant on significance level 0.25, 4) In case of significance level 0.5, critical value is 0.445, 5) In case of significance level 0.25, critical value is 1.32.

According to the table, it was proved that in the satisfaction model the groups of the men and women after 40 years are significant in the one dimension and the group of the men before 30 years is significant in the two dimension. So these properties can be used as the influential indices when they classify the satisfaction degree characters. And as it is shown that the significant in the importance degree model are the men and women before 30 years in one dimension and the men after 40 years in two dimensions, these properties can be used as the indices that classify the importance characters.

As the above results mentioned, it is estimated that to illustrate them is appropriate in view of the combination of the categories for explanation variable items such as sexuality and age. Therefore, centering around these items, Let us illustrate the satisfaction and the importance model made by ALSCAL method.

6. ILLUSTRATIONS OF THE SATISFACTION AND IMPORTANCE DEGREE MODELS

6. 1. Illustration of the Satisfaction Degree Model

What illustrates the second dimension solution synthesizing the satisfaction degree model made by the ALSCAL method and the Component Loading from the Principal Component Analysis is as figure 3.

Looking into the axis direction by Component Loading, first, the case that they are satisfied with the travel cost is placed on the fourth quadrant face between the negative direction of axis 1 and the negative direction of axis 2. In addition, the case of the men in the forties and more who are relatively sensitive to the influence of the object economy and the women in the thirties and less who have the propensity to consume beyond a small income shows the high

satisfaction degree. In the proper grade they are placed on the second quadrant face between the positive direction of the axis 1 and the negative direction of axis 2 and the men and women in the thirties and less who is relatively unafraid of the grade rest satisfied.

Also, in the satisfaction degree of the travel time, straightening, and continuity they are placed on the first quadrant face between the positive direction of axis 1 and the positive direction of axis 2 and especially closer to the axis 2. In the satisfaction degree of the travel time, however, the men in the thirties and less and the women are higher and in that of straightening and continuity the men in the thirties and less and the women in the forties and more are higher. The men in the thirties and less who prefer the short time movement are included in both of them.

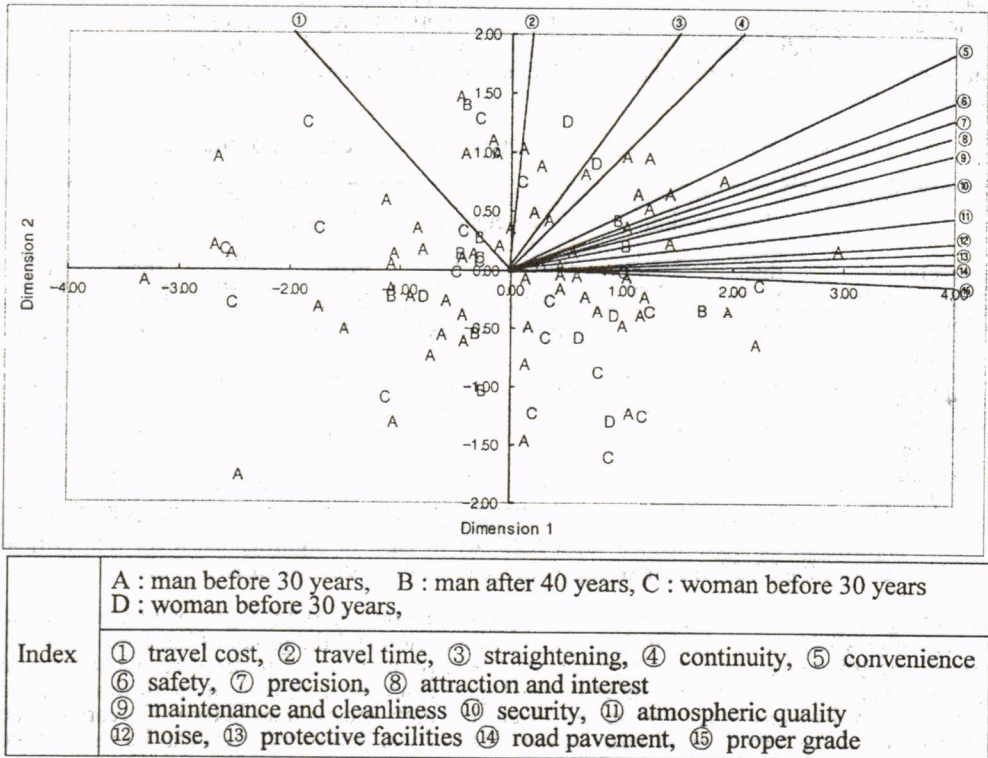


Figure 3. Relationship on Ideal-point of Measure Index and an Appraiser by ALSICAL Method(Satisfaction Degree Model)

On the other hand, in the satisfaction degree of the atmospheric quality, noise, protective facilities, road pavement, and proper grade they seem to be on the first quadrant face between the positive direction of axis 1 and the positive direction of axis 2 but are closer to the axis 1. But in the satisfaction degree of the atmospheric quality the men are higher and in that of noise, protective facilities, and road pavement the women in the forties and more and the men are higher. Therefore, in the environment the men rest more satisfied. And in the satisfaction degree of convenience, safety, precision, attraction and interest, maintenance and cleanliness, and security they seem to be on the first quadrant face between the positive direction of axis 1 and the positive direction of axis 2 but are kind of halfway between the axis 1 and 2. However, the men are higher in the satisfaction degree of convenience and security and the women in the forties and more and the men are higher in that of safety, precision, and maintenance and cleanliness. So the men rest more satisfied in the main.

Summing up, the men in the thirties and less are higher in the satisfaction degree in most aspects except for the economic aspect such as the travel cost.

6. 2. Illustration of the Importance Degree Model

The illustration of the two-dimensional solution that compounds the importance model based on the ALSICAL method and the results based on PCA is as in figure 4.

In the direction of axes based on the Component Loading, the importance degree of straightening, continuity, travel cost, and travel time is on the first quadrant face between the positive direction of axis 1 and the positive direction of axis 2 but closer to the axis 2. The importance degree in straightening and continuity of them are higher in the men and that of the travel cost and time is higher in the men in the thirties and less. Therefore, the importance degree of them is mostly higher in the men in the thirties and less.

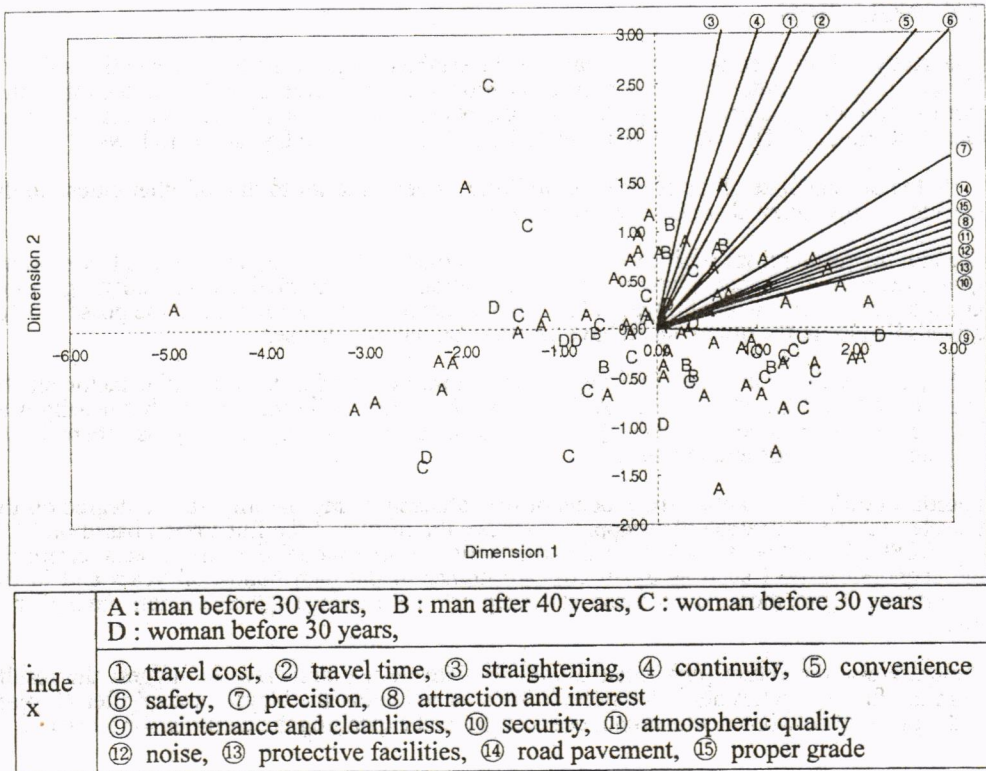


Figure 4. Relationship on Ideal-point of Measure Index and an Appraiser by ALSICAL Method(Importance Degree Model)

The satisfaction degree of road pavement, proper grade, attraction and interest, atmospheric quality, noise, protective facilities, and security is on the first quadrant face between the positive direction of axis 1 and the positive direction of axis 2 but closer to axis 1. And the men in the thirties and less are higher in the importance degree. And the satisfaction degree of convenience, safety, and precision is also in the first quadrant face between the positive direction of axis 1 and the positive direction of axis 2 but a little halfway between the axis 1 and the axis 2.

However, the satisfaction degree of convenience and safety is higher in the women in the thirties and less and the men, and that of precision is higher in the men in the thirties and less. Therefore, they are all higher in the men in the thirties and less in the mains. In addition, the satisfaction degree of maintenance and cleanliness is on the second quadrant face between the positive direction of axis 1 and the negative direction of axis 2, and the women mainly think that it is more important.

Summing up, the importance degree model shows that in most of the rest aspects except for maintenance and cleanliness the men in the thirties and less evenly recognize the importance of them. According to the results of the analyses above, the men in the thirties and less show the higher satisfaction degree in the rest aspects except for the economic aspect like the travel cost in the satisfaction degree model and the higher importance degree in the rest aspects except for the maintenance and cleanliness in the importance degree model. As have been seen above, it could be seen that it is more possible to make the active young men participate in the usual bicycle use. Accordingly, it is judged that when the traffic policies which can raise the usual bicycle use is established, it is desirable to introduce many policies to lead the men in the forties and more and the women to participate in the bicycle use. Especially, these results, to some extent, appear consistent with the outcome of the CHAID analysis above.

7. CONCLUSION

This study will be used as the basic data for the establishment of the hereafter policies for the bicycle use and in order to establish the evaluation and classification models on the influential factors and the analysis of the bicycle use state, the results of the analysis based on Quantification II Theory, CHAID analysis, and ALSICAL method are as follows:

First, the present state of the bicycle use in Pusan is very inferior to that of other cities. So the bicycle transportation share is very low as 0.4%

Second, the results from setting up the evaluation model of the usual bicycle use based on the Quantification II Theory show that the interrelation rate is 0.90596 and sexuality, age, jobs, kinds of car, income a month, types of housing, educational background, and the possession of driver's license in the order named have an effect on the bicycle use.

Third, the results from analyzing the classification model of each influential factor on the usual bicycle use based on the CHAID method show that while the objects that usually uses bicycles is the women before 30 years, the objects that does not usually use them is the women after 40 years and the men.

Fourth, in order to establish the models of the satisfaction and the importance degree on the bicycle use and to evaluate their appropriateness, the results of the illustration based on PCA and ALSICAL method show that in the satisfaction degree model the rest aspects except for the economic aspect such as travel cost are higher in the men before 30 years and in the importance degree model the rest aspects except for maintenance and cleanliness are higher in them.

Conclusively, the future plans related with the bicycle use will have to suggest the results from the further studies about the policies such as activating the bicycle use of after 40 years and more and the women who do not use bicycles and expanding the facilities for bicycles.

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