

A Study on Evaluation of Quality of Life in Consideration of Water/Green Environment

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ABSTRACT: Recently, the interest about water/green environment rises. But, it does not become clear enough, that water/green environment influences Quality of Life. The purpose of this study is the analyzing Quality of Life quantitatively with the data of the questionnaire survey, from the viewpoint of water/green environment. The subject area was Maebashi City, Gunma Prefecture. We used “factor analysis” and “covariance structure analysis”. Result of factor analysis we obtain five factor of the Quality of Life: Safety, Convenience, Environment, Housing conditions, Comfort. In addition we clarify evaluation structure of Quality of Life in consideration of water/green environment such as the river or the park by using covariance structure analysis. As the result, we made clear that Quality of Life is different depending on individual attribute and district characteristic, and that water/green environment affected Quality of Life. And we show measure effects.

Keywords: Water/green environment, Quality of Life, Evaluation, Covariance structure analysis

1. INTRODUCTION

In these modern times, with advancing industrialization and urbanization, the scenery of the water and green environment has been transformed. People in these present times, have a heightened desire, a craving for spaces where they can live at ease. Their interest for the Quality of Life with as much natural contact with those familiar green spaces, waterfront and the beautiful townscape has increased. In this research, based on the results of a questionnaire survey regarding the Quality of Life of the residential areas of Maebashi city, special attention is paid to the living environment of the residential areas that incorporate water/green and the like. Our purpose is a making structural model, for the evaluation of Quality of the Life, as seen from the inhabitant's point of view.

2. RESEARCH POSITION

In the research that pays attention to the Quality of Life, Kaji's research is enumerated [1]. They clarify structural analysis of the consciousness of the inhabitants. Moreover, they showed the relation between living environment and evaluation of inhabitants to living environment, and offer an evaluation method of their living environment and the Quality of life. After this research, various evaluation methods and models have been proposed by Morimoto [2], Yoshida [3], Doi [4], and Morita [5]. In addition, a Quality of Life research which pays attention to water environment, Taniguchi is also included [6]. They propose that in order to improve the quality of life, an improvement in the water environment and a better evaluation of this model need to be made. Not just as research, a plan which designates improvements to the charm of the water spaces in Tokyo is set out as a goal [7]. Such as this plan, many urban development plans that pay attention to the water environment are going on all over Japan.

The main focus of this research is on the Quality of Life especially to the living environments with water and green. The Quality of Life of the inhabitants is determined by city activity and living environment. City activity consists of traffic, land utilization and economic activity etc, living environment consists of the proximity to rivers, forested land, farmland and the growth plants and other living things. These two are thought to exert mutual influence on each other. In addition, it is clarified that the Quality of Life is different depending on individual attributes and district characteristics by existing researches. In this research, individual attributes and district characteristics are considered. As we a model which evaluate all the Quality of Life and which pays attention to a water/green environment has been established. This research aims to provide a useful model through which all aspects of quality of life can be measured quantitatively especially focusing on the water/green environment.

3. QUESTIONNAIRE SURVEY

3.1 Research Area

The area in which the Quality of Life questionnaire survey was conducted is designated as Maebashi city, Gunma prefecture. Maebashi city has three “class A rivers”: Tone river, Hirose river and Momonoki river. In addition, the hydrophilic park which begins in the Shikishima park located in Maebashi city. And, Maebashi city advertises itself as: “The city of water, green and poetry”. Maebashi city promotes businesses such as promenades along the rivers as well as other services and the reforestation an improvement of the cycling road following the plan which is called “The general plan for the Greening of the Maebashi city” [8]. Specially, we designated research area as Maebashi city of the left bank of Tone river that is affected by water environment. Research area is shown in Fig.1 on the next page.

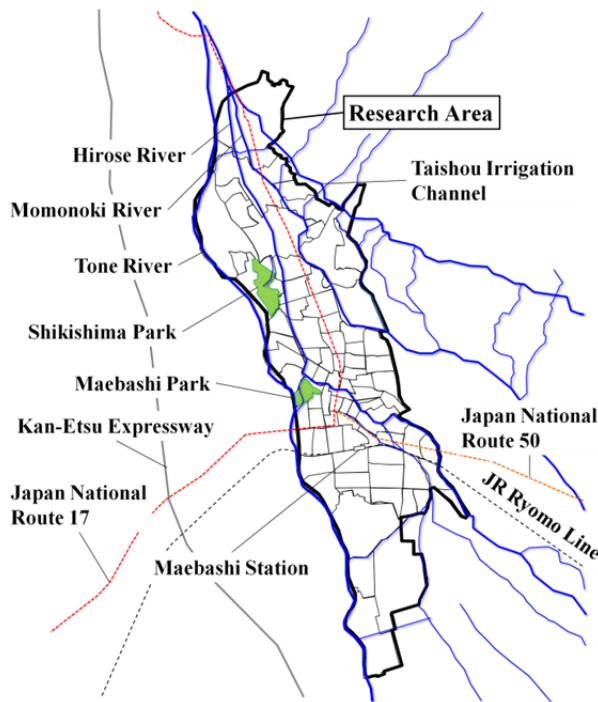


Fig.1: Research Area

3.2 Summary of Questionnaire Survey

Summary of questionnaire survey is shown in Table 1, and items of evaluation are related the Quality of Life (Subjective evaluation) is shown in Table 2. The survey was distributed to 4,000 households inside the area of our research, we received 2,118 responses. When those responses were appraised and reviewed as being valid and complete, the effective results were reduced to 1,646. Items of Subjective evaluation (Table 2) refer to appraisal items of Quality of Life research by [3] and [5], it added the item regarding water and green environment (A12, A13).

4. FACTOR ANALYSIS

Factor analysis was applied to items of Subjective evaluation, the component of Quality of Life was extracted. With this analysis, because A17 and A20 is correlatively high which is shown in Table 2, it excluded the item of A20. Also A21 was excluded of analysis. Concerning items of Subjective evaluation, the typical five latent variables where sum of squares exceeds 1.0 were extracted. The Table 3 is something which rearranged the factor loading after the varimax rotation. We defined factor collected those where the respective factor load quantity is high, "Safety" and "Convenience", "Environment" and "Housing Conditions", "Comfort". A12, A13 which are thought that the relation to green and water environment is high during Subjective evaluations, "Environment" in the Quality of Life which is defined, it has the respective factor loading 0.821 and 0.737. It understood that the element regarding water and green is related to the Quality of Life largely.

5. PRESUMPTION EVALUATION MODEL

5.1 Covariance Structure Analysis

In main research of the Covariance structural model, when Quality of Life is appraised, we use Yoshida's model [3].

Table 1: Summary of the questionnaire survey

Date	Distribution:Mid-November, 2008 Collection:December 14, 2008 (Mailing deadline)
Research Area	Maebashi City of the left bank of the Tone River Population:99,000 Number of Households:42,000
Sampling	Systematic random sampling to household Sampling rate:9.5%
Object persons	Members of 4,000 households
Survey method	Distribution:Posting Collection:Mailing
Survey items	1) Personal attribute, Household attribute, House style 2) Five stage evaluations of Quality of Life (1.Very good, 2.Good, 3.Average, 4.Poor, 5.Very poor)
Number of samples	Household:1,293 (Recovery rate:32.3%) Persons:2,118 Valid vote:1,646

Table 2: List of Subjective evaluation

Variable	Variable name (Survey items of QoL)
A1	Safety against the flood damage
A2	Safety against the earthquake and fire
A3	Crime prevention
A4	Safety against the traffic accident
A5	Sanitary condition
A6	Noise and vibration
A7	Accessibility to the post office and bank
A8	Convenience for the commuting
A9	Accessibility to the hospital and welfare facility
A10	Convenience for the shopping
A11	Convenience for the public transportation
A12	Prodigality of the green environment
A13	Prodigality of the water environment
A14	Convenience for the sport and recreation
A15	Goodness of the sunshine and ventilation
A16	Extent of the house and garden
A17	Easiness of the walking in the district
A18	Goodness of the townscape
A19	Usability of a car in the district
A20	Usability of a bicycle in the district
A21	Comprehensive evaluation

Table 3: Result of Factor analysis

Variable	Factor1 Safety	Factor2 Convenience	Factor3 Environment	Factor4 Housing Conditions	Factor5 Comfort
A1	0.765	0.139	0.036	0.136	0.060
A2	0.750	0.067	0.183	0.211	0.146
A3	0.602	0.185	0.156	0.081	0.132
A4	0.598	0.103	0.249	0.104	0.236
A5	0.441	0.277	0.285	0.179	0.161
A6	0.373	0.081	0.323	0.290	0.110
A7	0.109	0.731	0.090	0.042	-0.022
A8	0.049	0.723	0.029	0.063	0.155
A9	0.145	0.698	0.121	0.050	-0.011
A10	0.082	0.577	0.053	0.126	0.159
A11	0.157	0.541	0.069	-0.013	0.232
A12	0.130	0.064	0.821	0.103	0.093
A13	0.252	0.058	0.737	0.276	0.095
A14	0.209	0.250	0.504	0.139	0.174
A15	0.194	0.100	0.174	0.723	0.079
A16	0.233	0.079	0.251	0.688	0.224
A17	0.324	0.303	0.169	0.158	0.623
A18	0.291	0.169	0.270	0.299	0.504
A19	0.294	0.358	0.164	0.239	0.390
Sum of squares	2.761	2.656	2.029	1.494	1.138
Contribution ratio	14.53%	13.98%	10.68%	7.87%	5.99%
Cumulative contribution ratio	14.53%	28.51%	39.19%	47.05%	53.04%

This model can analyze the individual attribute, district characteristic, Subjective evaluation, and Quality of Life.

Covariance structure analysis can display the complicated statistical model graphical causal relation between variables the arrow (path) with by the path figure which is displayed. It is possible because with the structural equation model to form the model which is based on the hypothesis of the analyst in comparison with former multivariate analysis, it is flexible to interpret data which is given.

Individual attribute and district characteristic were designated as Objective variable, those Latent variable (Quality of Life) exists also constructed the Covariance structural model between Subjective evaluations. Causal relation between Objective variable and Latent variable is called structural equation, this is suitable to multiple regression analysis. In addition, causal relation of Latent variable and subjective appraisal value is called measurement equation, this is suitable to factor analysis.

5.2 Presumption Covariance Structure Model

Continuously, considering five Quality of Life, it set the causal relation of individual attribute and district characteristic, also presumed the Covariance structural model. We obtain data of district characteristic on the map. Goodness of fit of the model became GFI=0.80. Sufficient goodness of fit you cannot say, but sign condition of path coefficient, the appropriateness of interpretation of variable, it illuminated in purpose of this research which pays attention to water/ green environment the figure adopted the model of Fig.2 on next page. The Table 4 is summary of Objective variables, and the Table 5 is path coefficient of the variable which is used for the model is shown in Fig.2. Table 4 and Table 5 are on the next page.

“Safety”, the flood damage, earthquake, fire, crime prevention and traffic accident, is the Latent variable which is related to the safety regarding hygiene. It is found that from the fact that path coefficient of the dummy of 65 years old or more of objective variable has shown negative value, as for the senior citizen degree of safety decreases. “Convenience” is the Latent variable which is related to the convenience of shopping and public traffic. From the fact that path coefficient of the ages 65 and older dummy and the employee dummy of Objective variable has shown negative value, the senior citizen and the employee is a tendency where convenience decreases. On the one hand, path coefficient of the student dummy has shown correct value, as for the student, it is found that it is the tendency which appraises the convenience of research area high. “Environment” is the Latent variable which is related to water/green environment which has paid attention in this research and sport recreation. As Objective variable is distance to the city park, path coefficient it reaches negative value, the city park becomes far, as for appraisal of “Environment”. It is found that it decreases.

Path coefficient of the employee dummy and the apartment dummy where “Housing conditions” is the Latent variable which is related to sunshine, through wind sequence and the extent of the house and garden, is Objective variable has shown correct value. “Comfort” is the Latent variable which is related to the easiness of walking, easiness of using of the automobile. Objective variable becomes the variable whose distance to the waterfront is significant, has shown the fact that extent and the comfort where distance to

the waterfront becomes far decrease. Like above, to improve the Covariance structural model is also conversely. In Objective variable, the fact that it is related to water/green environment is distance to the city park and distance to the waterfront. Waterfront such as Tone river, Hirose river and Momonoki river, and city parks has been distributed to research area, it became the model which can explain the Quality of Life of residence area with the approach characteristic to water/green environment. In addition, also it was the model which can explain the Quality of Life with individual attribute, concerning the change of Quality of Life due to the change of future population became the model which can be appraised. At the time of Covariance structure analysis of this research, the fact that Amos of the SPSS co. is used.

6. EVALUATION MEASURES

By using Covariance structural model, evaluate water green environmental measure. The next two measures, “waterfront development” and “City parks development” were set. Fig.3 shows positions about new waterfront and city parks on the next page but one.

6.1 Waterfront Development

Such as Tone river, Hirose river and Momonoki river which are existence as waterfront in research area extension is 34.5km. In addition, there is a irrigation canal 29.1km inside research area, presently, it is the space which the resident can't get close, part has become the culvert. These like the Hirose river and the Momonoki river you service as the waterfront inside the city, it makes the space where the resident can become familiar in the waterfront. Because of this, rivers extension inside research area reaches approximately 2 times, it is supposed that “Comfort” improves due to the fact that distance to the waterfront becomes short from each area.

6.2 City parks Development

67 city parks are maintained inside service research area, the city park exists in inner 47 areas of 84 areas inside research area. Among 37 areas where the city park is not serviced, 6 areas of urbanization control area are excluded, the city park (the block park) to set one each in 31 areas of area designated for urbanization. Because of this, the number of city inside research area parks becomes with 98 and approximately 1.5 times from 67, “peripheral environment” improving is supposed due to the fact that distance to the city park becomes small from each area.

6.3 Evaluation of Water/green environmental Measures

The result of measuring of water/green environment, measure improves each one “Comfort” “Environment”. Increase of evaluations of “Comfort” and “Environment” after the waterfront and city parks development shows Fig.4 and Fig.5 on the previous page. In order to grasp regional the effect to the whole research area, population of classified by appraisal value ranking of Quality of Life was rearranged. The Fig.6 shows change of “Comfort” due to the service of the waterfront. The Fig.7 shows change of “Environment” due to the service of the city parks. Sooner or later the population which enjoys the improvement effect of quality of life with the measure which relates to water/green, has increased.

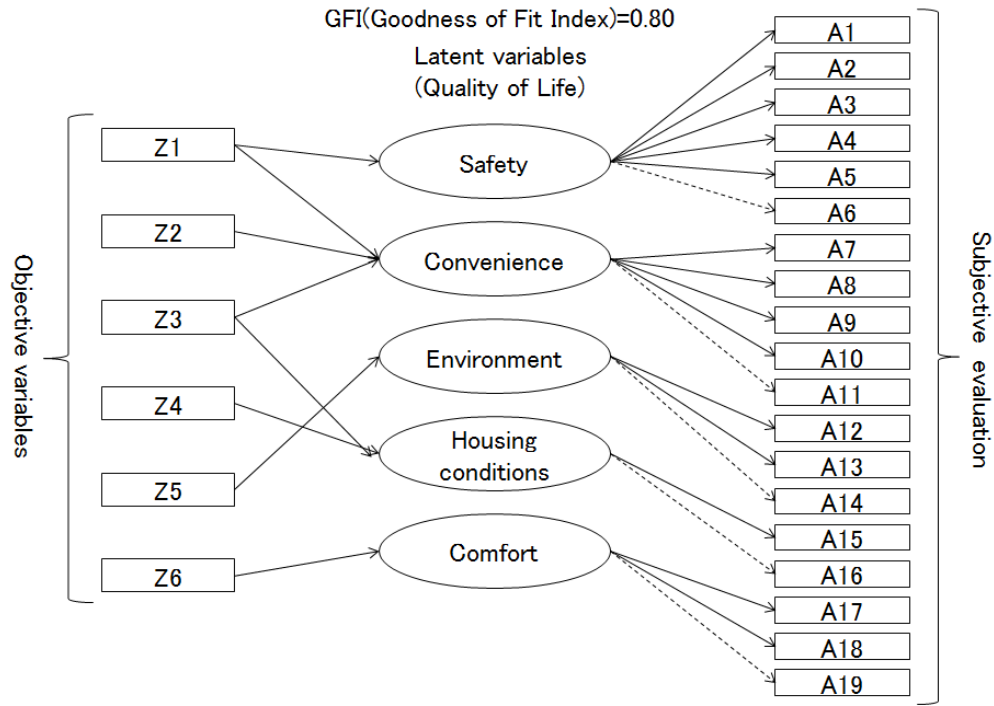


Fig.2: Estimated Covariance structure model

Table 4: Objective variables

Division	Variable name		Definition
Personal attribute	Z1	Ages 65 and older dummy	Sample aged 65 and over = 1, the others = 0
	Z2	Student dummy	Sample is a student = 1, the others = 0
	Z3	Employee dummy	Sample is an employee = 1, the others = 0
	Z4	Apartment dummy	Sample lives in the apartment = 1, the others = 0
District attribute	Z5	Distance to <u>city park</u> (This is green environment)	Square of distance to the nearest city park (square kilometer)
	Z6	Distance to <u>waterfront</u> (This is water environment)	Square of distance to the nearest waterfront (square kilometer)

Table 5: Path coefficient

Objective variables	Path coefficient	Latent variables	Path coefficient	Subjective evaluation
Z1	-0.185(6.656)	Safety	0.754(18.526)	A1
			0.802(18.927)	A2
			0.643(17.231)	A3
			0.677(17.670)	A4
			0.557(15.935)	A5
			0.492(∞)	A6
Z1	-0.070(2.536)	Convenience	0.729(19.973)	A7
Z2	0.058(2.137)		0.725(19.992)	A8
Z3	-0.057(2.089)		0.696(19.506)	A9
			0.609(18.030)	A10
			0.562(∞)	A11
Z5	-0.076(2.793)	Environment	0.863(20.881)	A12
			0.792(21.611)	A13
			0.575(∞)	A14
Z3	0.088(4.291)	Housing conditions	0.516(3.7350)	A15
Z4	0.116(5.626)		1.172(∞)	A16
Z6	-0.110(3.913)	Comfort	0.838(18.232)	A17
			0.656(19.455)	A18
			0.605(∞)	A19

The value in round brackets is "t value".

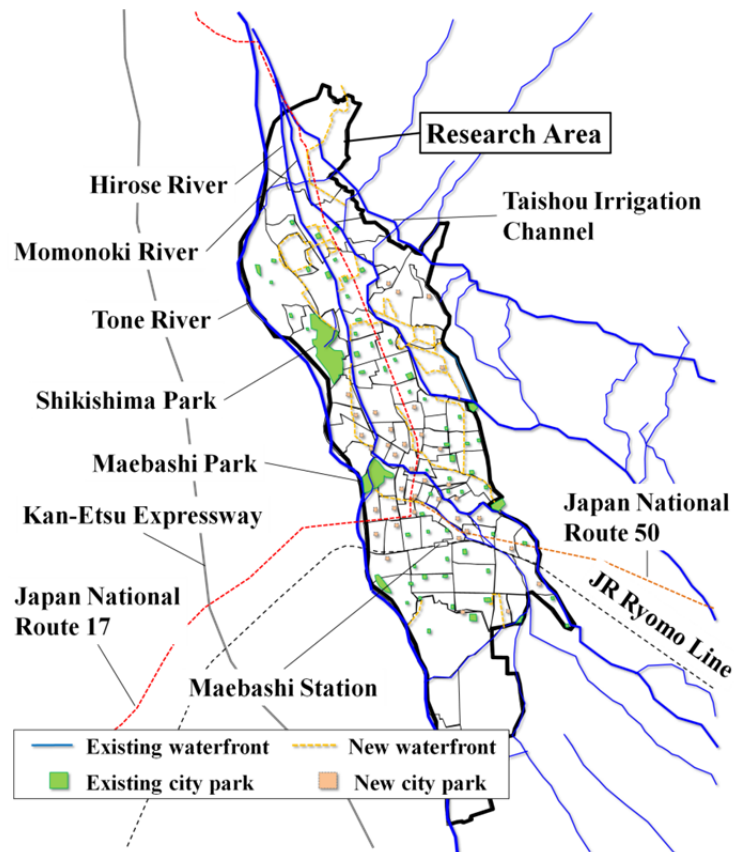


Fig.3: Waterfront and City parks Development

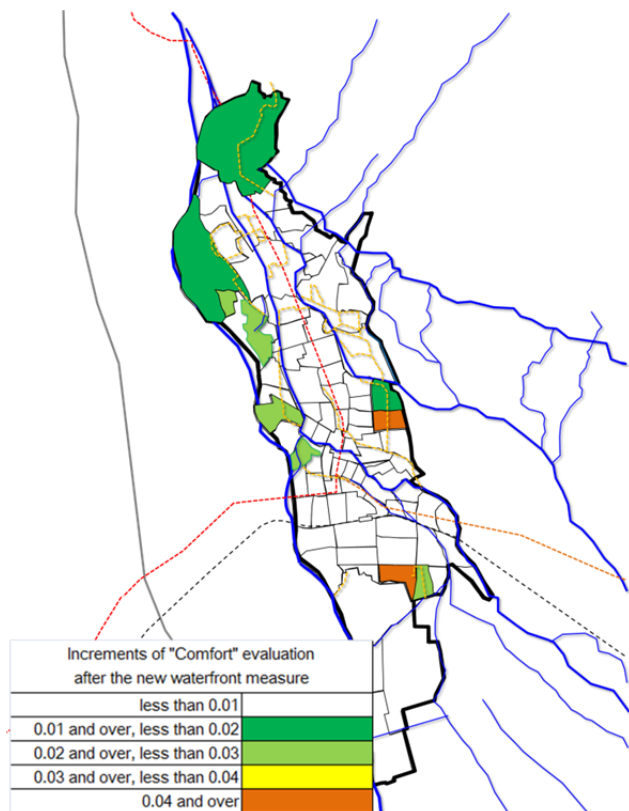


Fig.4: Result of Waterfront development

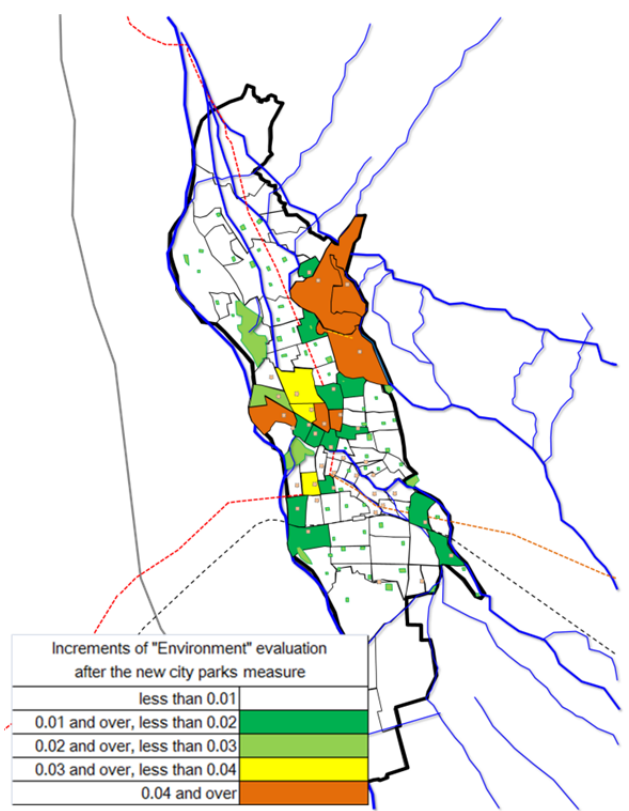


Fig.5: Result of City parks development

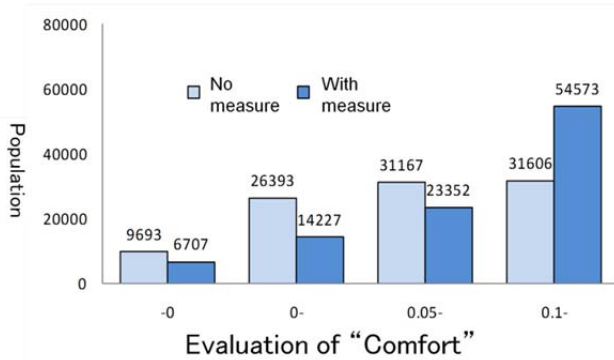


Fig.6: Change of "Comfort" due to measuring

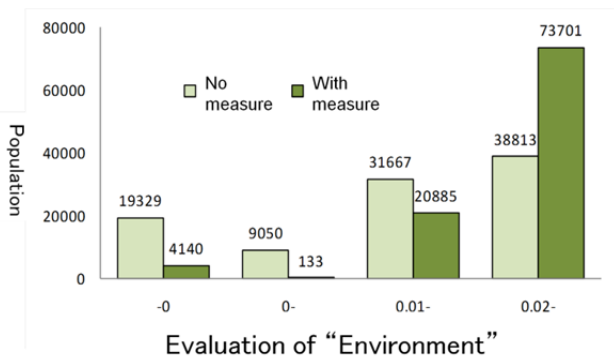


Fig.7: Change of "Environment" due to measuring

7. RESEARCH CONCLUSION

Summary of Objective variable of this research (individual attribute and district characteristic), Latent variable, Subjective evaluations which is due to questionnaire survey uniformly, also it was possible to construct the covariance structural model. It was constructed individual attribute and the district characteristic regarding water/green form the Quality of Life. When appraisal of waterfront and city parks service measured which relates to water green environment. We verified that "Comfort" and "Environment" improves. As from above, the purpose in this research cleared that the appraisal structure of Quality of Life which includes water/green environment, it is thought that it was possible to do measure appraisal.

8. FUTURE TOPIC

Future topic is improvement the evaluation model of Quality of Life. In this research, water quality content of the rivers and waterfront as water environment is not included.

In existing research, a model involves the water cycle, matter cycle model which can estimate the change of water quality and water content. In the future, we would like to examine the appraisal Quality of Life with water quality and water content. In addition, in order for appraisal of measure other than water/green environment to become possible, we would like to keep adding various district characteristic.

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International Journal of GEOMATE, June, 2012, Vol. 2, No. 2 (Sl. No. 4), pp. 241-246

MS No.3h received August 30, 2011, and reviewed under GEOMATE publication policies.

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