Study on Diversified Developments Improving Environmental Values
-In Case of University Campus -

Kuriko Iwai, and Michihiro Kita

Abstract—This study aims to clarify constructions which enable to improve socio-cultural values of environments and also to obtain new knowledge on selecting development plans. CVM is adopted as a method of evaluation. As a case of the research, university campus (CP) is selected on account of its various environments, institutions and many users. Investigations were conducted from 4 points of view, total value and utility value of whole CP environments, values of each environment existing in CP or development plan assumed in CP. Furthermore, respondents’ attributes were also investigated. In consequence, the following is obtained. 1) Almost all of total value of CP is composed of utility value of direct use. 2) Each of environment and development plans whose value is the highest is clarified. 3) Moreover, development plan to improve environmental value the most is specified.

Keywords—CVM, Development Plans, University Campus, Improvement of Environments Value.

I. INTRODUCTION

Traditionally, development projects were made decisions only by attaching importance to earning rates, terms of construction works and political influences, which lead to slight developments’ influence to socio-cultural values these areas originally have. In addition, development projects were usually not practiced with recognizing areas broadly at long-term point of view.

In this paper, it is advocated to decide development projects which enable to improve socio-cultural values of environments and to keep them for a long time, which was proceeded at two points below.

1) Planning of plural developments at a long term viewpoint
   Plural patterns of development projects were assumed in order to evaluate those influences to socio-cultural values around developing environments, which is considered based on calculations of those appraised values. Furthermore, environmental values lost by practicing these developments are clarified.

2) Relative evaluation of diversified developments and existing environments
   The development project considered to improve environmental values the most is decided through evaluating values lost or appeared by practicing developments.

CVM is adopted as an appropriate way of valuation, which is verified throughout evaluations of various environments and diversified developments. And also the adaptability of CVM to the aims of this study is considered.

II. THE INVESTIGATION CASE

A university campus is decided to adopt as a case of this study, just exchanging between community and university. As usual, evaluations of socio-cultural values were not often grappled with, such as national environments, historic property and exchanging to community, especially at a viewpoint of people blessed with CP envelopments. And also studies on methods to decide developments improving these values effectively were not enough, in spite of increasing needs to develop CP environments strategically by university’s own source of revenue.

University is interpreted as a sort of urban miniatures because of its plenty users, environmental accumulations and variety of activity. So it is natural to grow louder for requests for appropriate development plans, just as it was a city to construct environments comfortable.

There are many numbers of campuses, Toyonaka CP of the Osaka University is selected as an appropriate case of this study due to various factors such as its potential in socio-cultural values, and plenty number of inhabitants around CP, and pressure of developments caused by limitation of site area in CP and integration to another university.3

III. THE OUTLINE OF PREVIOUS STUDY

A. Study on Campus Planning
   Many researches dealing with CP planning were conducted in the past [1], though study on socio-cultural values existing in CP or developments influences to them, which is the main theme of this study, was not confirmed. At this point, this study is the first attempt of all.

B. Study on Evaluation to Socio-cultural Value by Means of CVM
   Studies based on CVM are classified into 1; study on evaluation of environments and projects by using CVM and 2; study on techniques to apply CVM. This study comes under 1, the case history of studies on 1 gives examples such as evaluation of nature [2], environments and views of historical city area [3] [4], and as evaluations of projects, values of a barrier-free project held in stations and institutions [5], improving living environments [6], tree planting rooftops [7], a move of metropolitan functions [8], constructions of shores [9] and so on. Although many studies were conducted, this is the first attempt to take CP as a case in order to evaluate various environments and developments expected to conduct there.

Analyses of evaluations by using CVM give examples such as a relationship between attributes and WTP [2] [5] [9], classification of total values such as utility value [3] [4], verification of projects profits [8], application to reach mutual agreements about development projects [10], and so on. In this study, relationships between WTP and attributes of respondents and also evaluations of CP construction are investigated.

IV. EVALUATIONS BY USING CVM

A. Meaning of Adopting CVM
   Besides CVM, for typical examples of the way to evaluate environments quantitatively, the Substitution Method or the Travel-cost Method is taken. Compared to them, CVM has much
wider application range, so that it can apply to anything, in theory, if only virtual markets can be constructed, which makes it possible to evaluate CP environments at various viewpoints. Furthermore, using questionnaires enable to take respondents’ opinions into projects, and utilizing amount of money as unit of evaluation also enable to evaluate values relatively.

B. Technical Issues of CVM

Although using CVM enable to evaluate various kinds of values in theory, its reliability is always open to question, because of taking questionnaire as the way of investigation. Especially bias, which represent to make difference from true values caused by various factors such as content of explanations or ways to answer questions, is regarded as the most questionable matter. Therefore it is important to hold the bias to the minimum in order to raise reliability of investigation using CVM.

V. THE PROCESS OF THE STUDY

In this study, the process bellow was conducted in order. 1) Determining survey design to make evaluation forms 2) Conducting investigations using evaluation forms 3) Analyzing results of investigations statistically at various points of view 4) Based on results of analyses, estimating total appraised values and profits of long-term developments.

VI. THE SURVEY DESIGN

A. The Subjects of Investigations

Students, the faculty and inhabitants around CP were chosen as subjects of investigations just because they were considered to have opportunities to enjoy CP environments frequently (Table I1). In terms of inhabitants, all of households living within a range of some 1 km² distance from the edge of CP, which means ordinary people can visit on foot, were selected. On the other hand, students and the faculty commuting to Toyonaka CP at time of conducting investigations were chosen as subjects.

All of three, having chances to visit CP in their daily lives is the most important condition to select.

B. The Order of CVM Investigations

All of investigations were conducted based on the process bellow. 1) Establishment of the plural sorts of investigations In order to evaluate and analyze CP at various angles, 4 kinds of surveys were established (Table II).

In the investigation number III Inv. # the following), 12 types of areas which is regarded as a symbol of CP or expected to be constructed in the near future were adopted as subjects to investigate (Table III).

In the Inv. V., 5 patterns of development projects were settled on by putting some assumed constructions together based on results of the survey which has been conducted to establish the Campus Master Plan (Table IV). In order to define what type of CP environments respondents hope, decision of development projects attached importance to specify merits and demerits caused by these practices. Concerning where to construct or how to make a development project, it was decided by considering results of hearing investigations to the charge posts such as the Campus Design Laboratory and the Institution Department, which enable to assume more practical development plans. Extensions or reconstructions of buildings where lectures or researches are held or repairing of roads excludes from the investigation subjects because the government grants a subsidy to these developments.

2) Information shoved to respondents

On filling out the investigation forms, respondents look through pictures, image illustrations and itemized explanatory notes about each investigation subject. This information is based on content of references, HP and listening investigations to the charge posts. On the occasion of collecting information, its reliability was paid much attention, and also in order to keep values of bias minimum, conditions of taking pictures or making illustrations were matched in all investigations.

3) Question of WTP

a) Establishment of Scenarios

Scenarios used in the Inv. # 1-3 are shown on the Table V. In the Inv.

<p>| TABLE I |</p>
<table>
<thead>
<tr>
<th>DETAILS OF INVESTIGATION SUBJECTS(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
</tr>
<tr>
<td>Total number</td>
</tr>
<tr>
<td>University Graduate School</td>
</tr>
<tr>
<td>Teaching Staff</td>
</tr>
<tr>
<td>Toyonaka City</td>
</tr>
</tbody>
</table>

<p>| TABLE II |
| TYPES OF ASSUMED INVESTIGATIONS |</p>
<table>
<thead>
<tr>
<th>Inv.</th>
<th>Type</th>
<th>Contents of Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Utility value of directly use of CP environments</td>
<td>Estimating an appraised value of whole CP environments at the present time</td>
</tr>
<tr>
<td>II</td>
<td>Utility value of indirectly use of CP environments</td>
<td>Estimating a value of CP environments from an angle of utilizing</td>
</tr>
<tr>
<td>III</td>
<td>Total appraised value of specific environments existing in CP, such as ponds or gardens, to choose 12 areas as typical examples of CP</td>
<td>Evaluating values of specific environments existing in CP, such as ponds or gardens, to choose 12 areas as typical examples of CP</td>
</tr>
<tr>
<td>V</td>
<td>Utility value of directly use of CP environments after developments</td>
<td>Estimating value of CP environments where the patterns of development projects are suppose to be conducted</td>
</tr>
</tbody>
</table>

# 3, different scenarios were assigned in every 12 patterns of investigations (Table V). While in the Inv # 5, it was adopted as scenarios to collect expenses from CP users because lack of university’s own funds or government subsidy made it harder to maintain CP environments in the present condition. And if enough funds were collected, it would be able to practice maintenance to keep environments clean and comfortable as usual.

b) Presentation of Money Amounts

After reading scenarios, respondents were given questions on payments of certain amounts which are composed of 3 patterns of the choices such as 1) agree, 2) disagree, which signify that respondents request less expensive payment than presented amount of money, and 3) disagree to form of questions itself including payment way.

As a way to inquire WTP to respondents, the Single-Bound Method was adopted due to its characteristic property of being hard to cause bias and to easy to reply for respondents. And as a way of payment, contribution to funds was adopted for the purpose of finding out WTP based on respondents’ free will. Terms of paying contributions were decided 1 year and respondents were assumed to pay in one lump sum. In order to estimate reliable values of all investigations, it was showed to respondents CLEARLY that bearing them caused to diminish fortune used for another purpose, the present level of education or to respondents that bearing them caused to diminish fortune used for another purpose, the present level of education or research was not to change if scenarios had been realized, uses of contribution were limited to contents written in investigation forms, and all of scenarios were hypotheses never to be realized and so on.

Depend on the result of 2 times pre-tests subject to students, amount of money shown in investigation forms was decided 5 kinds; 100, 500, 1000, 2000, 5000 yen*. Therefore, 130 patterns of investigation forms, which led by the multiplication of 26 investigations by 5 amount of money, were established throughout the survey design.

In order to make relationships between respondents and their WTP clear, investigations on respondents’ attributes were conducted to all of them (Table VI). Their sense of value was questioned in category A, B, D and as was relationships between CP and themselves in category C, E.

VII. ENFORCEMENT OF INVESTIGATIONS

In some opinions, the Individual-interview Method is suitable for the way of investigations using CVM, although it tends to require much time and money. Accordingly, in this study, investigation forms were distributed among a group of dozens respondents, giving basic
A. The Way to Analyze WTP

In this report, significant response samples, which exclude resistant response samples from distribution samples, are selected as appropriate subjects of analyses, and the Logistic Regression Analysis is adopted as a way to estimate central values of WTP (1).

\[ y = \frac{k}{1 + a \cdot \exp^{-\frac{-x}{b}}} \]  

(1)

a; coefficient, b; constant, k; the maximum value, x; approve rate (→)

Fig. 1 shows the integral curve of students’ approve rate to preserve CP environments and on this occasion, various values estimated by applying formula 1 are shown in Table VIII.

B. Analysis Results

In the same process, central values of all investigations were estimated (Fig. 2). According to them, in almost all of

<table>
<thead>
<tr>
<th>Inv. #</th>
<th>Investigation Areas</th>
<th>Explanation about investigation areas</th>
<th>Main reasons to select as investigation areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>III-1</td>
<td>The Dormitory of Matikan-yama</td>
<td>One of the dormitories of Osaka University where mainly the faculty lives. It has deepcrit appearance and deficit operation.</td>
<td>It is located near the station and also at the front of the Handai slope. Where many people pass by, but these good conditions are not utilized well at present.</td>
</tr>
<tr>
<td>III-2</td>
<td>Nakayama Pond</td>
<td>The largest pond of 3 existing in CP, used as a reservoir. Precious waterside scenes can be seen around there.</td>
<td>It is located along the Handai slope, which supposed to provide a waterside-space to passersby. Bad condition of maintenance prevent it from being used.</td>
</tr>
<tr>
<td>III-3</td>
<td>Green area next to the Building of Igo</td>
<td>There are many grown trees and parked bicycles around there. Some people visit there to park bicycles but not so many.</td>
<td>It is not utilized well although it locates beside the East Gate which is likely a front door of the university.</td>
</tr>
<tr>
<td>III-4</td>
<td>Space next to Students Exchanging Institute</td>
<td>A space next to the welfare institute. Some people occasionally make use of it as a parking area or a space to exercise but not so many.</td>
<td>It is not utilized well although it locates beside the East Gate, just same as Inv. III-3, and also a broad space with a fine view.</td>
</tr>
<tr>
<td>III-5</td>
<td>Green area in front of the Building of Language Research</td>
<td>A space where many trees grow. Some people pass there although the alley is constructed.</td>
<td>It is at present, not yet utilized well regardless of its plentiful natural environments and good locations in front of the Main Street (Inv. III-6) which is a center of CP.</td>
</tr>
<tr>
<td>III-6</td>
<td>The Main Street</td>
<td>A street many people pass through and also park bicycles. Main buildings, many bulletin boards and gardens are along this street.</td>
<td>It is a center place of CP and almost all people related to the university pass.</td>
</tr>
<tr>
<td>III-7</td>
<td>Namiko Garden</td>
<td>A historical park whose name comes from the old name of the Osaka University. Some people take lunch, rest or read books there.</td>
<td>It is in condition of maintenance improves untidy, although it has plenty of nature and located beside the Main Street just as Inv. III-5.</td>
</tr>
<tr>
<td>III-8</td>
<td>Space next to the Building of Common Education</td>
<td>One of places along the Main Street (Inv. III-6) and faced to the entrance of the buildings of common education.</td>
<td>Due to facing the Main Street, many pedestrian pass through, though few people make use of it.</td>
</tr>
<tr>
<td>III-9</td>
<td>Green area in the corner of the ground</td>
<td>Place where many trees grow. Some use it to park bicycles, though it has a bad condition of maintenance.</td>
<td>It is located at the end of the Main Street, which means it has a role of eye-stop.</td>
</tr>
<tr>
<td>III-10</td>
<td>Ubagaya Pond</td>
<td>Used as a reservoir. Precious waterside scenes can be seen around there.</td>
<td>Although it has plentiful ecosystems and history there, few people know its existence.</td>
</tr>
<tr>
<td>III-11</td>
<td>The alley in front of the Ubagaya Pond</td>
<td>An alley of stone pavement which has abundant natural environments. Some pass this alley to take a shortcut.</td>
<td>Only a part of students and inhabitants utilize, and few people know its existence.</td>
</tr>
<tr>
<td>III-12</td>
<td>The Building of Ex-cyberspace</td>
<td>The older one of the two cyberspaces built in CP. Many students use there relatively although new cyberspace was built.</td>
<td>Because it is opened for longer time, many students make use of it regardless of establishing the newer one. On the other hand, some who make no use of it propose to demolish it.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inv. #</th>
<th>Plan Types</th>
<th>Content of Development Plans (Inv. # of developed area)</th>
<th>Expected MERITS Caused by Practicing the Following Development Projects</th>
<th>Expected DEMERITS Caused by Practicing the Following Development Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>V-1</td>
<td>Priority in Vehicles</td>
<td>■ Found a new bus rotary after taking down the Building of Ex-cyberspace (III-12) ■ Found a new paved road at the east side of CP (III-11) ■ Construct a parking lot after filling in both of Nakayama Pond (III-2) and Ubagaya Pond (III-10).</td>
<td>■ Central area of CP becomes the exclusive zones for pedestrians. ■ To secure evacuation routes in case of emergency.</td>
<td>■ To demolish the building of ex-cyberspace. ■ To fill in two ponds. ■ To demolish a part of gardens.</td>
</tr>
<tr>
<td>V-2</td>
<td>Priority in Bicycles</td>
<td>■ Found a new bus rotary after taking down the building of ex-cyberspace (III-12) ■ Establish a new multilevel parking for bicycles (III-3) ■ Found a new parking after filling in Ubagaya pond (III-10).</td>
<td>■ To conduct regulation of vehicles traffic in CP ■ To make it easier to pass by bicycles.</td>
<td>■ To demolish the building of ex-cyberspace. ■ To prohibit parking of bicycles in the main street. ■ To fill in two ponds.</td>
</tr>
<tr>
<td>V-3</td>
<td>Priority in pedestrians</td>
<td>■ Found a new bus rotary after taking down the Building of Ex-cyberspace (III-12) ■ Plant the main street with trees (III-6).</td>
<td>■ Central area of CP becomes the exclusive zones for pedestrians. ■ Plentiful trees are provided.</td>
<td>■ To demolish the building of ex-cyberspace. ■ To limit in areas where people permit to pass by bicycles. ■ To prohibit parking of bicycles in the main street.</td>
</tr>
<tr>
<td>V-4</td>
<td>Priority in Exchanging</td>
<td>■ Build a sports institution after taking down the Dormitory of Matikan-yama (III-1) ■ Establish a life-educational institution after filling in Nakayama Pond (III-2).</td>
<td>■ To promote residents’ utilization of CP environments ■ To establish institutions effectively many people requested.</td>
<td>■ To fill in a part of the pond ■ To demolish the dormitory.</td>
</tr>
<tr>
<td>V-5</td>
<td>Master Plan Type</td>
<td>■ Found a new bus rotary after taking down the Building of Ex-cyberspace (III-12) ■ Found a new paved road and bus rotary jointly at the east side of CP (III-9,11).</td>
<td>■ Central area of CP becomes the exclusive zones for pedestrians. ■ To secure evacuation routes in case of emergency.</td>
<td>■ To make a symbol of CP. ■ To demolish the building of ex-cyberspace. ■ To lose a part of gardens such as SNamiko Garden.</td>
</tr>
</tbody>
</table>
In this report, focused on no payment at all.

The university plans to conduct developments below at 12 investigation areas showed in TABLE. 3. In order to practice another plan to prevent them, it is necessary to collect funds because of being lack in university’s own funds or government subsidy, though if it happens; it becomes possible to preserve these areas in a present condition.

In order to investigate how reliable estimated values are, their consistence with tendencies expected generally is considered, whose results are obtained.

1) In common to all of three, respondents who have experiences of volunteer activities show higher appraised values.

2) It is clarified that students who have participations in club activities show higher values, and also that those of the university shows higher values than the graduate school, despite of less remarkable interrelations between their grades and WTP.

3) In occasion of the facility, conspicuous relationships are not shown at any attributes because of many numbers of resistant respondents.

4) In case of inhabitants around CP, the closer they connect to CP environments or the longer time they lead their lives around CP for, the higher values they tend to show.

5) In any of three, place of residence, annual incomes and members of family influence rarely to appraised values.

At the viewpoint of preserving CP environments, the following is obtained.

1) Over 50% respondents agree to preserve CP environments.

2) The reasons why respondents AGREE to preserve CP are mainly composed of evaluating environments existing in CP such as ponds or gardens (Table X).

3) Some respondents disagree to preserve CP mainly because they agree to the scenario which means reconstruct CP to a new one (Table XI).

C. Investigation of Reliable

In order to investigate how reliable estimated values are, their consistence with tendencies expected generally is considered, whose results are the following.

1) In case of inhabitants, the more times they visit to CP or the closer relationships to community their lives have, the higher values are shown.

2) In case of students, higher values tend to be shown by those who have opportunities to enjoy CP environments through their club activities or who stay in CP to have all classes that the university encourages to take.

3) Some students who stay in CP for far longer time than usual
TABLE VII

THE SAMPLE DATA OF ALL INVESTIGATIONS

<table>
<thead>
<tr>
<th>Inv. #</th>
<th>I</th>
<th>II</th>
<th>V.1</th>
<th>V.2</th>
<th>V.3</th>
<th>V.4</th>
<th>V.5</th>
<th>V.6</th>
<th>V.7</th>
<th>V.8</th>
<th>V.9</th>
<th>V.10</th>
<th>V.11</th>
<th>V.12</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Number of Distribution Sample</td>
<td>1282</td>
<td>1272</td>
<td>1147</td>
<td>1137</td>
<td>1147</td>
<td>1137</td>
<td>1137</td>
<td>1137</td>
<td>1137</td>
<td>1137</td>
<td>1137</td>
<td>1137</td>
<td>1137</td>
<td></td>
</tr>
<tr>
<td>The Number of Response Sample</td>
<td>693</td>
<td>676</td>
<td>580</td>
<td>579</td>
<td>580</td>
<td>579</td>
<td>579</td>
<td>579</td>
<td>579</td>
<td>579</td>
<td>579</td>
<td>579</td>
<td>579</td>
<td>579</td>
</tr>
<tr>
<td>The Number of Significant Response Sample</td>
<td>647</td>
<td>644</td>
<td>492</td>
<td>517</td>
<td>501</td>
<td>510</td>
<td>513</td>
<td>511</td>
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<td>511</td>
<td>511</td>
<td>511</td>
<td>511</td>
<td>511</td>
</tr>
<tr>
<td>The Number of Resistant Response Sample</td>
<td>53</td>
<td>91</td>
<td>72</td>
<td>82</td>
<td>75</td>
<td>83</td>
<td>83</td>
<td>83</td>
<td>83</td>
<td>83</td>
<td>83</td>
<td>83</td>
<td>83</td>
<td>83</td>
</tr>
<tr>
<td>The Response Rate</td>
<td>8.2%</td>
<td>14.1%</td>
<td>14.0%</td>
<td>15.9%</td>
<td>15.0%</td>
<td>16.3%</td>
<td>16.2%</td>
<td>16.2%</td>
<td>16.2%</td>
<td>16.2%</td>
<td>16.2%</td>
<td>16.2%</td>
<td>16.2%</td>
<td>16.2%</td>
</tr>
</tbody>
</table>

TABLE VII
VALUES OF FORMULA ON STUDENTS’ PRESERVATION OF CP ENVIRONMENTS

<table>
<thead>
<tr>
<th>coefficient</th>
<th>constant</th>
<th>maximum</th>
<th>standard value</th>
<th>value k</th>
<th>deviation</th>
<th>value of F</th>
<th>value of P</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>b</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.210071</td>
<td>-9.27807</td>
<td>132000</td>
<td>0.245518</td>
<td>91.13001</td>
<td>0.0000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IX. ESTIMATION OF TOTAL APPRAISED VALUES

In order to prevent affection of excessive values caused by ethical satisfactions of donation, central value is considered to be appropriate to estimate total appraised values (2).

\[ TAV(Yen) = M(S) \ast T(S) + M(F) \ast T(F) + M(I) \ast T(I) \]

where:

- \( M(S) \): Central Value-Students
- \( M(F) \): The Faculty
- \( M(I) \): Inhabitants
- \( T(S) \): Total Number-Students
- \( T(F) \): The Faculty
- \( T(I) \): Inhabitants

As a result, it is gained that the utility value of CP environments occupy almost all of total value; the former, which is calculated 10,355,000 yen, is equal to 97% of the latter calculated 10,586,000 yen. And it is also gained that Namiko Garden (Inv. III-3) shows the highest value of 12 cases of environments existing CP (Fig. 4).

Fig. 2 The Central Values of WTP on All Assumed Investigations
TABLE XI

<table>
<thead>
<tr>
<th>Students (193, 63)</th>
<th>Attributes</th>
<th>Central Values (YEN)</th>
<th>The Percentage of Each Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Faculty</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Agreement</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Disagreement</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other Opinions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Choose WP</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Resident</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TABLE X

<table>
<thead>
<tr>
<th>Subjects (366, 260)</th>
<th>Attributes</th>
<th>Central Values (YEN)</th>
<th>The Percentage of Each Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Faculties</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Agreement</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Disagreement</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>Other Opinions</strong></td>
<td></td>
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Fig. 3 the Approval Rate on Preservation of CP Environments

Based on results from investigation, V, total appraised values of entire CP environments after having conducted plural constructions mean those values expected at present. Although it is supposed to be natural to estimate values which are expected after all of constructions are completed, it has much difficulty to assume that all constructions of this study are completed at the same time and also that commodity price or sense of values never change at all throughout constructions period. Thus, values expected at a point of investigation decided to be investigated.

![Image of a table and graph showing data and analysis related to the preservation of CP environments.](image-url)
In the investigation \( V \), expected present values of direct utility in CP where plural constructions are completed were calculated. Those of entire environments in CP were estimated by applying to expression 3 which means to use a ratio of present total value calculated in Inv. \#1 to present direct utility value calculated in Inv. \#II.

\[
T(d(C)) = \frac{U(d(C)) + U(C)}{T(C)}
\]

(3)

\( T(C) \): Total Appraised Value of CP Environments Calculated in Inv. \#1
\( U(C) \): Utility Value of Directly Use of CP Environments Calculated in Inv. \#2
\( T(d(C)) \): Total Appraised Value of CP Environments after Development
\( U(d(C)) \): Utility Value of Directly Use Calculated in Inv. \#5

In order to utilize CVM as an effective means to evaluate environments or projects, selections of respondents or response rates should be thoroughly deliberated. Particularly in the case of applying to CP, respondents are required to recognize that all of investigations assumed in CP are quantitatively evaluated at viewpoints of those who are blessed with CP environments and also verified from various angles. Consequently, the following knowledge is obtained.

1. Most people mainly appreciate utility value of directly use of CP environments.
2. Environments to preserve in the future is clarified through relative evaluations among environments existing in CP.
3. In case of constructions planned at a long-term view, the same above is obtained.
4. Relative evaluations of development plans make it clear that which one is considered to improve CP environments the most.

4. Consider the total appraised values estimated in chapter 8-1 (shown in Fig. 5), plan type of priority in exchanging (Inv. \#4) should be the first one to practice, likewise. In the case of plan type of priority in pedestrians (Inv. \#3), regardless of its high appraised value, the rate is under 1.0, because practicing these developments is supposed to lost plenty of environments. On account of making the rate over 1.0, which means to improve environmental values, it is considered necessary to reexamine where to develop. On the other hand, plan type of priority in vehicles or bicycles is clarified that their rates are near 1.0 while their appraised values are extremely low, because both of development plans’ value and environments’ value lost by developments is low. At the point of improving CP environments, this suggests that whether developments are practiced or not, it makes less difference and, in addiction, less advantages in aspect of cost-effectiveness. Therefore, these plans are not advisable to practice in the actual budget for constructions. Considering the circumstances mentioned above, development plans improving environmental value of CP are specified in aspects of total appraised value and VIR.

### X. CONCLUSION

Throughout this study, various environments and constructions assumed in CP are quantitatively evaluated at viewpoints of those who are blessed with CP environments and also verified from various angles. Consequently, the following knowledge is obtained.

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**FOOTNOTES**

* It means values which come from direct using of certain environment in some way. Total value of environments is able to be classified into 6, such as the utility value of direct use, which is gained by making direct use of environments in some way, or the utility value of indirect use, which is gained through behaviors or pictures of environments, or the inheritance value, which derived from possibilities of using those environments by posterity.

*2* *Y. Arayama “Environmental Economics of City Amenity” 2003.* In case of CP environments, taking lunch in the garden, taking a walk, and attending lectures using classrooms are considered to use CP environments directly, which lead to occur the utility value of direct use. Other values are classified into 6, such as the utility value of direct use, which is gained by making direct use of environments in some way, or the utility value of indirect use, which is gained through behaviors or pictures of environments, or the inheritance value, which derived from possibilities of using those environments by posterity.

*3* *K. Katayama, T. Zyosyo, T. Onishi “Study on quantitative evaluations of capital functions’ moving using CVM” in the 34th report on theses of the City Planning Institution of Japan 1999, pp.73-78.

*4* *N. Hashimoto, S. Sakurai “Study on CVM evaluations of the project to develop an artificial beach in the Tokyo bay” in the 35th report on theses of the City Planning Institution of Japan 2000, pp.661-666.

*5* *S. Yokoyama, T. Zyosyo, T. Onishi “Evaluations and analyses of the project improving resident environments of low income brackets’ area in developing countries-case study of the San Antonio in the Manila metropolitan area based on CVM” in the 34th report on theses of the City Planning Institution of Japan 1999, pp.151-156.

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*7* *Kuriko Iwai was born in Osaka, Japan in 1983, studied architectural planning and urban planning at the University of Osaka, and earned a bachelor’s degree of Eng. Dep. in 2006.* She is in her 1st grade of graduate school of the Osaka University, and researches environmental management of facilities and economic method of evaluating environments. Ms. IWAI is a regular member of societies such as Architectural Institute of Japan, the City Planning Institute of Japan.

*8* *S. Yokoyama, T. Zyosyo, T. Onishi “Evaluations and analyses of the project improving resident environments of low income brackets’ area in developing countries-case study of the San Antonio in the Manila metropolitan area based on CVM” in the 34th report on theses of the City Planning Institution of Japan 1999, pp.151-156.*


*10* *K Katayama, T. Zyosyo, T. Seda, T. Onishi “Study on quantitative evaluations of capital functions’ moving using CVM” in the 34th report on theses of the City Planning Institution of Japan 1999, pp.73-78.*


*12* *K. Katayama, T. Zyosyo, T. Seda, T. Onishi “Study on quantitative evaluations of capital functions’ moving using CVM” in the 34th report on theses of the City Planning Institution of Japan 1999, pp.73-78.*

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