Chapter 1
An Experimental Approach for the Sustainable Regional Governance: Regional Environment Diagnosis of Hachioji City 2013-15

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Abstract
The globalized economies have experienced many kinds of market and government failures. Municipalities must attain many targets with limited resources at the same time. Public private partnerships in regional governance could pave the way on the sustainable economic societies. The sustainable scheme of the regional governance should be cooperative with many stakeholders in the community. This paper focuses on the bottleneck of the regional communication and provides the theoretical foundation to trigger initiatives for the voluntary contribution by residents. The empirical evidences in the environment diagnosis of Hachioji City, Tokyo 2013-2015 could provide the experimental method to improve steadily the collaborative regional governance.

Key Words: regional environment diagnosis, experimental and regional governance, public private partnership, voluntary contribution, communication and participation in community

1. Introduction
Since the 1980s, the neo-liberalism of market economies has prevailed in the growing prospects of global economies. However, liberalization of economies accompanies the decreasing intervention or regulation by the governments to the market economies. Coincidentally, urban and regional issues such as environments and social welfares have been becoming more imperative. The structural changes by the post industrial revolution have brought about the diversities of industries and residents in the regions. The uniform program by the government over the countries does not care for the diversified social needs and apparently loses the effectiveness. The representative systems of democracy established in the 20 century could not match the diversified needs. The reason is stated as follows. The members in the local parliament are selected by the regional election. To represent the needs of the residents they are obliged to obtain a mission or target to be fulfilled. They do not necessarily obtain the precise information of various social needs to make priority over them. If the communities are not forced immediately to decide
many imperative targets, agreeable decisions could be obtained in the ordinal discussions. But increasing targets to be achieved make hard to focus on the primary aim for the region. Most representatives are likely to fail to attain the primary goal. And the development of global market has added new demands to provide public goods. Since the competition over the global markets depresses the growth of governmental revenue, the austerity principle of the government enhances the importance to prevent governmental bankruptcy. This principle might seek for enlarging private provision of public goods. To achieve social needs promptly and suitably we must construct cooperative framework participating the concerning stakeholders in the region and improve the system to provide public goods steadily and effectively.\textsuperscript{1) }

Many regions have funded the various cooperative frameworks of the region as the result of own preceding experiences. This paper aims to develop an empirical analysis based on the regional frameworks in the environmental practice of Hachioji City, Tokyo Prefecture. Hachioji City had established the basic ordinance of environment 2002 and promoted private and public partnership experimentally. In particular, Hachioji City has designed system of environmental diagnosis to become the central apparatus in the private and public partnership of this region and started it with the cooperation of Chuo University.\textsuperscript{2) }Shiwa Town, Iwate Prefecture has followed the system since 2004. This paper presents some experimental findings to improve cooperative framework from a statistical analysis of the practical performance.\textsuperscript{3) }

The participation and the cooperation by the residents are not dispensable to attain the fine regional environment. By using compulsory means such as penalty and tax, regional governments could induce residents to behave cooperatively with the regional policies in appropriate issues. But the compulsory policies are required to be approved by the local parliament. Actually, the legitimate compulsory policies are based on the consents by the residents. The compulsory policies are permitted in only limited fields and could not define directly actions of the residents in a large scope. Consequently, the current trends represented by globalized economies, new industrial revolution and the austerity principle of the government are

\textsuperscript{2) }Hachioji City and Chuo University have continued the projects on the regional diagnosis in the framework of public private partnerships to be named as the “Chuo University ・ Hachioji City Model” Li, Qiang (2016) p.4.
\textsuperscript{3) }Tanaka (2009c) explains the development brought by the experimental practices.
expected to enlarge the voluntary contributions by the private. The growing contributions by the private should enhance evaluation of the construction of efficient framework of private public partnerships.\textsuperscript{4)
}

To enhance the regional sustainability the scheme of the regional communication should be reformed to improve the voluntary contribution. The reconstruction of the regional governance should proceed experimentally. This paper aims to develop a revolutionary method to manipulate reform of the regional communication. This chapter reconstructs Tanaka (2017a), and presents new perspectives. The main results are summarized as follows. In the first this paper provides new approach to improve the evaluation of the sharing communication in the region. In the second this paper explores the bottleneck in the regional communication and finds out the solutions for the regional problems. In the third this paper demonstrates that initiatives of municipalities on the regional issues are related closely with efforts on the communication problems. This paper evaluates the cooperative structure of regional practices. The discussion is organized by 3 sections. The section 2 makes clear theoretically the scheme to develop the voluntary contribution of residents. The section 3 investigates empirically the structure of the bottlenecks in the regional communication by basing on the evidences of regional environment diagnosis. The section 4 estimates the connected effects among the regional practices by using correlation coefficients inter parts of indexes and proposes the method to evaluate the integrate system of regional policy.

2. A model analysis on voluntary contribution of regional issues.

In this section, we introduce the model to investigate the voluntary provision of public goods. It is assumed that the residents are classified into the two types. Individual 1 contributes actively and individual 2 is passive to contribute. Individual 1 and 2 are supposed to provide public goods and services $x_1$ and $x_2$, and to consume private goods $y_1$ and $y_2$. The prices of public and private goods are normalized to be units. The incomes of two individuals are denoted by $M_1$ and $M_2$. We assume that individual 1 has more income than individual 2 and that the comparison of incomes is expressed by the inequality $M_1 > M_2$. The individuals in the identical region are assumed to consume the same level $G$ of public goods provision. The utility functions regarding individuals 1 and 2 are expressed by concave functions,

$$u_i(G, y_i), \ i = 1, 2.$$  \hfill (1)

\textsuperscript{4)} Magnusson (2015) and Tanaka (2009a) focus on enhancing importance of the governance for the cities.
The constraints of income are presented by

\[ x_i + y_i = M_i, \quad i = 1, 2. \]  \hspace{1cm} (2)

The investigation on the voluntary contribution by the residents is funded on the following model analysis. Waste disposal is stated as provision of public goods. To reduce the waste efficiently not only the voluntary efforts by the residents but also construction and maintenance of burning facilities by the municipalities should be improved with the best mixed combination. Municipalities are supposed to provide responsibly public goods \( g \) to compose \( G \). When the supply and the demand of public goods equilibrate, the following expression states the condition of market equilibrium,

\[ G = g + x_1 + x_2. \]  \hspace{1cm} (3)

Figure 1 illustrates how the communication between the municipalities and residents could improve regional voluntary contribution. In the first, the income constraints indicated by the expression (2) are denoted by IJ and FH in Figure 1. The points of optimal consumption are exhibited by the points B and A. The optimal consumption of public goods for individual 1 and 2 is stated by \( x_2^* \) and \( x_1^* \) and the inequality written by \( x_1^* > x_2^* \) is assumed to be obtained. The two individuals are supposed to provide public goods independently without negotiations. Individual 1 provides \( x_1^* \) of public goods and is not satisfied with \( x_2^* \) provided by only the individual 2. The individual 1 would not decide to cancel the provision of public goods. In the other hand, the individual 2 could obtain more utility from \( x_1^* \) than the optimal point A. Even if the individual 2 stops to provide public goods, he is afford to consume \( x_1^* \) of public goods, and to obtain private goods with his income \( M_2 \). Consequently, the individual 2 consumes the vector \( (x_1^*, M_2) \) located in the right and above the point A, and gains higher utility than \( u_2^1 \) with the initial optimal point A. In this region the public goods are secured at \( x_1^* \) provided voluntarily by the individual 1 and the individual 2 would not contribute public goods any more. In some cases, many residents attempt seriously to decrease wastes but others are not concerned with the reduction of the wastes. The total wastes could not reduce under the status quo at the point B. In other cases, even if many residents refine own green gardens, the regional green environment could not improve better if some residences might turn up to be ghost houses.

In the previous situation, appropriate regional public goods could be provided voluntarily not by all but by a large numbers of residents. In the second, we propose the theoretical framework that the local government could improve the mechanism of public private participations by making all utilities of residents better. It should be noticed that the point B is not evaluated to represent a sufficient participation in the communities. For
example, even if the individual 1 cleans up the open space neighboring the own residence, many wastes in the streets possibly appear all around the region. Some public and private cooperative efforts could improve the regional environment in the streets. The provision of public goods $g$ by the municipalities is possible to trigger the cooperation regarding environmental preservation. To investigate the public and private cooperative framework the income constraint (2) is replaced by

$$x_i + y_i = M_i + g, \quad i = 1, 2 \tag{4}$$

If the local government provides large enough $g_2$, the individual 2 changes the non contribution into the contribution with provision of public goods. For $i = 2$, (4) means to shift the income constraint line of the individual 2 right and upward from FH to KL in the Figure 1. Figure 1 shows that the point C of optimal consumption on the income constraint line KL is indicated by the vector $(G_2^{**}, y_2^{**})$ for $G_2^{**} > x_1^*$.

The mathematical expression states precisely the above graphical
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explanations. When municipalities do not join the framework of public and private partnerships, the public provision of public goods is expressed by the equality $g_1 = 0$ and $g_2 = 0$. In the ordinal usage of the consumption theory, we assume non negative constraints ($x_1 \geq 0, x_2 \geq 0$) for public goods. It is assumed also that the consumption of private goods is positive. By using the Lagrange multiplier $\lambda (>0)$, the Kuhn – Tucker theorem describes the conditions of the optimal consumptions $^5$ by (5), (6) and (7).

$$\frac{\partial u_1}{\partial x_i} + \lambda \leq 0, \quad i = 1, 2. \quad (5)$$

$$\left( \frac{\partial u_1}{\partial x_i} + \lambda \right) x_i = 0, \quad i = 1, 2. \quad (6)$$

$$\frac{\partial u_i}{\partial y_i} + \lambda = 0, \quad i = 1, 2. \quad (7)$$

The above conditions prove that for $x_1 > 0$,

$$\frac{\partial u_1}{\partial x_1} + \lambda = 0, \quad (8)$$

is obtained and for, $x_2 = 0$,

$$\frac{\partial u_2}{\partial x_2} + \lambda < 0, \quad (9)$$

holds. When individual 1 decides to consume the point B indicated by (8), (9) implies that the optimal point of individual 2 should be explained by Figure 2. The effects of initiatives by the municipalities are assured by the comparative analysis on the variables $x_1$ and $x_2$ defined by (8) and (9) and the amount of the vertical axis $G$ in Figure 1 and 2. At the first, assuming the Nash conjecture, $\frac{dx_i}{dx_j} = 0$, for $i, j = 1, 2$, the marginal substitution rate of $G$ and $x_1$ or $x_2$ to private goods are transformed by (10) and (11).

$$- \frac{dy_1}{dG} = - \frac{dy_1}{dx_1} = 1. \quad (10)$$

$$- \frac{dy_2}{dG} = - \frac{dy_2}{dx_2} < 1. \quad (11)$$

Figure 2 illustrates the free riding behavior of individual 2 expressed by (11). (10) and (11) are depicted by the points B and E. When majority members of individual 1 decide the optimal solution (10), the individual 2 to contribute no public goods replace the income constraint (2) by

$$x_2 + y_2 = M_2 + x_1^*. \quad (12)$$

If the municipalities would not construct any effective mechanism of public

5) The optimal conditions regarding the corner solution are stated in many textbook regarding mathematical programming. The expressions are assured formally by Tanaka (1988); p.20.
private partnerships, the income constraint lines of individual 2 move FH to QR. As individual 2 receives public goods $x_1^*, x_2$ in (12) is replaced by $x_1^*$. He consumes the private goods purchased by $M_2$. Individual 2 consumes the point E and raises utilities $u_1^3$ to $u_2^3$ without any actual contribution of public goods. Although the individual 2 prefers the point S to the point E, the point S is not available by the constraint of $M_2 = y_2$.

Figure 2 illustrates theoretically how some residents would not provide public goods positively. To improve collaborating mechanism in regional community we must make an incentive scheme to prevent the negative behaviors in the voluntary contributions. Figure 2 exhibits the situation that government could not make enough initiatives for the resident 2 to provide voluntary contribution. The local government ought to participate in the incentive scheme more seriously. If the government intervenes in the public services insufficiently or improperly, the vitalization of the private sector might decline. The municipalities should construct the incentive scheme to makes influence positively on the contributions of the both types of residents.
The scheme is expected to proceed in the two steps. In the first step, the municipality initiates provision of public goods $g_2$ to stimulate the free riding individual 2. The income constraint of individual 2 is rewritten by $x_2 + y_2 = M_2 + g_2$.

In Figure 1, the line FH moves upwardly to KL. The optimal consumption is indicated by the point C. The horizontal value of the point C is denoted by the amount of public goods $G_2^{**}$. Noticing that $g_2$ equal to the length of FT, the spatial analysis between the points T and C is assured to indicate the inequality $G_2^{**} > g_2$. Since the individual 1 does not obtain willingness to provide public goods from the inequality $G_2^{**} > x_1^*$, it should be reminded that the policies to improve participation of the individual 2 discourage the contribution of the individual 1. The individual 1 would like to select the point Q denoted by $(G_2^{**}, M_1)$ to take higher utility than the point B. Although we could ensure that the individual 2 contributes positive public goods with the governmental provision $g_2$, the individual 1 expresses no contribution of public goods. In this paper we have argued that the region should enlarge the participation of residents to accommodate diversified social needs. We could present the scheme to prove the evident on the discussion as follows. In the second step, to activate contribution of the individual 1 the municipality constructs the cooperative scheme to provide $g_2$ for the individual 1. The program attempts to transform the passive performing individual 1 into active contributing residents. The budget constraint line IJ for the individual 1 moves to the line MN. The optimal consumption is denoted by the point D. The point D takes the individual 1 higher utility than the non-contributing point Q. When the horizontal value of the point D is $G_1^{**}$, the individual 1 is willing to contribute voluntary public goods $G_1^{**} - G_2^{**}$. In the expression (3) $g$ is stated by $g = g_1 + g_2$. The amount KI indicates the overlapping governmental supports for the two residents. The amount MK implies net governmental provision to support the contribution of the individual 1. If the value $G_1^{**} - G_2^{**}$ exceed the distance MK, the individual 1 is ensured to make a net contribution. This scheme makes sure the collaboration between the private and the public. Reminding that $g_1$ and $g_2$ are positive, we conclude that the local governments should construct specific social infrastructure to accommodate the social needs of every type of resident. As the diversification of residents proceeds, for the cooperation on the region the municipalities must elaborate the integrating mechanism to adapt various social needs.

The public and private partnerships should aim to activate the voluntary contribution of the residents. In the above considerations we could make clear the some causes to prevent residents from contribution. We conclude that the municipalities should construct the integrated incentive scheme to
activate the cooperative partnerships by the diverse residents.

The theoretical analysis in this section makes clear two results. In the first, each type of individuals obtains the possibility to be tempted not to contribute public goods. As the negative participations in residents become to cover the community, the vitalization of the region might disappear. The municipality should make the scheme to facilitate residents to contribute voluntarily. In the second, the scheme to increase participation of all individuals enlarges the contribution of public goods and could progress the achievement of social needs of the region. The theoretical implication argues that the following approach is effective to improve voluntary participation by the residents. The municipality identifies the no contributing residents and should take care them intensively. Developing scheme of communication makes possible to perform successful contribution by residents.

3. The empirical foundation on the participation and the communication in the region

3.1 The environmental practice of all the prefectures

In 2, we provide the theoretical framework to take a view of the mechanism by which municipalities could construct the cooperative scheme to improve voluntary contribution of the residents. The implications of the theoretical analysis should be assured by the empirical research. The Chuo University - Hachioji City Model is produced appropriately to match the theoretical analysis. In this paper we demonstrate that the environment diagnosis in Hachioji City could guide actually to carry the participation of residents. The theoretical analysis indicated by in the previous section is proved completely by the empirical research.

The regions are obliged to achieve the sustainable governance effectively. Tanaka and Morita (2017b) suggest that the environment diagnosis 2013-15 provides the significant information on the performance of public private

<table>
<thead>
<tr>
<th>Part of index</th>
<th>Average Ecovalue</th>
<th>Variance</th>
<th>No contributor</th>
<th>Index of Cooperation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water, Sewage</td>
<td>7.08</td>
<td>4.43</td>
<td>0~4</td>
<td>0.33</td>
</tr>
<tr>
<td>Waste,Recycle</td>
<td>7.91</td>
<td>2.69</td>
<td>0~5</td>
<td>0.50</td>
</tr>
<tr>
<td>Energy</td>
<td>5.39</td>
<td>6.18</td>
<td>0~2</td>
<td>0.17</td>
</tr>
<tr>
<td>Natural Environment</td>
<td>10.03</td>
<td>19.89</td>
<td>0.1</td>
<td>0.05</td>
</tr>
<tr>
<td>Green Policy, Town Plan</td>
<td>5.56</td>
<td>9.74</td>
<td>0.1</td>
<td>0.07</td>
</tr>
<tr>
<td>Air</td>
<td>3.35</td>
<td>2.98</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Living Environment</td>
<td>4.91</td>
<td>4.11</td>
<td>0.1</td>
<td>0.13</td>
</tr>
<tr>
<td>Social Environment</td>
<td>9.57</td>
<td>16.97</td>
<td>0~2</td>
<td>0.11</td>
</tr>
<tr>
<td>Total</td>
<td>53.80</td>
<td>197.10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Ecovalues are stated with no correction
Source: Tanaka (2017a)
partnerships in Hachioji City. This paper presents a complementary investigation on public private partner-ships for Tanaka and Morita (2017b).

We produce Table 1 to observe empirically performances of the individual to be indicated in the theoretical analysis of the section 2. Table 1 employs the part of index exhibited in the environmental index “Check and Do\textsuperscript{6}”. Before we begin to discuss the results of the environmental diagnosis, the following remark should be noticed to calculate the eco values. Possibly, there is not an appropriate option for some residents to be chosen in the environmental diagnosis. For example, the residents who do not own vehicles cannot answer the questions to save the fuel of the car. In this case, the residents are added by one eco value and we notice that the eco values are complemented with the corrected evaluation.

In the survey of the environmental diagnosis Tanaka and Morita (2017b) estimate that the residents to have not any efficient access to the communication of the community amount to 21 indicating 5.7% of total population. In this paper, we suppose that the 21 residents to be observed in the environmental diagnosis could be identified by the individual 2 in Figure 1. For example, in the part of water and sewage total number of diagnoses under 3 is 19 and the number of 4 is 19. The total number under 4 is 38 and clears the requirement of 21. Although the precious rate is not sure to be proved, the environmental diagnosis is supposed to be able to propose the guiding methods to reduce the residents who are not willing to contribute provision of public goods. In the first, we find out the residents to occur communication troubles with the community. The residents are ordered according to the ascending order of eco values for the parts of index. Table 1 exhibits the scope of the non contributors and appears the cooperative structures of the region. The comprehensive structures of cooperation will be presented in the later part of this section. The cooperative practices might proceed voluntarily by developing the previous efforts of the regions and not show an uniform improvement over the regions. When the cooperation advances rapidly in the wide society, the variance of the indexes increases in the first phase. It is assumed that the inquiry of the variances exhibits what extend the region attempts to achieve the public private partnerships.

To improve the cooperative efforts for the regional environment the municipalities and the residents need to shear the common targets. To make clear the targets the regions should present the indexes to be accepted commonly. Tanaka (2009c) develops the index approach in the regional basic environmental plans empirically. The regional basic environmental plans are

\footnote{6) Tanaka and Hachioji (2003).}
constructed all over the country at the binging of the 21 century. Although the framework of the local plans is produced by the central government to guide the prefectures formally, environmental performances are depended actually on the evaluations of the local practices. The local environment plan is aimed to settle the regional issues influenced by the preceding experiences largely. By analyzing all local environmental plans comprehensively, the structures of local practices in the prefecture level could be evaluated numerically and comparatively. The prefectural environmental practices could be analyzed by the common approach with the regional environment diagnosis in the Hachioji City. The numerical targets in the basic environmental plans of prefectures are estimated to be 3115 and classified into the parts of index formed by “Check and Do” in the Chuo University · Hachioji City model.

To focus on the cooperative feature of the regional environments the indexes are divided into the demand and control index to be refined by regulations, legislations and other external controls and the voluntary index to activate local practices.\(^7\) The variances of the classified group are indicated in Table 2. Table 2 evaluates the regional environment governance in the country scale numerically. Some significant implications in Table 2 could be described as follows. The numbers in the part of water and sewage index are supposed to show great variations in the both types of index. In particular, the indexes tend to increase in the regions where had experienced the serious environmental disasters in the past. Consequently, in the part to be vulnerable for environmental disasters of the region, the variances are observed relatively high. The progressive policies in the part of air exhibit higher weight on the demand and control index than on the voluntary index. On the contrary, the index parts of waste and recycle, natural environment, social environment and energy indicate higher weight on the voluntary index than on the demand and control index. In the part of green policy and town plan the two variances present that some practices proceed but that the practices are performed in limited local areas. The practices in the living environments could be noticed to be remained in the underdeveloped

| Source: Tanaka (2009c) |

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situation. Table 2 provides an empirical evidence on the analysis of “Check Do” method to be an effective approach of the voluntary initiatives for regions.\(^8\)

3.2 Cooperation of indexes and the environmental practices in the region.

Table 1 implies that the indexes of cooperation express various values among many parts and that the parts with high value of index indicate to achieve the excellent performance in the participation of the region. The higher index value of the cooperation the part becomes, on the more cooperative pint such as C of Figure 1 the regional practice in this part is supposed to approach. For each part of index in the environmental diagnosis the index of cooperation indicates the rate that the maximum eco value obtained by the non contributing residents is divided by the maximum eco value in the region. The index is supposed to measure the progress in the public private partnerships. Table 1 suggests that the variances of eco values could evaluate the participations of residents with the comparison of index parts. We will explore the relations further.

Table 1 shows that the participations of residents present the diverse progresses over the index parts. We suppose a proposition that the privileges of initiatives for the index parts to be provided by the municipality make effect to diversify the participation of residents. To prove the proposition we survey the features of partnerships by investigating the part of diagnosis decreasingly regarding the index of cooperation from the highest one; part of waste and recycle. Table 2 states that this part is characterized by the larger indexes in the voluntary index.

Figure 3 shows that 5 residents indicate 0 eco value. This figure is supposed to be a statistical error. Actually, Figure 3 states the residents expressing eco values under 3 are only few. It is ensured empirically that the region achieves well performance of communication in the part of waste and recycle. We suppose that the municipality promotes the programs to reduce the waste intensively.\(^9\) In those programs, the fee for the waste is set up and the scheme of collection and separation of waste is announced publicly. Hachioji City carries many educational trainings successively so that the toll system to collect the waste might be accepted in the region.

The variance in the part of waste and recycle is the smallest 2.69 in the all

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8) Sakamoto (2006) explains the meaning of this method with the comparison of national environmental programs.

9) The Mayor Kurosu of Hachioji City, in the starting year 2004 of new collecting system, reported that over 1700 times of town meetings had been held: Tanaka (2007) 28p.
parts. Over average numbers of the diagnoses concentrate on eco value 7, 8, 9 in Figure 3. We could confirm the orderly behavior of public private partnerships in this part. The index of cooperation is showed by using Figure 3. The total number 20 at eco value 5 is under the benchmark value 21 but the total number 56 clear 21. Since 56 is too large by the comparison with the bench mark 21, we calculate the index of cooperation on the eco value 5; 0.5 (=5/10) approximately. The indexes of cooperation in other parts are presented in Figure 4.

Figure 4 exhibits the data to calculate the index of cooperation regarding
the all parts except the part of waste and recycle. The part of water and sewage presents the relatively high index value of cooperation. It is ensured that this excellent performance in this part is brought by a privileged initiative to improve the water environment of the Hachioji City. In particular, the industrial development in the Tokyo Area in the 1960s caused serious destruction of water environment in the Tama.

The revival of the environment in the Tama is proceeded by many related municipalities cooperatively. Hachioji City located in the upper stream has joined and contributed on the cooperation among the related municipalities.

The part of energy and social environment shows week cooperative initiatives. The other parts notice that the cooperative structures have not established systematically.

From Figure 4 through 10, the characteristics of communication for each part might be viewed in the distribution maps. Figure 4 exhibits the diagnoses of the water and sewage. When the water pollution caused serious environmental problems, the main pollutants have been emitted by the industrial sites and the regulation for the industrial pollutants has been enforced. As the regional environmental policies for water pollution have made reducing effects steadily, the concerns to mitigate water problems move from the regulation and the legislations of industrial pollution to initiatives to reduce pollutants from the sewage in livings of residents. The consumption and the customary acts of residents are noticed as an important target to be reformed in many regions. To solve the water issues the municipalities initiate the active practice to improve the custom of residents
in using the water. The practices have some effects on communication regarding water issue.\textsuperscript{10} Figure 4 shows an asymmetric distribution at the center of the eco value 7. The achievement of the improvement by Hachioji City in the water issue is ensured by the finding that the low eco values under 4 keep less diagnoses significantly.

Figure 5 indicates the energy part to be featured with a large variance. Observing that at the low eco value 2 large numbers of residents 45 appear, the energy part could not conform the residents to the common norm of acts. Consequently, we could not expect effective voluntary contribution of residents in this part. This reasoning is matched with the national environmental analysis in Table 2 regarding that voluntary indexes remain unsettled in the low level.

In Figure 6, the part of living environment presents the single peak distribution of diagnoses with mode 6. The majority member of residents keeps the well performance in the living environment. But under 3 of the low level eco values 83 residents exist separately from the well performed majority. Since the cooperative behaviors in the region are not expected to be

\textsuperscript{10} Tanaka (2015) : pp.111-117 employs the similar distribution graphic expression by the parts of eco values. The following two points should be remained. Firstly, Tanaka (2015) uses the data of after correction of eco values, but this chapter analyzes the eco value before correction. Secondly, Tanaka (2015) investigate the mode analyses, but this chapter focus on the residents with the low level performance of communication.
organized voluntarily, municipality should initiate the positive policies for the low eco value residents to have more concerns on the living environment.

Figure 7 exhibits diagnoses distribution of the social environment. According to the maximum total eco value 18 that residents could obtain in this part, it owns the relatively greater weight than the other parts. The variance 16.97 of this part is the second largest next to the natural environmental part and implies the diversity in the acts of social environment.
Figure 7 indicates that the 33 residents to exist under the eco value 3 would not participate on the program of social environment. In the national practices the voluntary index of social environment in Table 2 represents the highest in variance 52.41. From this figure some prefectures recognize that this part should obtain the strategic importance to attain voluntary contribution in the community. We could conclude that to improve the social environment indicates effectively to enhance the public and private cooperation.

The part of natural environment obtains the largest eco value 20 and the maximum variance 19.89 among the parts. Figure 8 exhibits the feature of the diagnoses regarding this part. This part obtains 21 residents presenting 0 and 1 eco value. The residents more than 21 are supposed to be not concerned with this part of index and to be passive group to improve natural environment. From the view of national statics Table 2 shows that the variance of voluntary index 41.43 in this part reflects the active initiatives for many prefectures to promote residential participations. 

Figure 9 states the distribution of eco value in the part of green policy and town plans. Since this part combines two related fields, the distribution of this part has not a single but the three peaks at 3, 5 and 9. The residents are divided into three groups according to consciousness on the part. In particular, the conscious group shears 106 residents between 0 and 3 and form a negative factor to promote public and private partnerships.

Figure 10 exhibits the distribution of the air part. The variance of this part
2.98 is the second smallest next to waste and recycle 2.69. The distribution does not shape a single peak and 37 residents express eco value 0. It implies that the framework for the cooperation could not be constructed yet. From the view on the national survey Table 2 states that this part obtains the second least voluntary index of variance. This evidence indicates that the voluntary contribution in the region has not developed enough to mitigate...
Table 5  Correlation Coefficients with Correction

<table>
<thead>
<tr>
<th>Part of Index</th>
<th>Water, Sewage</th>
<th>Waste, Recycle</th>
<th>Energy</th>
<th>Natural Environment</th>
<th>Green Policy Town Plan</th>
<th>Air</th>
<th>Living Environment</th>
<th>Social Environment</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water, Sewage</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.28</td>
</tr>
<tr>
<td>Waste, Recycle</td>
<td>0.53</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.17</td>
</tr>
<tr>
<td>Energy</td>
<td>0.28</td>
<td>0.29</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.77</td>
</tr>
<tr>
<td>Natural Environment</td>
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Test for No Correlation

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</table>

Source: Tanaka (2017a)

climatic change problems.\textsuperscript{11)}

4. A Correlation Coefficients Approach on Cooperation Scheme of Regional Environment

The section 2 demonstrates theoretically that the scheme of public private partnership could improve public goods in the region effectively. It is assured that the regional environment should obtain multiple aims such as preventing pollution of air and waters, saving the consumptions of recourses, risk management of the region and the corporate social responsibility at the same time. To attain each aim effective policies are executed. As the number of initiatives to be employed is increasing, those results must be ensured to be achieved more consistently. We should construct an integrated evaluation system on the regional environment to achieve the aims efficiently. In this section we argue that the approach of correlation coefficients among the

\textsuperscript{11)} Oharu and Sakurai (2009) divides each area into smaller regions and adds experimental surveys. They attempt to explain the feature in the environmental behavior of the energy part.
parts of index provides an effective and integrated evaluation of the regional environment.\textsuperscript{12)} The analysis of correlation coefficients evaluates the weight of each part in the regional environmental and identifies the synergy effects in the environmental practice. Table 5 produces the correlation coefficients matrix by employing eco value with no correction.

The correlation coefficients extend the maximum 0.53 between the water and sewage and the waste and recycle and the minimum 0.15 between the waste and recycle and the air.\textsuperscript{13)} The test of no correlation ensures the significance all over the cells in the table 2 below. All parts of the environmental indexes are constructed into the organized body. The total values of correlation coefficient indicate the relative weight in the regional environment for the parts. To investigate the influence of the 8 parts completely we explore the correlation coefficients according to descending order of this total values. We focus on the two parts for the correlation coefficients to be greater than 0.3.

In the first, Figure 11 presents that the correlation coefficient of the green policy and town plan attains the largest total value. The parts to exceed 0.3 are listed as the parts of the natural environment, the social environment, the living environment, the air and the water and sewage. The green policy and

\begin{figure}[h]
\centering
\includegraphics[width=0.7\textwidth]{chart.png}
\caption{The Part of the Green Policy and Town Plan}
\end{figure}

\textsuperscript{12)} Mark et al. (2000) make clear the implication of the evaluation method for the integrated frameworks.

\textsuperscript{13)} Tanaka (2009b) discusses the non correlation using Table 9 and 10. This paper proposes the method of analysis with the regard to the part that efficient of correlations are higher than 0.3.
The residents to achieve high eco values present correlating eco values regarding greenery index in the natural environment and the living environment and regarding the town policy index in the water and sewage, the air and the living environment. The social environment has a correlation because it is expected to improve this part effectively.

The social environment marks the second largest value of the total correlation coefficients. Figure 12 exhibits that the coefficients exceed 0.3 in the parts of the water and sewage, the waste and recycle, the natural environment, the green policy and town plan and the living environment. The above evidences imply that the part of social environment owes the vital energy to improve the large scope of regional environment. As passive investigations, the parts of energy and air to be lower than 0.3 of the correlation coefficients show scarce connections with the part of social environment and are not sufficient enough to contribute regional environment.

Figure 13 states the correlation coefficient analysis on the part of the water and sewage. The projects to improve this part are connected with the parts of the waste and recycle, the natural environment, the green policy and town plan and the social environment. This part is evaluated to contribute critically on the fore three parts with active practices in the social environment.

Figure 14 represents the distribution of correlation coefficient regarding the part of natural environment. The parts to exceed 0.3 are the parts in the water and sewage, the green policy and town plan, the air and the social environment. In the fore three parts this part are evaluated as the critical
factors by many residents. At the same time, the improvement on the part of the natural environment could not be achieved without the collaboration with the part of social environment.

Figure 15 presents the distribution of correlation coefficients regarding the parts of the waste and recycle. Referring the discussion with Figure 12 and 13, the practices to improve the regional environment are likely to focus on the two parts of the waste and recycle and the water and sewage together. The part of the social environment might be employed to promote improvement of regional environment.

Figure 16 exhibits the correlation coefficients of the living environment.
The part of the green policy and town plan and the social environment achieve the target of the coefficients 0.3. The evidences imply that to improve the practices of the green policy and town plan and the social environment is effective to improve the living environment.

Figure 17 and 18 present the distribution of the correlation coefficients in the parts of the energy and the air. The part of energy could not keep the coefficients with all other parts above the target value 0.3. This evidence makes contrast with the regional environmental diagnosis of Shiwa Town presented in Table 6. Shiwa Town, Iwate Prefecture, had executed the
regional environmental diagnoses and collected 117 diagnoses in 2012. The coefficient of the energy part in Shiwa Town exceed the target value 0.3 in the 4 parts, the waste and recycle, the green policy and town plan, the air and the social environment. By referring this comparative investigation, we could argue that Hachioji City could not perform active regional approach on the part of the energy. The analyses regarding the part of the air have discussed already in previous parts. Figure 18 shows that the part of the air has lower correlations with other parts except for the parts of the natural environment and the green policy and the town plan.
The regional environmental diagnosis could focus on the feature of regional environment. Table 6 is produced to be comparable with Table 4 and could be applicable for the regional investigation of environments.

Although the comparative discussion on the part of the energy has been stated above, the regional diagnosis of Shiwa Town brings about some contrasting view with the analysis of Hachioji City. The coefficient in the part of the air exceeds the target value 0.3 in the parts of the energy and the natural environment but the coefficient in the part of the green policy and town plan remain at 0.28 under the target value. Regional environmental analyses depend on the regional features such as environmental issues and preceding practices. As the reference, Table 7 lists the correlation

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Table 6 Correlation Coefficients with no Correction: Shiwa Town in 2012

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Source: Tanaka (2017a)

Table 7 Corelation Efficient with Correction

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Source: Tanaka (2017a)

The regional environmental diagnosis could focus on the feature of regional environment. Table 6 is produced to be comparable with Table 4 and could be applicable for the regional investigation of environments.

Although the comparative discussion on the part of the energy has been stated above, the regional diagnosis of Shiwa Town brings about some contrasting view with the analysis of Hachioji City. The coefficient in the part of the air exceeds the target value 0.3 in the parts of the energy and the natural environment but the coefficient in the part of the green policy and town plan remain at 0.28 under the target value. Regional environmental analyses depend on the regional features such as environmental issues and preceding practices. As the reference, Table 7 lists the correlation

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14) Tanaka(2015)demonstrates that ages and eco value have no correlation (p.120;Figure 3-15). However, environmental diagnosis of Hachioji city in 2015 takes unbalanced distribution of ages. 70 ages and 80 ages count 55 and 14 for the total numbers 114. It is assumed that the composition of ages influences the eco value in the part of energy and air environment.
coefficients based on the eco value with correction. Comparing Table 6 and 7, the procedure of the correction of the eco value tends to decrease the coefficients.

5. Concluding Remarks
After the legislations and the budget for the particular issue are decided, the performances of the regional governance depend mainly on the cooperative actions by residents. The concerns of the residents are diverse and rapidly changing. Governmental provision of public goods remains a large number of unattained social needs. In order to achieve various proposes, residents should not only seek the self interests but also contribute efficiently social benefits. In particular, the energy and resources saving projects, such as the recycle projects, the car shearing business and the construction of the smart city should accompany the efficient regional energy system and positive participation of residents.\(^{16}\) The individual and voluntary acts are necessary to confirm with the common target in the region. In particular, the low carbon society is necessary to be recognized as imperative factor to construct the sustainable regions.

This paper investigates the scheme of communication for the sustainable regional governance. The section 2 proves theoretically that the active voluntary contribution by the residents could increase the provision of public goods. In the section 3 the theoretical proposition is confirmed empirically by the regional environmental diagnosis in Hachioji City. The section 3 suggests that the bottlenecks in the regional communication exist and that the attempted programs performed in some parts, for examples, the waste and recycle, the water and sewage, could overcome the communication problems. The region has practiced some initiatives experimentally and elaborated proceeding approaches for the environmental issues. To obtain the real effect of the relative programs we should recognize the integrated impacts of the regional practices. The section 4 insists that correlation coefficients of inter part indexes imply the integrated reflection of the precedent practices. Collaborative effects of the initiatives in the different parts could be effective method for the integrated governance of the region. This paper demonstrates that the effective governmental initiatives could save the bottlenecks on the community communication and that the experimental approached in this field

\(^{15}\) Acs,Z. J. (2013) explains the contribution of the private funds for the regional development of USA.

\(^{16}\) Rifkin(2014), Leigh and Balakely(2013) and Tallon(2013) that the structural change of industry transform the economic and social systems of the region.
performed only limited scopes. The integrated framework of regional governance should include the sustainable mechanism to improve voluntary contribution of residents.

References
Tanaka, H. (2007), Participation of Residents, Regional Environmental Diagnosis and Sustainability, Good Practice Program, (written by Japanese).
Tanaka, H. (ed.) (2009a), Management and Scheme in Global Regional Network,
Educational GP of Chou University. 


