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CAPACITY DEVELOPMENT AND SOCIAL CAPACITY ASSESSMENT (SCA)

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Abstract: This paper presents the basic design of the Social Capacity Assessment (SCA) studies in the case of environmental management. Firstly, it is defined basic concepts of SCA. In this model, the Social Capacity for Environmental Management (SCEM) is defined as the capacity to manage environmental problems in a social system composed of three actors, i.e., government, firms, and citizens and their interrelationships. The Social Environmental Management System (SEMS) is defined as interactions between the SCEM and institutions. According to these definitions, interactions between the SEMS, socio-economic condition, environmental quality and external factors shape a total system. Secondly, based on these concepts, we build the analytical methods of the SCA. The SCA is made up of the following five steps, (1) Actor-Factor Analysis, (2) Indicator Development, (3) Institutional Analysis, (4) Path Analysis, and (5) Development Stage Analysis. Finally, based on analytical methods provided above, the aid program for social capacity development is designed in order to achieve the aid effectiveness.

1. Introduction

During the 1990s, it became apparent that the Replacement Approach, i.e., the one-sided transfer of knowledge and technology from advanced countries to developing countries was insufficient to deal with the issues of international development assistance. Moreover, a recent study conducted using the Capacity Development Approach

(Fukuda-Parr *et al*. 2002) revealed that the self-efforts of the developing countries are necessary to improve their social capacity and enable them to achieve sustainable development performance. Although there has been some progress in the stakeholder and the institutional analyses (see Morgan and Taschereau, 1996; Lopes and Theisohn, 2003), there still exists a need to further intensify the research and development on Capacity Assessment.

In 2003, the Graduate School for International Development and Cooperation (IDEC) at Hiroshima University launched the 21st century Center of Excellence (COE) program, "Social Capacity Development for Environmental Management and International Cooperation" (Principal Researcher from July 2003 to March 2007 was Professor Shunji Matsuoka. In April 2007, he transferred to a professor at Waseda University.). The COE program is a five-year research project granted by the Japanese Government. It proposes a conceptual development model and indicators of Social Capacity for Environmental Management based on an environmental policy research, from technological and socio-economic perspectives. The purpose of this program is to design policy proposals for international cooperation and to achieve aid effectiveness in the field of environmental management. Final objective of this research is to encourage developing countries to evaluate and enhance their own social capacity for environmental management.

In 2004, this COE program in cooperation with several government agencies established the Japan Committee on Social Capacity Development (JCSCD). The objective of the JCSCD is to innovate Capacity Development frame work, based on the experience of East Asian Countries. The committee consists of Hiroshima University, the Japan International Cooperation Agency (JICA), the Japan Bank for International Cooperation (JBIC), the Institute of Developing Economies, the Japan External Trade Organization (IDE-JETRO), and the National Institute for Environmental Studies (NIES).

Since the launch of this COE program, the Social Capacity Assessment (SCA) model has been proposed in order to enable developing countries to achieve sustainable development. The research on the SCA has progressed on the following three consecutive levels: (1) the definition of concepts, (2) the establishment of the formal models, and (3) the development of the indicators (Matsuoka and Kuchiki 2003, Matsuoka, 2004, Matsuoka *et al*. 2004, Matsuoka 2007). In November 2005, during our joint seminar with the representatives from the World Bank in Washington D.C., a productive discussion regarding the design of our SCA was made. Based on the outcomes of our discussions during the joint seminar, we launched a pilot program in 2006. The pilot program applied the SCA methodology to Indonesian water quality environmental management case and Mongolian combating desertification case.

This research paper summarizes the studies carried out under this COE program in order to develop our SCA. The paper is divided into five sections. Section 2 introduces the concept and analytical methods of the SCA. Section 3 provides a detailed description of the following analytical methods: 1 Actor-Factor Analysis; 2. Indicator Development; 3. Institutional Analysis; 4. Path Analysis; and 5. Development Stage Analysis. Section 4 discusses the program design for social capacity development based on the analytical approaches described in section 3. Finally, section 5 presents the summaries and conclusions of our analysis.

2. Social Capacity Assessment (SCA)

Determining the target capacity level and obtaining information about the system factors of capacity development, i.e., socio-economic factors, environmental quality, and external factors, are the initial problems faced during the assessment of social capacity. Since the SCA has to be applied by the developing countries, it should be inexpensive, simple, and based on scientific research. Moreover, the development of the self-assessment ability of a developing country must also be considered, in order to enable the country to assess its own social capacity.

The Social Capacity for Environmental Management (SCEM) is defined as the capacity to manage environmental problems in a social system composed of three social actors, i.e., government, firms, and citizens and their interrelationships (see Figure 1). The Social Environmental Management System (SEMS) is defined as the system of interaction between the SCEM and institutions (see Figure 2).

Figure 2 also shows the interrelationships between the SEMS, the socio-economic condition, the environmental quality, and the external factors in the total system. The SEMS of a country is constrained by the existing socio-economic conditions and the condition of the environmental quality. Furthermore, here we observe the inter-prescribing relations between environmental quality and socio-economic conditions (See, e.g., Matsuoka and Kuchiki 2003 and Matsuoka *et al*. 2004).

As evident in figure 3, the SCA is designed to analyze the interactions between the SEMS, the socio-economic condition, and the environmental quality of a total system. Apart from this, it is also designed to analyze the social capacity of each actor and the interactions between all the social actors. Thus, the SCA reveals the current social capacity and the development path of a particular region and/or a country. The SCA includes the following five steps: 1. Actor-Factor Analysis, 2. Indicator Development, 3. Institutional Analysis, 4. Path Analysis, and 5. Developing Stage Analysis. The next section provides a brief introduction to these steps.

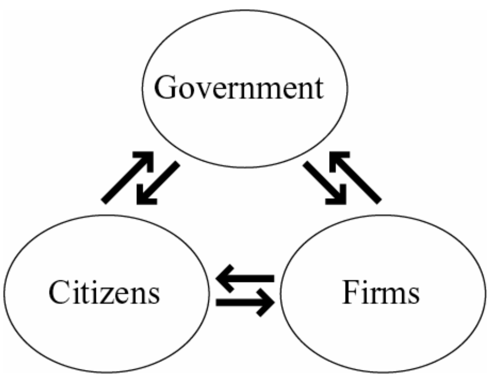

Figure 1 Social capacity for environmental management
Source: Matsuoka and Kuchiki (2003)

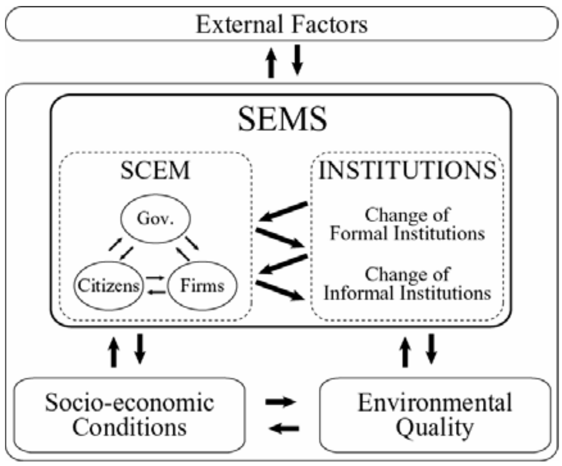

Figure 2 Social environmental management in total system
Source: Matsuoka (2005)

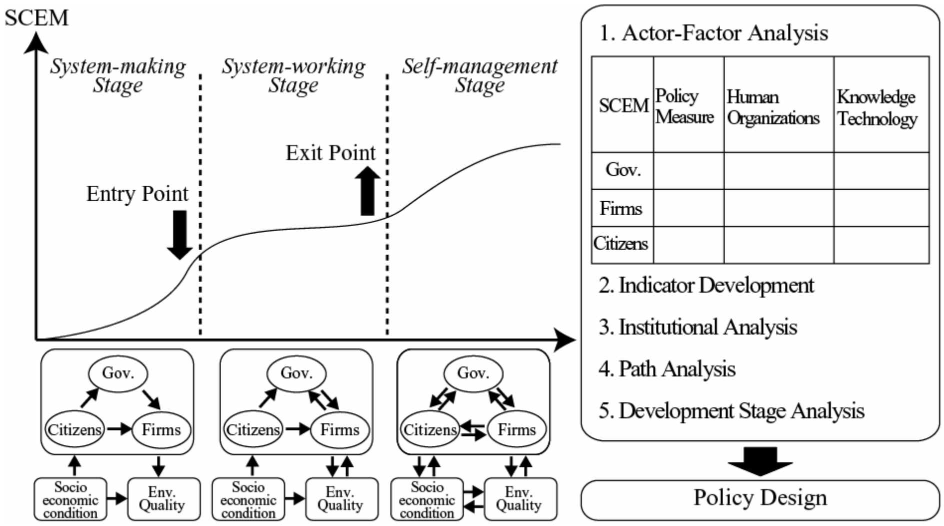

Figure 3 SCEM and Social Capacity Assessment
Source: Matsuoka (2005)

2.1. Actor-Factor Analysis

The actor analysis evaluates the social capacity at a given time period, by analyzing the capacity of social actors (i.e., government, firms, and citizens) and their interrelations. This analysis also provides information regarding “critical minimum or benchmarks”, that is, the capacity level each social actor has to satisfy that the social system functions. The factor analysis, on the other hand, focuses on the factors of social capacity, i.e., policies and measures, human and organizational resources, and knowledge and technology. It provides information on the existing condition of each factor and its critical minimum.

2.2. Indicator Development

This develops the indicators that carry summary information regarding the Social Capacity for Environmental Management. Based on the actor-factor analysis, two different statistical approaches are proposed.

2.3. Institutional Analysis

The institutional analysis investigates the institutions that form the basis of social capacity. The analysis deals with formal institutions (e.g., legal system) as well as informal institutions, and their interactions. The results of the institutional analysis reveal information regarding the reformation of current institutions for the development of social capacity.

2.4. Path Analysis

Based on the targets set by prior analyses, the path analysis concentrates on the development path of social capacity in order to achieve the targets. The path analysis also investigates the development path of the social capacity level, the socio-economic background, and the environmental performance. Thus, based on the relationship between the social actors and its development path, the path analysis provides the respective capacities of the social actors.

2.5. Development Stage Analysis

Based on a three-stage development of social capacity, i.e., system-making, system-working, and self-management, the development stage analysis reveals information regarding the current development stage, the next development target, and the approach to achieve the target (along with the path analysis). Thus, the development stage analysis can also be considered as a strategy for providing aid assistance.

Through the five steps analysis mentioned above, the SCA enables us to measure the current capacity level, the development path, the current state of development, and the institutions necessary to improve the capacity for environmental management. The next section presents a detailed explanation of each analysis.

3. Social Capacity Assessment Approach

3.1. Actor-Factor Analysis

The actor-factor analysis reveals the level of social capacity by combining the results of both the actors and factors approaches. This provides us with a concrete estimation of the social capacity. The results obtained by the actor-factor analysis enable us to design suitable programs for international development assistance.

In order to appropriately conduct the actor-factor analysis, we propose an actor-factor matrix (see Table 1) of 3 actors and 3 factors, i.e., a 3×3 matrix. The data used to construct this matrix is obtained from statistical tables and through the interview and survey of each social actor. The cells of this matrix indicate the level of social capacity attained by each social actor. Table 1 displays the information regarding the programs and projects designed to compensate for the capacity gap, i.e., the difference between the actual social capacity and the critical minimum of social capacity established for each social actor's contribution to the designated factors.

Table 1   Actor-Factor Analysis: The Actor-Factor Matrix

Factors / Actors	Policy & Measure	Human & Organizations	Knowledge & Technology
Gov.	Existing Capacity	Critical Minimum	Project
Firms	Capacity Gap		Project
Citizens			
G - F			
G - C			
F - C			
G - F - C			

The critical minimum that is obtained for each factor and is assumed to yield good results in terms of the environmental performance is distributed among the actors proportional to the roles they perform in their respective societies. However, this distribution is not always fixed, and changes in the initial situation might induce changes in the distribution of the critical minimum. These changes depend on institutions such as a political system and the relationship between the actors, historical path dependency, and the characteristics of the environmental problem. Moreover, the time required for the transition to the next development stage might also induce changes in the distribution of critical minimum among the social actors. (For details, see section 3.5).

For the purpose of our analysis, we assume the government (G), firms (F) and citizens (C) as the social actors. However, it is also possible to consider a collection of scientists and media as the fourth social actor (Zhang *et al*. 2004). Furthermore, we define the SCEM as the environmental management capacity stipulated by the capacity levels of the social actors and the correlation between them. Table 2 shows the classification of actors that are targeted for assessment. Among previous researches that have contributed to our understanding of the factors of environmental management capacity, the joint work by the UNEP and WHO, which focused on the air quality management capacities in cities, is worth a mention (UNEP/WHO 1996). The above-mentioned study assumes that the capacity for air quality management comprises four elements (see Figure 4). However, the targets in this study were limited to the capacity of the government and the local administration for managing the air quality. Thus, we focus on extending this parameter of analysis by including the capacities of firms and citizens. Table 3 shows an example of the results of an assessment using the actor-factor analysis for air quality management in China. Considering the capacity of the government in China, we find that the critical minimum for the capacity for air quality management had been achieved during the mid 1990s.

Table 2 Classification of Actors in the Actor-Factor Analysis

	Classification
G: Gov.	Central government
	The government offices concerned
	The sections concerned
	The government
	The government offices concerned
	The sections concerned
F: Firms	Industry
	Industry fields (Major groups, Medium groups)
	Firms (Big business, Small and medium-sized businesses)
	Industrial unions
C: Citizens	Civil Society Organization (NGO, NPO, CBO)
	Citizens
G: Gov. - F: Firms	
G: Gov. - C: Citizens	
F: Firms - C: Citizens	

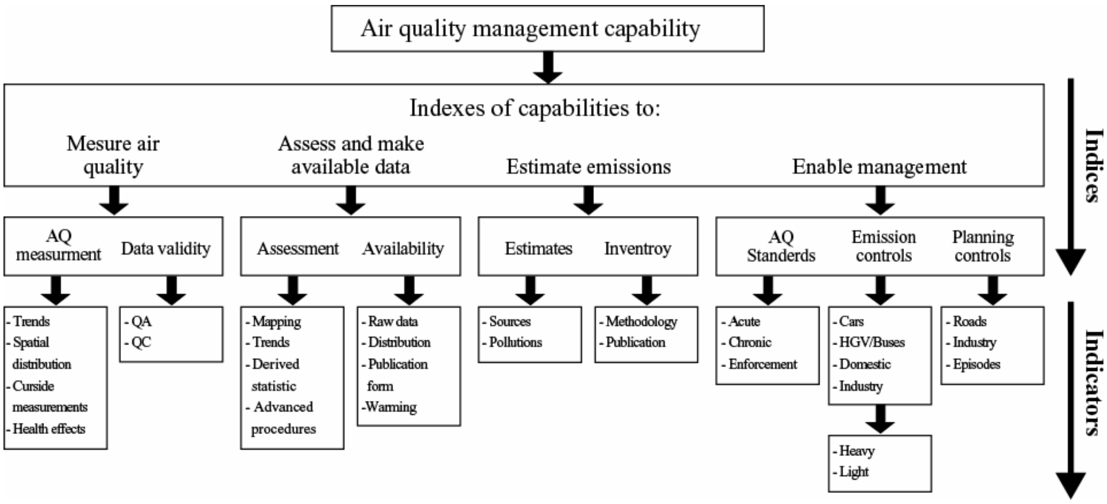

Figure 4 Air quality management capacities
Source: UNDP/WHO (1996)

Table 3 Actor-Factor Analysis: Air Quality Management in China

	P: Policy & Measure	H: Human & Organizations	K: Knowledge & Technology
G	***Critical Minimum***		
	Command and control - environmentals law are developed.	Organization -environmental Administration is developed.	Research, investigation -air pollution monitoring stations are installed. -environmental information is disclosed.
	1979 Environmental protection law (trial version) 1987 Air pollution control law 1989 Environmental protection law 1995 Environmental protection law 1996 The ninth five year plan	1988 National Environmental Protection Administration (NEPA) 1998 State Environmental Protection	1990 The China Environmental Yearbook 1995 Upgrade its quality
	In the mid-1990s, Critical Minimum was achieved (*System-working*)		
F	***Critical Minimum***		
	Command and control -obey the law	Equipment, facilities -install end-of-pipe technology	research, investigation -self-monitoring for emission source
		a questionnaire etc.	
C	***Critical Minimum***		
	Command and control -lodge a complaint, make demands, lobbying	Organization -NGO, NPO activity	Research, investigation -recognize air quality
		a questionnaire etc.	

3.2. Indicator Development

We develop two SCEM indicators using the following different statistical approaches: (1) Frontier/Tobit approach and (2) Factor Analysis approach. This section describes the methodology and the empirical applications of both these approaches.

3.2.1. Frontier/Tobit Approach

This approach is based on the Total System conceptual framework. In this framework, the SCEM as well as socio-economic conditions are included as a single component influencing the environmental performance (see Figure 2). Our analytical framework is as follows: First, the directional distance function estimates the emission-based environmental efficiency as environmental performance (of air quality). The Tobit model is then applied and the estimated environmental efficiency is used to identify the SCEM variables affecting the efficiency scores. Finally, the SCEM indicator is calculated as the weighted average of the SCEM variables.

We begin our analysis with the measurement of the environmental efficiency. Figure 5 illustrates the relationship between production (*y*) and the corresponding SO_2 emissions (*b*). Suppose that the current level of production of a firm *i* is *y*, while the observed SO_2 emission level is *b*. However, if this firm incorporates and operates with the best practice technology, then the SO_2 emission can be reduced to *b** with the output remaining constant. The production frontier line indicates the efficient (i.e., minimum feasible) SO_2 emission at the given output. We define environmental efficiency as the distance between observed and efficient levels of SO_2 (*b*, *b**); the smaller the distance the greater is the efficiency. In this study, the environmental efficiency is empirically estimated by using the directional distance function (Fare *et al*. 1994).

Once the environmental efficiency is estimated, the next step is to evaluate the role of the SCEM using the Tobit model. In this study, the Tobit model selects one SCEM variable for each of the three actors, The identified variables are used to construct the indicator for the SCEM. This is defined as follows:

$$S_{it} = \left(\omega_g \tilde{G}_{it} + \omega_f \tilde{F}_{it} + \omega_c \tilde{C}_{it}\right) \qquad (1)$$

where S_{it} is the level of SCEM for province *i* in year *t*. $\tilde{G}_{it}$, $\tilde{F}_{it}$, $\tilde{C}_{it}$ represent the environmental management capacities of the government, the firms, and the citizens, respectively. ω_g, ω_f, and ω_c represent their weights. These are adjusted such that $\omega_g + \omega_f + \omega_c = 1$. Thus, our indicator proves to be a convenient measure because it always ranges between 0 and 1.

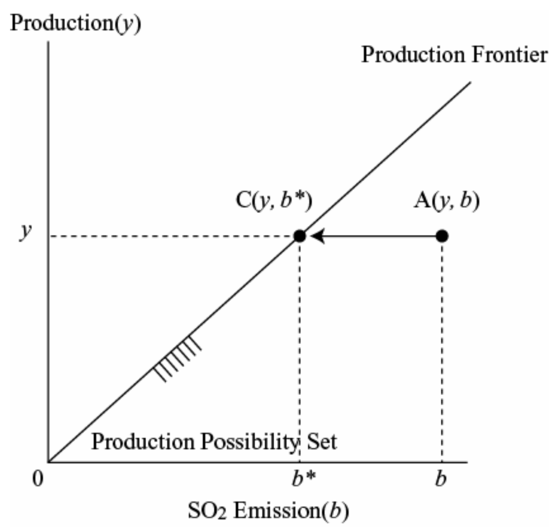

Figure 5 Production frontier and environmental efficiency
Source: Tanaka and Watanabe (2005)

An empirical application of this framework is conducted by using the province-level data of China's manufacturing industry from the period 1994–2002. Using the Tobit model, we identify the total number of monitoring stations as the government's capacity and the ratio of SO_2 reduction as the firms' capacity. However, due to limited data, we are unable to include the citizens' capacity as a part of our model. Thus, the SCEM in this application refers only to the capacities of the government and the firms.

Figure 6 depicts the SCEM and the normalized SO_2 emissions in China's manufacturing sector for the period 1994–2002. The figure indicates a significant increase of nearly 40% in the SCEM - from 0.25 in 1994 to 0.35 in 2002 - during the estimation period. In addition, the SO_2 emission is shown to be fairly responsive to the SCEM. Figure 7 illustrates the environmental management capacities for the government and the firms during the same estimation period. The firms' capacity (SO_2 reduction rate) increased from 0.19 in 1994 to 0.42 in 2002 - an increase of more than 120%. On the other hand the government's capacity (total number of monitoring stations) development rate improved by a mere 8%, i.e., from 0.31 in 1994 to 0.34 in 2002. Thus, the SCEM development in this period is largely due to an improvement in the firms' capacity, while the contribution by the government is rather limited.

In this section, we developed the indicator for the SCEM using the Frontier/Tobit approach. We observed a rapid increase in the SCEM in China for the period 1994–2002. Moreover, the results indicated a significant contribution of the firms in the development of the SCEM, while suggesting a limited contribution of the government. However, in order to provide future suggestions and recommendations, a further interpretation of these results is required. Finally, this approach can be extended to conduct an international comparison using international panel data. In future studies, we will use the same approach to analyze the SCEM development in Asian countries.

3.2.2. Factor analysis approach

Factor analysis is a statistical analysis technique that is used to uncover the latent relationships between many observed variables. This approach allows numerous correlated variables of air quality management policy to be summarized by fewer

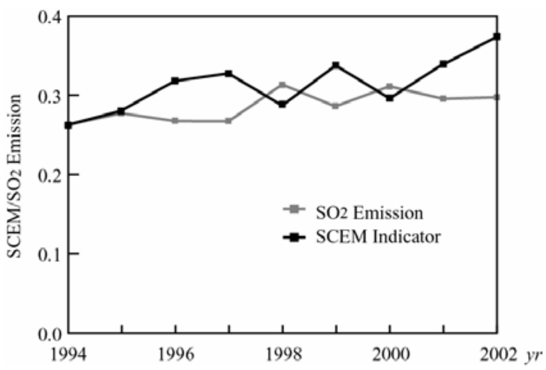

Figure 6 SCEM indicator and SO_2 emission in China's manufacturing Sector

Source: Tanaka and Watanabe (2005)

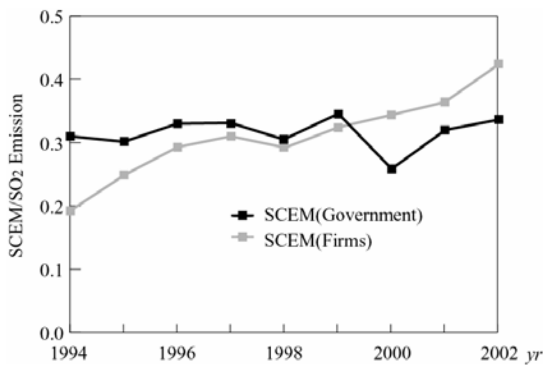

Figure 7 Actor-specific environmental management capacity

Source: Tanaka and Watanabe (2005)

Table 4 Factor Loading and Contribution of Factor Loading (1) (Kitakyushu-city)

Data	factor 1	factor 2	factor 3	factor 4	elements of capacity
budget for the Environmental Research Center (ERC)	0.933	-0.182	0.000	0.058	"policy resource" management
budget for Environmental protection (City)	0.819	-0.080	0.380	0.342	
number of personnel * average employment period (ERC)	0.733	0.310	0.411	0.347	
number of monitoring stations	0.692	0.172	0.502	0.408	
number of personnel * average employment period (City)	0.096	0.915	-0.076	0.216	"command and control" policy enforcement
number of investigations into emission source (City)	-0.229	0.855	0.167	0.024	
number of inspections of a sample from emission source (ERC)	0.133	0.707	-0.033	0.450	
amount of finances provided by gov. to the firms for air pollution control (City)	-0.198	0.073	-0.818	-0.100	"financial support" policy enforcement
number of finances provided by gov. to the firms for air pollution control (City)	-0.571	-0.372	-0.603	-0.286	
number of presentations in academic society (ERC)	0.394	0.253	0.170	0.864	provision of "scientific knowledge"
number of articles published in academic journal (ERC)	0.193	0.420	0.271	0.526	
eigenvalue	3.363	2.508	1.821	1.594	
contribution(%)	52.0	21.4	6.9	4.2	
cumulative contribution(%)	52.0	73.4	80.2	84.4	

Source: Murakami and Matsuoka (2005)

Table 5 Factor Loading and Contribution of Factor Loading (2) (Osaka-city)

Data	factor 1	factor 2	factor 3	factor 4	elements of capacity
number of monitoring stations	0.971	0.189	-0.034	0.002	"policy resource" management
number of personnel * average employment period (City)	0.832	0.443	0.220	0.216	
number of personnel * average employment period (ERC)	0.687	0.629	0.225	0.213	
budget for the Environmental Research Center (ERC)	0.665	0.604	0.257	0.317	
budget for Environmental protection (City)	0.613	0.542	0.381	0.409	
amount of finances provided by the gov. to the firms for air pollution control (City)	-0.225	-0.952	-0.046	-0.049	"financial support" policy enforcement
number of finances provided by the gov. to the firms for air pollution control (City)	-0.492	-0.827	-0.052	-0.108	
number of articles published in academic journal (ERC)	0.068	-0.029	0.992	-0.091	provision of "scientific knowledge"
number of presentations in academic society (ERC)	0.389	0.496	0.580	0.230	
number of investigations into emission source (City)	0.020	-0.383	-0.503	-0.568	"command and control" policy enforcement
number of inspections of a sample from emission source (ERC)	-0.212	-0.103	0.043	-0.489	
eigenvalue	3.538	3.479	1.995	0.891	
contribution(%)	42.6	30.3	10.7	4.9	
cumulative contribution(%)	42.6	72.9	83.5	88.4	

Source: Murakami and Matsuoka (2005)

dimensions, i.e., factors. In the context of this research, the factors are interpreted as the elements of capacity for air quality management that contribute to the environmental performance. Murakami and Matsuoka (2005) estimate the factors of government capacity for air quality management in Kitakyushu and Osaka cities by using the factor analysis. In this study, the capacity for air quality management is assumed to be equal to the factor scores and to the contribution of factor loadings that are estimated by using the data on air quality management policies in Kitakyushu and Osaka cities from 1970 to 2000. Tables 4 and 5 show the results of factor analysis for each city. The screen test for factor analysis reveals four elements of capacity in each city. The four elements are further arranged into three factors, i.e., Policy & Measure, Human & Organization, and Knowledge & Technology (see Table 6).

By using the factor scores and the contribution of factor loadings, we estimate the weighted average for all the four elements. This is assumed to be an indicator of the capacity for air quality management in each city. The contribution of factor loadings is assumed to be the weights for capacity elements. The average weights of the factors of capacity of the two cities are as follows: Knowledge & Technology is 7.5%, Human & Organization is 47.3%, and Policy & Measure is 31.8%.

Table 6 Correlation of the Three Actors and Critical Minimum

Actors / Factors	Gov.	Firms	Citizens		G・F	G・C	F・C	G・F・C
Policy & Measure				⬅				
Human & Organizations				⬅				
Knowledge & Technology			↓Critical Minimum	⬅				

Note: The State of Correlation of the Three Actors has an effect on the Critical Minimum Level.

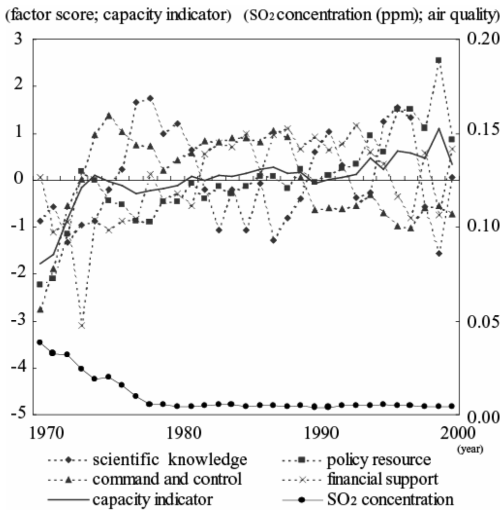

Figure 8 Trend of government capacity for air quality management (Kitakyushu- city in Japan)
Source: Murakami and Matsuoka (2005)

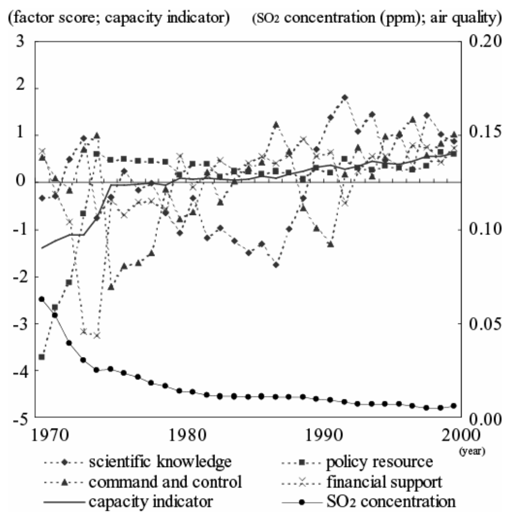

Figure 9 Trend of government capacity for air quality management (Osaka- city in Japan)
Source: Murakami and Matsuoka (2005)

Figures 8 and 9 show the change in the government's capacity for air quality management from 1970 to 2000. It can be observed that the rapid improvement in government capacity in the early 1970s resulted in a dramatic reduction in the SO_2 concentration. Additionally, the effects of each indicator of capacity on the SO_2 concentration are estimated by a simple regression analysis.

3.3. Institutional Analysis

The institutional analysis of the SCA investigates a group of institutions (see, e.g., Aoki and Okuno, 1996) that constrain social actors' activities and capacities. It also regulates the current capacity level and affects the future formulations of social capacity. Therefore, this study will focus on the role of the individual institutions and the group of institutions as well as the processes of transitions among them. For this purpose, we will classify the institutions into two categories: principal institutions and secondary institutions, and then, we will classify each category into two subcategories, i.e., formal and informal institutions.

The method of classifying an institution as a principal or a secondary institution is based on analyzing them according to the level of their incentive or disincentive, i.e., the upper levels are principal institutions, and the lower levels are secondary institutions. Further, in order to classify the institutions into the subcategories, i.e., formal and informal institutions, this study follows North's study (1990) and defines formal institutions as public formalized rules, such as state laws, and informal institutions as unspoken rules, such as social norms and customs that influence the behavior of social actors.

While investigating informal institutions, we pay close attention to the changes in the relationships between the social actors. Figure 10 indicates the basic concepts for analyzing the informal institutions. Based on these concepts, we identify three types of relationships between the social actors: one-side (or direct) relationships, mutual relationships, and multilateral relationships (partnership). As shown in table 6, each relationship has an effect on the critical minimum capacity of each actor. Thus, the next step is to analyze the impact of each relationship between the actors on their critical minimum capacities.

In order to conduct this analysis, we introduce a case study wherein we have analyzed the institutional changes in Ube City. Ube City, often referred to as the "Ube Model" or the "Ube System" (Nose, 1996), is a model Japanese city that has succeeded in effectively managing the problem of air pollution. The most important characteristic of the Ube model is that the decision-making process is not solely dependent on government regulations; rather, it is a joint exercise carried out by a committee comprising representatives from industry, government, educational system, and general population. It is therefore believed that the spirit of the Ube model can be replicated by formally institutionalizing the informal institutions, however, keeping in mind, the specific culture and customs of a city (see Table 7).

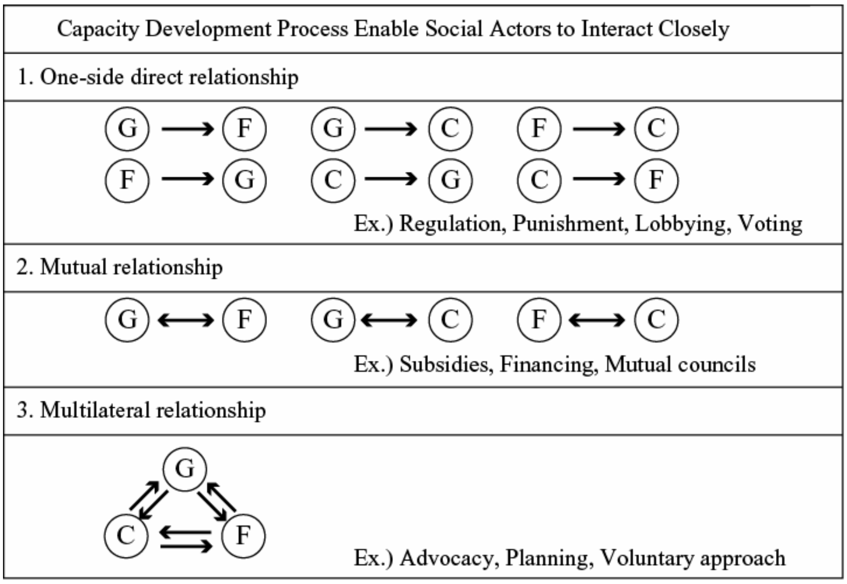

Figure 10 The Benchmarks for the social actor's relationship

Table 7 The Benchmarks for The Social Actor's Relationships

	Principal Institution	Secondary Institution
Formal Institution	Ube Model ↑	
Informal Institution	Institution based on the specific culture and customs of Ube City	

Table 8 Environmental Policy and the Characteristics in Ube City

	Dust pollution	SO_2 pollution
Main Events	1949 (Dust control measure was initiated) Ube City Dust Fall Control Committee 1952 - 54 The citizens held large-scale Anti-dust pep rallies 1956 Ube Pozzoran Cement 1957 The mayor and important business owners set numerical targets for dust control measures and each factory decided to make a plan, including time limits and expenditures, in order to accomplish the goals that were laid down.	1960 Ube City Air Pollution Control 1962 SO2 monitoring devices were set up in 19 area 1968 Enactment of the Air Pollution Control Law 1969 The first official warning was announced in Ube City 1970 The first air pollution alarm in Yamaguchi prefecture was officially announced in Ube City 1971 Ube city concluded the pollution control agreement 1972 The full-scale work on SO2 measures began after finalizing the enforcement details of the pollution control agreement
Principal Institution	Ube Model	Pollution Control
Characteristics	The dust control measures were adopted promptly and social capacity was formed.	The institutions of the Ube model did not function efficiently for the SO2 control measures. Social capacity did not improve and sufficient pollution control measures were not adopted. Eventually, institutional change in Ube City accelerated under the external pressure of the increased restrictions that were instituted at the national level. The improvement of social capacity was achieved through the institutional change that was instituted after the finalization and implementation of the pollution control agreement in 1971. This resulted in an improvement in the efficiency of the SO2 control measures.

Source. Matsuoka *et al.* (2004)

Table 8 indicates the environmental policies and their characteristics in Ube City. Figure 11 shows the relationship between institutional changes (formal and informal) and the SCEM of Ube City, while figure 12 shows the systemic change and the formulation of SCEM in Ube City. Thus, we observe that as compared with the policy for dust pollution, the measures for controlling SO_2 in Ube City were delayed until the enactment of the pollution control agreement in 1970. According to this investigation, we conclude that (1) the knowledge and technology were not sufficient to control SO_2 pollution in Ube City, and (2) the characteristics of the Ube Model. Thus, these conclusions highlight the following:

(1) The institutions needed for controlling pollution differ on a case by case basis and depend on the type of pollution;
(2) The efficiency of the performance of the institutions is closely related to the SCEM in the region.

Therefore, in order to achieve a higher capacity level for a country, it is important to analyze the nature of the existing institutions, i.e., whether they are principal/secondary and formal/informal. Moreover, it is also important to ascertain whether the actors' capacities of environmental management satisfy the efficient performance requirement of the institution.

3.4. Path Analysis

The path analysis clarifies the information and the conditions that are prerequisites for setting a rational capacity level target. Moreover, an analysis of the path (strategy or program) adopted for the current social capacity level helps in identifying the ideal path toward achieving the set target.

As discussed in the previous section, social capacity is developed through the interactions between the actors and the institutions. In a broader sense, we can consider the capacity level as defined by the interrelationship among the capacity level, the socio-economic levels and the performance levels (environmental quality). First, the path analysis deals with the development process of the total system, which consists of three components.

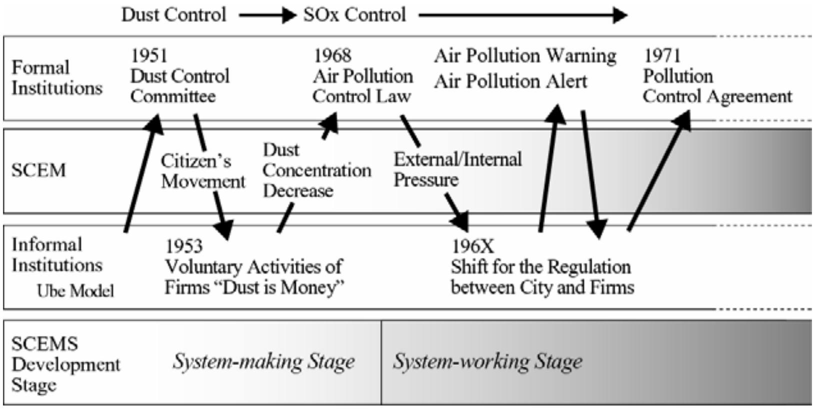

Figure11 Institutional change and social capacity environmental management
Source: Matsuoka *et al*. (2004)

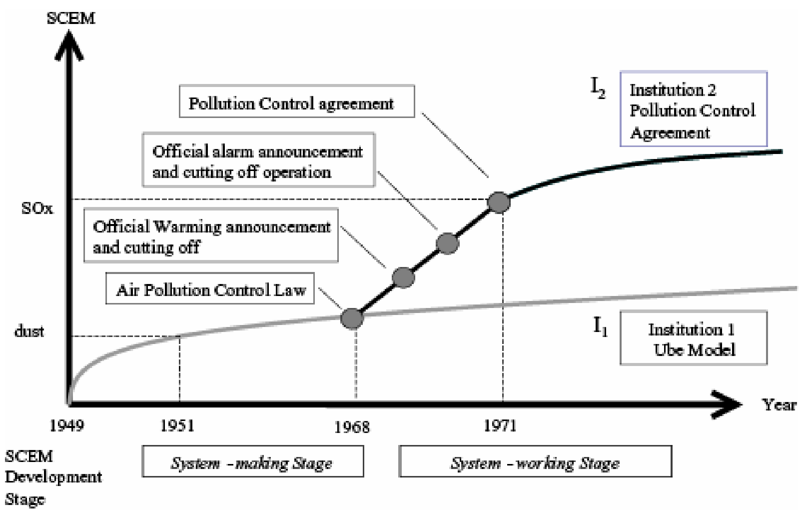

Figure 12 Social capacity for environmental management in Ube City
Source: Matsuoka *et al*. (2004)

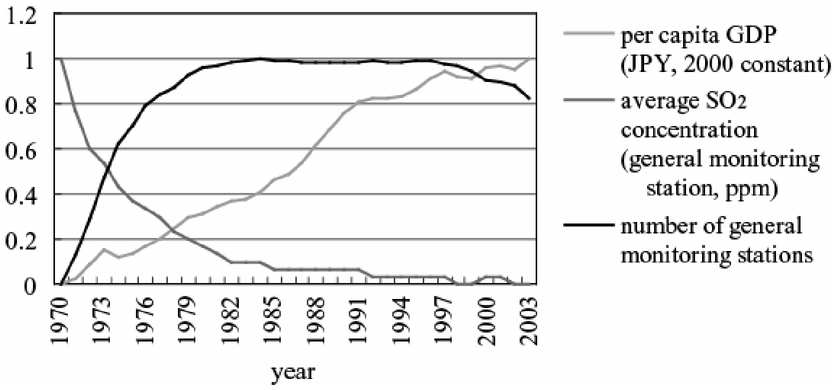

Figure 13 Transition of SCEM, socio-economic conditions, and environmental performance: The case of SO_2 in Japan
Source: Ministry of Environment, Japan (2005)

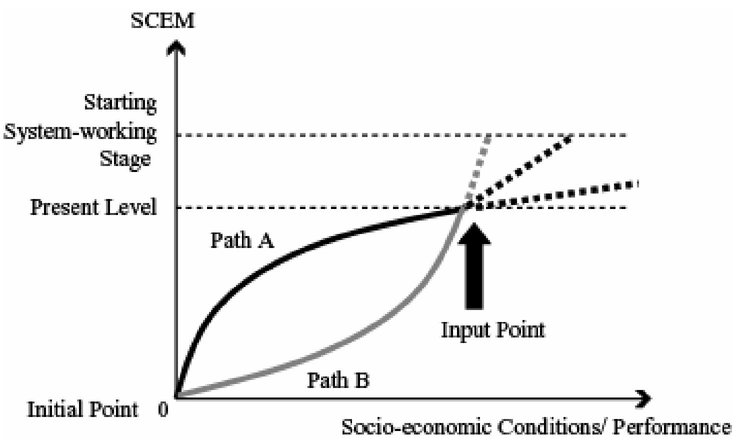

Figure 14 Path analysis

Figure 13 informs us about the indicators pertain to SO_2 in Japan. We adopted the SO_2 general monitoring stations as the capacity level, per capita GDP as the socio-economic level, and the performance level as the average monitoring data at the stations; although, due to limited information, this data was compiled after the peak of the observed SO_2 value. According to the figure, we observe that until the mid 1980s all the three components improved (capacity and socio-economic level increased, while the performance level decreased). However, post the 1980s the socio-economic level continued to improve, while the capacity level remained almost constant and the performance level stabilized at a low level. Based on this information, it can be said that until the mid 1980s the system operated efficiently resulting in an improvement in the environmental performance. However, since then the system continues to operate at a necessary minimum capacity, irrespective of any improvement in the socio-economic level.

By conducting a thorough analysis of the cases of different countries and their environmental issues, we can identify the characteristics responsible for the improvement of the environmental performance in each case. For example, figure 14 clearly demonstrates the differences between the cases wherein the adopted path changes from SCEM-led to socio-economic conditions-led and vice versa. Moreover, such a path analysis enables us to identify the course that we must adopt for improving environmental performance in the future.

Thus far, we have focused on the change in the level of the three components of the total system. However, in order to understand the development process of the system, it is necessary to bear in mind that these changes do not occur independently; rather, they undergo a transition in the context of the interrelationship between the three components. Honda *et al*. (2004) analyzed the relationship between these three components for 47 prefectures in Japan. From among these analyses related to several environmental issues, let us present the case of SO_2. The analysis is carried out using the Granger Causality Test and is based on the data for the period ranging from 1982 to 2000. Figure 15 confirms the existence of interrelationships between the three components for 23 out of 47 prefectures. In order to complete the path analysis, we need to verify the hypothesis that the change would occur from a state of weak or partial interrelationship at an early stage to that of a strong interrelationship with an interactive impact on all the three components (we do not exclude the possibility of plural paths to achieve the target). Thus, we shall now investigate the methodology and pursue these analyses.

In addition, the development processes of the capacities of social actors and their relationships also form a part of the path analysis' targets. In this case, we assume a certain level of substitutability among the actors; for instance, part of the government's role can be borne by a firm or a citizen. Future efficient capacity development paths are different for cases with different paths, such as government-led and citizen-led; however, they have the same level of social capacity as a whole. Regarding aid policy, this proposition implies that there should be cases wherein firms or citizens would not rely on the government to government approach and would be the direct beneficiaries of the aid.

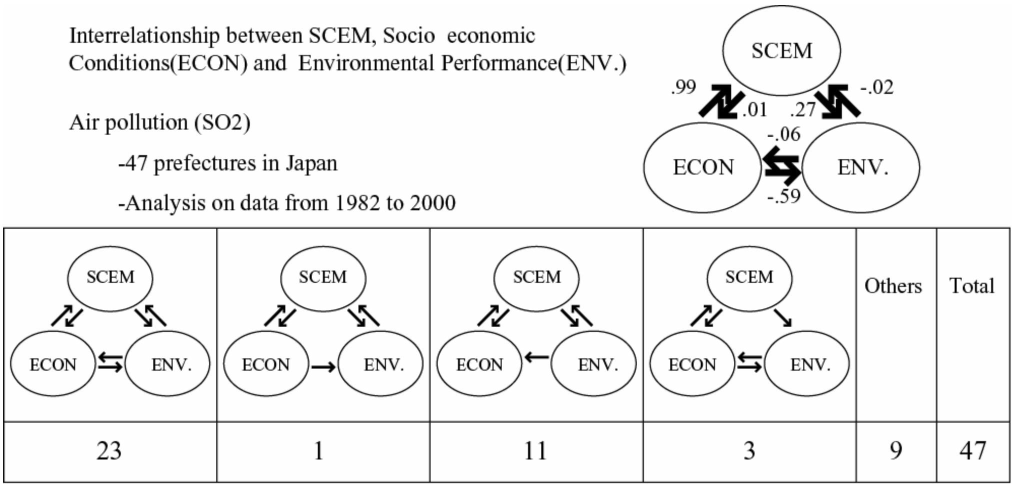

Figure 15 Interrelationship between SCEM, socio-economic conditions, and environmental performance

Source: Honda *et al*. (2004)

3.5. Development Stage Analysis

The development stage analysis that is conducted on the basis of the actor/factor analysis, the indicator development, the institutional analysis, and the path analysis, aims at specifying the development stage based on the benchmarks and then presenting the development process and the direction for further development. The analytical results highlight certain preconditions that clarify appropriate quantity, quality, and timing of input in order to enable development and aid policies to be implemented as programs.

Matsuoka and Kuchiki (2003), bearing in mind industrial pollution, assumed the following three development stages for the SEMS: system-making stage, system-working stage, and self-management stage. Table 9 indicates the stages and the benchmarks of SEMS.

Table 9 The Stages and Benchmarks of Social Environmental Management System

	System-making stage	*System-working stage*	*Self-management stage*
Definition	Period in which the bases of SEMS, especially governmental institutions, are developed.	Period in which the regulations between the government and firm sectors become stronger through the setting the incentives for pollution abatement and industrial pollution improves after reaching its peak.	Period in which a comprehensive environmental policy is needed, since new types of environmental issues emerge, and the firms and citizens sectors take leading roles through voluntary approaches for environmental management. Harmonious relations between government, firms, and citizens accelerate the efficient social environmental management.
Environmental Issues	Poverty related issues and issues related to industrial pollution.	Issues related to Industrial pollution.	Consumption-related issues.
Issues related to Industrial Pollution	Degradation.	Turning point (peak of the Environmental Kuznets Curve).	Improvement.
The Role of the Three Actors	-Government (system-making) -Firms (efforts for pollution reduction) -Citizens (pressure on the government and firms and research cooperation)	-Government (pollution control regulation) -Firms (pollution reduction) -Citizens (pressure on the government and firms and research cooperation)	-Government (proposal of comprehensive policy) -Firms (voluntary approach) -Citizens (voluntary approach)
The Relationship between the Three Actors	Government - Firms Government - Citizens	Government - Firms Government - Citizens Firms - Citizens (through government)	Firms - Citizens Government - Firms Government - Citizens
Benchmarks (Essential)	-Environmental Law -Environmental Administration -Environmental Information (Monitoring Data)	-Regulation -Reaching the peak of pollution level and improvement	<First phase> (In the case of developing countries) -Graduation / Independence from ODA <Second phase> -Comprehensive Environmental Management
Benchmarks (Important)	- Negotiations between Government-Firms, Government-Citizen - Mass media	- Negotiation, adjustment, and cooperation between Firms and Citizens	Voluntary approach of Firms and Citizens (Environmental Accounting, Environmental Reporting, Green Consumption, and Advocacy Planning)

Source: Matsuoka and Kuchiki (2003)

The system-making stage focuses on the development of the fundamental functions of the SEMS. Since this stage particularly focuses on the capacity development in the government sector, the benchmarks in this stage should be the development of the environmental law (basic law and acts for specific pollution control mechanisms), environmental administration, and environmental information. With regard to the environmental information benchmark, it is important to arrange the data by networking, understanding the environmental status, and then presenting the policy measures. Thus, we use not only the number of monitoring stations but also the first publication of the State of the Environment and the like as specific evaluation indicators.

In the system-working stage, the system actually starts functioning to improve the environmental quality. This occurs in response to the improvement of the basic environmental administrative institutions. As the pollution trend changes—from increasing to decreasing—a turning point of the so-called environmental Kuznets curve is observed. With reference to this, we focus upon the results of the implementation of government regulation (reduction of pollution by firms) and the consequent change to a decrease in pollution levels. In order to evaluate the achievement of pollution reduction measures, the standard achievement ratio of SOx—a typical industrial pollutant—will be observed as the indicator. If the achievement ratio for all the monitoring stations in the country is higher than 90%, then it is considered to be an indication of the end of SOx pollution. In developed countries, the Command and Control (CAC) has played a significant role in pollution reduction at the system-working stage. The CAC requires the government to utilize its administrative capacity in order to understand the state of pollution, set regulation standards, and ensure that those responsible for pollution are complying with the regulations. It is observed that as compared to the governments of developed countries, the governments of developing countries lack this administrative capacity and are therefore ineffective in implementing the CAC. However, pollution reduction can be realized efficiently by effectively introducing the market based instruments (MBIs) for environmental regulation and utilizing the market mechanism (Matsuoka, 2000).

The self-management stage is the stage wherein the system develops in a sustainable manner through the strong interrelations between the government, firms, and citizens, and a comprehensive environmental policy is enforced. At this stage, firms and citizens voluntarily adopt and participate in initiatives for environmental management. For instance, firms voluntarily upgrade their facilities in order to obtain the ISO 14000 certification as an in-house environmental management program, and in order to increase the efficiency of environmental management, they adopt environmental accounting. Moreover, they highlight their environmental management achievements in order to court consumer appreciation and thus gain a competitive advantage in the market. With regard to international cooperation, at this stage, a developing country becomes less dependent on donor's assistance and utilizes its own financial and human resources.

As a country experiences the development of SEMS, the roles and relationships of the three actors also evolve. The government sector plays an important role in managing and coordinating issues at the system-making and system-working stages; however, at the self-management stage, its responsibility evolves to supporting the firms and the citizens by designing a framework for comprehensive environmental management.

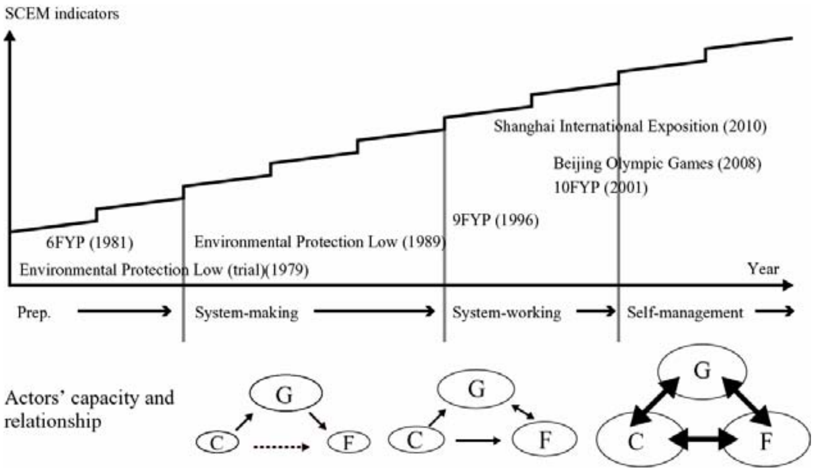

Figure 16 Development stages of SCEM: The case of China
Source: Japan Society for International Development (2004)

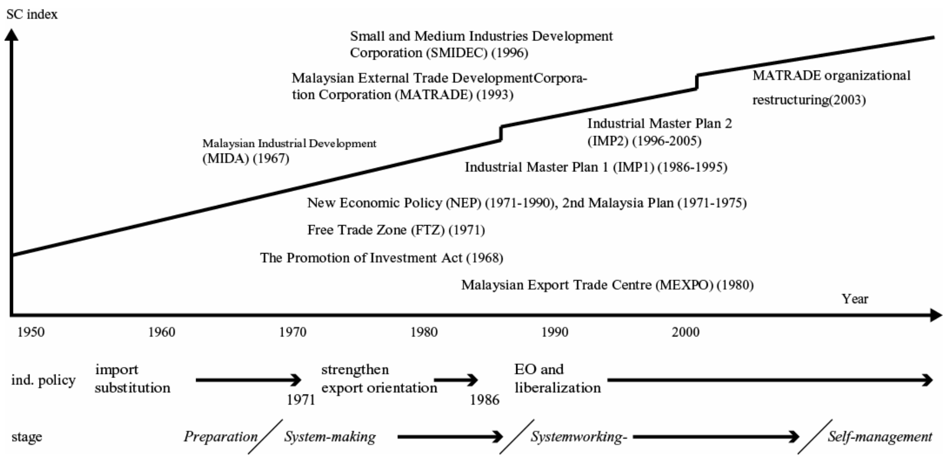

Figure 17 Social capacity development in trade: Malaysian case
Source: Hiroshima University - Mitsubishi Research Institute Inc. Joint Venture (2005)

Figure 16 shows the development of SCEM with the stages and benchmarks mentioned above (China's case). Considering economic indicators or passage of time as the horizontal principal and SCEM index (a group of indicators) as the vertical principal, it can be presumed that, by and large, China adopted the capacity development process that is shown in the figure. After the enactment of the Environmental Protection Law as the starting point of system-making, China entered a full-scale system-working stage during the 9th Five Year Plan (1996–2000). The 10th Five Year Plan (2001–2005) further accelerated this process. It is expected that China will be able to lay the foundation for initiating the self-management stage between the period of the Beijing Olympic Games in 2008 and the Shanghai Expo in 2010.

In terms of relationship between the three actors, the SEMS in China has changed drastically. As shown in figure 16, the government had exclusively performed all the functions and roles at the system-making stage. However, during the system-working stage, although the government continued to institute vigorous steps, the firms did render some important tangible contributions to curtail pollution. In addition, the relationships between the actors, particularly between the government and the firms grew stronger. Based on this, we can expect that during the self-management stage, a more balanced relationship, entailing the promotion of environmental industry and self-sustained growth of an environment-oriented market will be developed.

Moreover, we have also begun to apply the development stage analysis beyond the field of environmental management. Figure 17 describes the development stage analysis of social capacity development for trade (particularly export promotion) in Malaysia. The research is conducted for the JICA evaluation project (Thematic Evaluation: Economic Partnership). We observe that it is possible to conduct the analysis based on a similar format of benchmarks and stage setting; nevertheless, the trade capacity has its peculiar characteristics, such as the limited role of citizens and the vulnerability of performance level to external conditions.

This section introduced and discussed the basic designs of specific analytical methods that form the components of the SCA. The methodology enabled developing countries themselves to understand the current state of pollution and the problem of social capacity. Adopting the analytical method mentioned here as a precondition, the final section deals with the following question: How to transform development and aid policies into effective programs for attaining the capacity level that developing countries regard as their target.

4. Designing the Program for Social capacity development

This section describes the program design for social capacity development. Based on the SCA framework, we develop the program approach to identify the target level of capacity, and to provide specific strategies to achieve the target. The program presents an overall package consisting of: (1) the relationship between social actors, (2) the input resources—their quantity and timing, and (3) the institutional changes.

The program approach differs from the conventional stand-alone projects in many respects. This approach considers the following: (a) wide and systematic approach; (b) recognition of mutual dependence of society, economy, and culture; (c) long-term project implementation; (d) the harmonization of system development and its process; (e) focus on the capacity of the recipient countries; and (f) cost reduction by avoiding redundant aid projects (Bolger, 2000). Table 10 shows a detailed comparison between stand-alone projects and the program for social capacity development.

Sector-wide approaches (SWAPs) for social capacity development can be classified as one of the approaches of the program. The SWAPs are primarily carried out in basic education and healthcare sectors in the African countries. Jones and Lawson (2000) characterizes the SWAPs as follows: (i) the harmonization of policies between the donor and recipient countries (policy alignment), (ii) efficiency improvement in internal and external resource allocations, (iii) developing partnerships with local stakeholders, and (iv) emphasis on ownership. This characterization, however, is insufficient. We define the program as a program involving three actors (government, firms, and citizens) and three factors (policy and measure, human and organizations, and knowledge and technology). Thus, our social capacity development approach always takes the form of the program.

Table 10 Programs and Stand-alone Projects

Principles	Stand-Alone Projects	Programs
Local Ownership	Projects are often supply-led.	Based on locally owned programs, involving a community of stakeholders.
Donor Coordination	Limited donor collaboration, leading to inefficiency.	A high level of donor coordination, ideally involving all of the donor community, under national leadership
Partnerships	Projects are often managed directly by executing agencies or project implementation units.	Programs are intended to involve movement towards the use of local procedures and controls.
Attention to institutional development, governance issues, and civil society participation	Projects attempt to ensure success by establishing project-specific control mechanisms. They thus attempt to bypass, rather than solve, certain institutional weakness.	Attention is brought to bear on institutional, governance, and participation issues necessary to ensure success and the accountability of local institutions to their constituents.
Results-based Approach	Attention is focused on the success of the projects themselves, even though other conditions necessary to the achievement of development results may not be met.	The focus is on results at the program level such as those identified in the Millennium Development Goals or in the PRSs.

Source: Lavergne and Alba (2003)

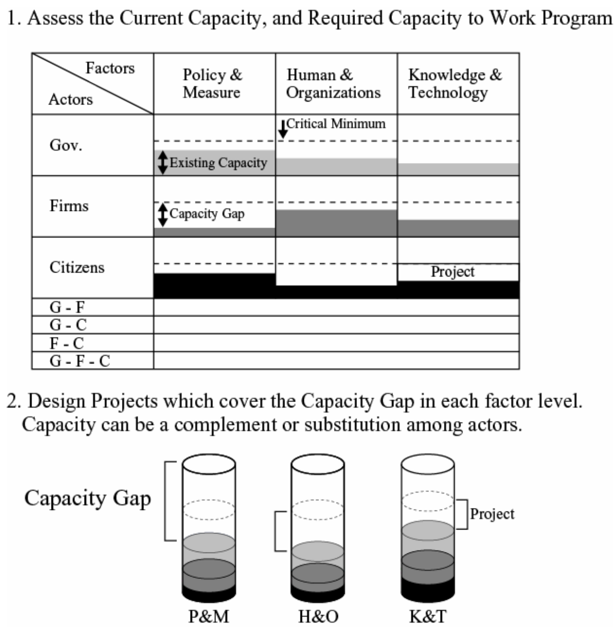

Figure 18 SCA and Program Design

The program design begins with social capacity assessment based on the actor-factor matrix presented in figure 18. When analyzing the pollution problem, the matrix is used to evaluate: (1) the current capacity for pollution abatement, (2) the critical minimum capacity during the system-working stage, and (3) the gap between current and critical minimum capacities.

It should be noted that we assume that capacities are substitutable between the actors, but not between the factors, i.e., the capacities are complements between the factors. For instance, suppose that the critical minimums for policy and measure, human and organizations, and knowledge and technology are 30, 50, and 10, respectively. Then, the critical minimum of policy and measure (30) can either be accepted solely by the government or it can also be accepted by the government and the firms jointly. Any combination of actors is possible in order to achieve the critical minimum; however, this is not true in the case of factors. Thus, the "Substitutability of actors" and "complementarities of factors" are equally important in our framework. The capacity gaps identified through the actor-factor matrix are expected to be filled by the projects. These projects are the ones based on the program (referred to as program-based projects) and are different from the conventional stand-alone projects.

Entry and exit points of the program and the projects can be determined through the development stage analysis of social capacity. Figure 19 illustrates the brown issue example. The figure shows the following institutional milestones during the system-making stage: (1) enacting environmental law, (2) the establishment of environmental administration, and (3) environmental information disclosure. Technical aids, such as the environmental center, are commonly provided by the JICA and can be effective in the latter half of the system-making stage (i.e., developing the system of environmental information disclosure).

In the system-working stage, it is important to focus on environmental business planning, resource allocation and organizational development, and research and development pertaining to pollution reduction. In addition to these, the pollution control management certification system, compliance with regulations, and financial assistance for developing environmental technologies are also important. Aid programs/projects can generally reach their exit point when the level of pollution decreases as per the target. In this stage, the environmental cooperation is horizontal, such as technology exchange, research exchange, and civil exchange. At the same time, the environmental policy measures take the form of economic instruments and self-regulation. Once this is achieved, the recipient countries will gradually move toward the self-management stage.

5. Conclusions

Based on the basic design of the SCA studies conducted under the current 21st COE program, this paper provides the definition of the SCEM as a total system and specific analytical methods, which are the components of the SCA, and the program design. Further, the case studies and the details of the following analytical methods are also provided: (1) Actor-Factor Analysis, (2) Indicator Development, (3) Institutional Analysis, (4) Path Analysis, and (5) Development Stage Analysis.

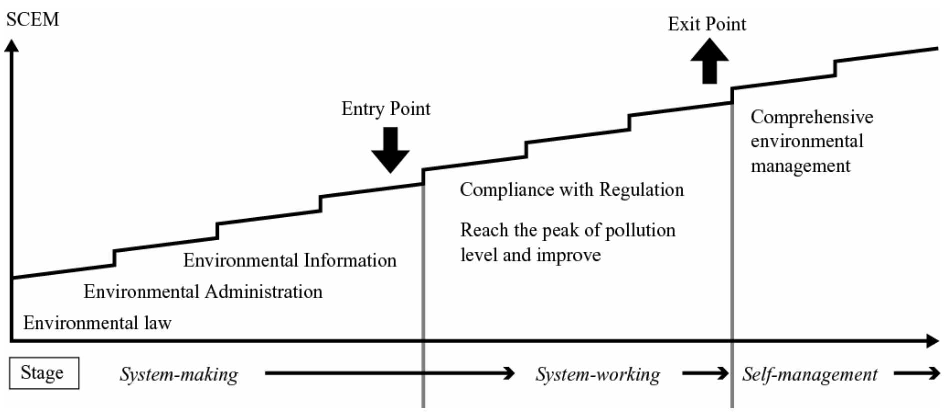

Figure 19 Entry, Exit Point, and the Development Stages

Hereafter, in order to design programs for achieving sustainable development in East Asia, we intend to continue studies on the SCA in East Asia and also intend to develop the models of the SCA.

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