How is a Sustainable Society Established? : A Case Study of Cities in Japan and Germany

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How is a Sustainable Society Established? A Case Study of Cities in Japan and Germany

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This research seeks the key mechanisms for the establishment of a sustainable society from the viewpoint of local politics. A case study was conducted for two ecologically friendly societies: Kitakyushu city in Japan and the Emscher area in Germany. Both societies suffered from severe environmental problems in the past, but recovered and became pioneering models of ecologically conscious societies over the past 100 years. The comparative investigations into their revitalization periods uncovered three commonalities: the presence of a symbol of an environmentally friendly society; a regional organization that manages projects with a comprehensive view; and the use of regional tangible and intangible resources created in the past. These three factors are considered important for achieving sustainable development in subnational societies in the future.

Keywords: Sustainable society, Analogy of history, Kitakyushu city, Emscher Park

1. Introduction

Economic development is one of the most important purposes of human society. For achieving this goal, urbanization and industrialization have occurred spontaneously from ancient times. Great amounts of energy, materials, and labor have been spent intensively in many places, and a large amount of manufactured goods has been produced and consumed. Especially after the Industrial Revolution, the global output of heavy industries drastically increased—by about 90-fold from the 1750s to the 1980s[1]. However, there is a trilemma among economy, environment, and energy[2]; rapid economic development and great consumption of resources in the past increased the burden on the environment, causing many environmental problems. Typical examples are the heat island phenomenon, water pollution, and air pollution in urban areas.[3] From a few hundred years ago to the present day, a number of cases of environmental problems have been reported, sometimes causing serious damage to human health. Examples are four health hazards in Japan[i] and diseases of respiratory organs in China[ii]. Especially with the progress of globalization in the present day, serious environmental pollution and diseases are caused frequently and simultaneously[5] in developing countries. Furthermore, a survey conducted by the United Nations Population Division[6] indicates that urban population will increase continuously in the future and will exceed six billion (70% of the world's population) in the 2050s. Hence, it is predicted that a vast number of people will suffer from environmental diseases and continuous growth of human society will not be achieved.

Under this circumstance, a fundamentally new direction for future development is required, with a strong focus on the concept of a sustainable society. The idea of "sustainable society" was suggested for the first time in 1980 in the World Conservation Strategy[7] of the International Union for Conservation of Nature and Natural Resources (IUCN). It was publicized all over the world by the declaration (Agenda 21)[8] adopted at the United Nations conference on environment and development at the Earth Summit in 1992. There are various definitions of sustainable society, but the most important and common theme among them is that sustainable development should satisfy the desires of the present generation and future generations. In other words, in a sustainable society, all resources like fossil fuel should be shared with future generations and spending them as if they grew on trees is prohibited. Moreover, we have a duty to preserve the environment to assure healthy lives of future generations.

With the diffusion of the ideas of Agenda 21, nowadays the importance of a balance between economy and ecology is widely recognized, and a number of organizations have launched development strategies to achieve an environmentally friendly society.[9] Some local societies in Japan and Germany are especially well known because they accomplished remarkable results despite suffering from terrible environmental conditions in the last century.[10] For example, Kitakyushu city,

which is one of the largest industrial regions in Japan, faced serious air pollution and water contamination in the middle of the last century. However, owing to continuous efforts of local government, private companies, and residents, the living standard in the region was improved and now Kitakyushu city is considered a model of an ecologically friendly society.

Because these advanced societies are attractive targets for environmental researches, a number of books, papers, and reports about them have been published (e.g., Shikata 1991[11], Sasaki 2008[12]). Although these studies introduced many interesting cases about individual challenges of a region, it is considered that they pay scant attention to universality because large parts of these reports focus only on a single case and comparison among multiple cases is not conducted. This is partly because each pioneering society uses methods that reflect the specific features and actual situations of the locality; thus there is little commonality by which to compare the respective local policies in detail.

However, as explained earlier, it is expected that more regions and societies will urbanize in the future, causing more environmental pollution and health crises for people. Therefore, it is quite meaningful to discuss a general, fundamental mechanism for constituting an ecologically friendly society. For that reason, this study investigated a political mechanism for establishing a sustainable society through comparative analysis of two ecologically friendly cities. The first case is Kitakyushu city, locates at the north part of Kyushu Island in Japan (fig.1(a));the other case is the Emscher area in Germany, surrounding the Emscher River (fig.1 (b)). As explained in the following section, the historical backgrounds and current situations of these two regions are amazingly similar although the political system and city size are different. For this reason, the expected results of this study will provide effective guidelines for a sustainable society. In other words, this study will provide many suggestive hints for next-generation urban design and continued development of human society for the future.

2. Historical backgrounds of the two regions

In this section, the historical backgrounds of the Kitakyushu region and the Emscher area in the past 100 years are reviewed, focusing on the economic and political situations. Comparative investigation revealed that the two regions had similar historical backgrounds from the end of the 19th century to the present day. The 100-year period is further divided into four phases.

2.1 Period 1: Dawn of heavy industry

2.1.1 Kitakyushu city

Until the end of the 19th century, Kitakyushu was a poor village, and people made a living by inshore fishery.

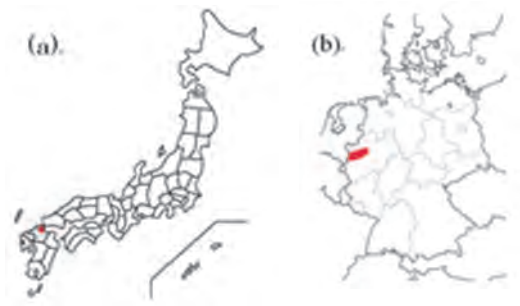

Fig. 1. Location of Kitakyushu (a) and Emscher (b)

Fig. 2. Landscape of Yahata in 1910 (photograph from http://meiji-meisho.at.webry.info/201305/article_3.html)

There was no major local industry, and population was small at that time.

However, an important turning point came in 1901 after the state-owned Yahata steel factory commenced operation in that year. The steel factory was built under the national policy of wealth and military strength and was one of the most important production bases of Japan. Figure 2 is a picture of the landscape of Yahata in 1910, showing Japanese traditional houses and the modern factory next to each other. After 1901, the population of the Yahata area rapidly increased by 40-fold going from less than 2,000 before 1901 to 84,682 in 1917.[13]

One of the most important reasons why a state-owned steel factory was built in Kitakyushu is the rich source of coal.[iii] There was a large coal supply center (Chikuhou coalfield) in the vicinity, and the amount of coal production in the Chikuhou coalfield was more than 50% of all coal produced in Japan at that time.[14] Moreover, a large river, the Ongagawa, connects the Chikuhou coalfield with Kitakyushu, and people took advantage of it as a useful water transport route for the coal. The technological standard of the steel industry at that time required large amounts of coal; thus, it was a great benefit for a steel factory to be adjacent to a huge coalfield.

One of the remarkable facts of this age is that steel production, which was a leading-edge industry at that time, was started suddenly through the power of the national government. In other words, there was little industrial base in Kitakyushu before 1901, and capital goods and technology were introduced from outside. Yoshio Kanzaki (honorary professor, University of Kitakyushu) has stated that “the process of developing of

industry in Kitakyushu is different from the ordinary one, that is, transition from light industry like textile manufacturing to heavy industry. The Yahata steel factory suddenly appeared as state capital in a place where there was no major industry" (Shikata 1991[11]). Takano (1959)[15] described this sudden change of local industrial structure as a typical urbanization type that is observed only in the modern era after the Industrial Revolution.

2.1.2 Emscher area

Similar to Kitakyushu, the Emscher area was relatively poor before heavy industry came. Although the south part of the Ruhr industrial area (around the Ruhr River) was one of the most important industrial areas in Germany from the middle of the 19th century, the north part of the area (around the Emscher River) was still undeveloped, and the population was small.[16]

Development of the Emscher area started with the increase in demand for coal resources in the beginning of the 20th century; a large investment was made by major companies. Similar to the case of Kitakyushu, the industrialization of the Emscher area proceeded rapidly without taking care of the natural environment, and the infrastructure was designed to meet the demands of heavy industry (Nagamatsu 2006[16] and Seltmann 2007[17]). In other words, there was plenty of room for development in the Emscher area at that time, and the city structure was tailored for efficient production of coal and steel.

Another feature in common with Kitakyushu was the use of water transport on the Emscher River. Figure 3 indicates the transition of the river from 1899 to 2007. In 1899, it was an aboriginal river with a meandering flow and rich natural life; however, major expansion works were conducted in the early 20th century to change the water flow (fig. 3(b)). As a result, the Emscher became a regulated artificial river, used as a practical water transport route and water drainage system.

2.2 Period 2: Golden age and ecological problems

The heavy industry in these two areas grew continuously in the middle of the 20th century. Under the policy of national enrichment, Kitakyushu and the Emscher area played similar roles in Japan and Germany. These two industrial regions were expected to be major production bases for steel, and their products were used for modernization, such as construction of infrastructure and buildings.

Japan had two wars around 1900, the Sino-Japanese War (1894-1895) and the Russo-Japanese War (1904-1905). These two wars increased steel demand under the national policy of wealth and military strength. Social infrastructures developed in consonance with the operation of the Yahata steel factory, making the Kitakyushu area more inviting for private steel production companies and associated industries. As a result, the Kitakyushu region became one of the most important industrial areas of Japan in the 1920s (Kasuga 1956)[18]. After World War II, the Japanese government implemented a priority production system[iv] and spent enormous amounts of the national budget for revitalization and strengthening of coal mining and steel production. This increased the shipment value of the Kitakyushu industrial area in the middle of the 20th century. Under this circumstance, the five cities[v] in the Kitakyushu region were merged to maximize the efficiency of the political system and economic connections among heavy industries; this established the current Kitakyushu city.

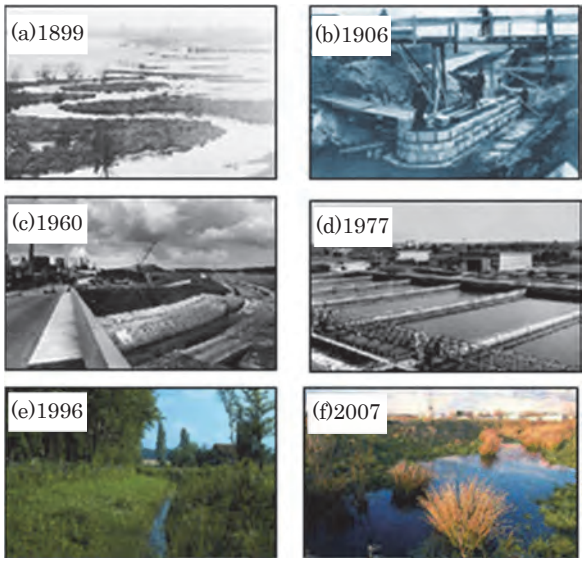

Fig. 3. Transition of Emscher River from 1899 to 2007 (all photographs from http://www.eglv.de/emschergenossenschaft/emscher-umbau/emscher/zeitreise/)

Similarly, the Emscher area made a large contribution to the development of the heavy industry of Germany in the 20th century by producing large amounts of coal and steel. The economy of the area rapidly developed owing to coal mining and the steel industry, thus increasing the population. After World War II, the importance of the Ruhr industrial area for West Germany increased because of the loss of industrial area in East Germany. The reconstruction of industry in the Ruhr progressed rapidly after World War II with the support of the Marshall Plan, and more than 50% of residents of the Emscher area were engaged in industrial production in 1970.[20] Figure 3(c) presents the landscape around the Emscher River in 1960. With the economic reconstruction, the amount of wastewater increased and a large wastewater treatment facility was built in 1977 (Fig. 3(d)).

In consequence, both Kitakyushu and the Ruhr were among the most important motive powers of Japanese and German industrialization in the 20th century. Although these two regions suffered serious damage during World War II, reconstruction proceeded with a high priority under the conditions of the postwar period.

Fig. 4. Landscape of Kitakyushu in the 1960s (photograph from http://www.city.kitakyushu.lg.jp/kankyou/file_0269.html)

Fig. 5. Landscape of the Emscher area in the industrial period (photograph from http://www.art-society.com/report)

Evidence of the social atmosphere of these two industrial areas at that time is the following song,[vi] the Yahata city anthem:

> The flame burns high billows, and the smoke covers the sky. The grand sight of the world, our iron factory. Yahata, Yahata, our home town. The progress of the city is our duty.

Figure 4 presents the landscape of Kitakyushu in the middle of the 20th century. A great amount of emission of smoke is observed in fig. 4, and the city anthem reflects the city's pride in it as a symbol of the great development of heavy industry in their town. Similarly, Nagamatsu (2006)[16] noted that residents of the Emscher area accepted air pollution and water contamination in exchange for high wages; moreover, environmental destruction (fig. 5) was admired as a sacrifice for national development.

2.3 Period 3: Decline of heavy industry and economic recession

However, the heavy industries in these regions gradually declined in the late 20th century. There are some reasons of the decline: a shift of the energy resource from coal to petroleum; decrease of the steel industry's coal consumption through energy-saving technologies; and change of industrial structure from secondary to tertiary industry. With the decline in heavy industry, an economic recession started, increasing the unemployment rate and decreasing the population (Taketoshi 2002[21], Nagamatsu 2006[16]). Furthermore, the environmental destruction from the previous time period caused serious public disruption. Fig. 6(a) shows the water contamination of Doukaiwan Bay in the 1960s due to the wastewater from factories. Doukaiwan Bay was known as the Sea of Death because no life could survive in the bay at that time.

Similarly, the Emscher area suffered from environmental problems in the late 20th century; the most serious problem was pollution of the Emscher River. Although wastewater treatment facilities were operated (fig. 3(d)), the water pollution became worse. U. Raasch, a technical officer of the water management organization

(a)

(b)

Fig. 6 (a). Water pollution of Doukaiwan Bay in 1960 (b). Current situation of Doukaiwan Bay (photographs from http://www.city.kitakyushu.lg.jp/kankyou/file_0269.html)

of Emscher at that time, described the situation as it existed then: "The Emscher is straightened and lined with impervious concrete beds to convey wastewater from cities as well as industrial areas along the river's course, resulting in the river becoming ecologically dead" (Salian and Anton 2011).[20]

The quality of life of the Kitakyushu and Emscher areas was degraded by economic recession and environmental problems. In other words, the Kitakyushu and Emscher regions were taken advantage of as if they were colonies exporting resources for the development of nations but, ironically, becoming forlorn places as the development proceeded.

2.4 Period 4: Area revitalization

In these severe situations, the Kitakyushu and Emscher areas both started a wide variety of area revitalization projects to improve living and economic conditions. One of the notable points is that both regions

Table 1. Growth of the environmental department of Kitakyushu city

Year	1963	1965	1970	1971	1975
Member	4	8	22	47	79
Status	unit	division	division	bureau	bureau

(data from Taketoshi 2002[21])

placed importance on ecology for revitalization, especially in the projects carried out in the late 20th century. Projects in that period in these two areas have been highly original and effective. As a result, Kitakyushu and the Emscher area are now known as the most successful models of ecologically friendly areas. The specific contents of the revitalization projects are described in the following paragraphs.

2.4.1 Kitakyushu area

Nomura (2011)[22] pointed out that the merger of five cities in 1963 paved the way for solving environmental problems. Before the merger, it was difficult to carry out practical ecological policy because the economy of Kitakyushu was strongly reliant on heavy industry (and the social atmosphere described above).

Under this situation, a public health unit was established in the Kitakyushu city office along with the merger in 1963. The unit had only four members at that time, and their competence was limited. However, the members and functions of the unit increased in later years, and the unit was raised to its present status (table 1). Much effort went into improving the environmental situation in Kitakyushu with the expansion of the department; for example, the staff started onsite inspections for monitoring the contaminant discharge status of heavy-industry factories. Furthermore, they developed local pollutant regulations that were stricter than the national rules.[vii] In addition, they concluded antipollution agreements with private companies and arranged financial support system for them to improve pollution prevention techniques in factories. Owing to these challenges, the public environmental disruptions in Kitakyushu region were resolved almost completely before 1980 (fig. 6(b)).

After the fight against pollution, the ecological movement of Kitakyushu entered a new stage for further improvement of the living environment and creation of a sustainable development policy. The city office launched a 15-year urban design plan named Kitakyushu Renaissance Conception in 1988. A unique project of this plan was the establishment of Eco-Town, which was a special district for fundamental research, demonstration experiments, and ecological businesses.[23] To this day, fundamental research and demonstrations have been conducted through the cooperation of universities and private companies. Ecological businesses are operated by some pioneering companies, and regular recycling of metal, plastic, and precision equipment is now an ongoing activity. Fifty-one demonstration experiments were finished, and about 1,300 new jobs were created in these new businesses by 2009.[24] With the increasing importance of ecological technology, there is now a focus on overseas expansion of ecological businesses, and cooperative enterprises with foreign companies have been started. Because of achievements like these, Kitakyushu is considered one of the most advanced cases of an ecologically friendly society in Japan.

Table 2 Proportion of jobs in 1970 and 2006

	Industrial production	Services
1970	58%	28%
2006	40%	70%

(data from Seltmann 2006[17])

2.4.2 Emscher area

As for the Emscher area, it is frequently pointed out that the Internationale Bauausstellung (IBA) Emscher Park Project[viii] was an important turning point in revitalization of that area (e.g. Kasugai 2002).[25]

The target area of the IBA Emscher Park Project extended through multiple political districts, and 17 counties and independent cities were included. There was no appropriate organization to move forward with the project, so a temporary company was set up for ten years (1989 to 1999) to manage the project. The company was funded by the Nordrhein-Westfalen state government, and 33 members, including two city officials, belonged to it.[25]

At the beginning of the IBA project, the company presented five major themes for area revitalization: the Emscher Park, the reconstruction of the Emscher water system, "working in the park[ix]," new uses for old industrial buildings, and new housing projects. Under these main concepts, the company offered area revitalization projects, not only for private companies but also for public organizations and individuals. The company evaluated the suitability of each project in light of the five fundamental concepts, and gave financial and informational support to carry out a project if it was accepted. During the ten years, 123 projects were conducted and more than 15 billion euros was invested,[26] improving the landscape, economic conditions, and infrastructure.

One of the most representative projects of IBA Emscher Park was the reconstruction of the Emscher River. With the development of heavy industry during the 20th century, the river was drastically modified artificially and used as a huge, efficient wastewater system (fig. 3, (c) and (d)). However, after the recession of heavy industry, such a huge wastewater treatment system was not needed any more.

Under this circumstance, residents and ecological organizations in the Emscher region started a grass-roots social movement demanding improvement of the

environmental condition of the Emscher River.[27] Following this action, the water management organization for the Emscher area (the Emschergenossenschaft) started a large project using the system of the IBA program. Although some work is still pending in 2016, achievement is observable in the Emscher River and its tributaries (fig. 3, (e) and (f)).

The revival of the original nature of the Emscher River provided a good image for people, and furthermore, the improvement of the landscape and the living and working environment attracted people from other regions. Taking advantage of this positive image, subnational governments in the Emscher area have been giving emphasis to development of ecological businesses like green tourism, health services, and ecological housing. As a result of these challenges, the Emscher area has broken from the past problem-ridden situation, changed its industrial structure, and improved the employment rate (table 2).

3. Three success factors for the achievement of an ecologically friendly society

In the last century, the Kitakyushu and Emscher areas passed through four time periods as described above. Although these two regions were in ecological predicaments due to industrial recession, they are now considered the most successful cases of ecologically friendly societies. In this chapter, I discuss the reasons why these two areas accomplished their remarkable achievements.

3.1 Management organization

The first point of success was the existence of unified management organizations, i.e., the city office of Kitakyushu and the IBA Emscher Park Company. Past studies pointed out that the persistent negotiations with, and support for, private companies by the city offices made a large contribution to establishment of ecological societies in Kitakyushu. As mentioned above, the antipollution policies in the Kitakyushu were put into effect after Kitakyushu city was created in 1963.

One of the remarkable points of the challenge of the Kitakyushu city office was its specific approach, called the "Kitakyushu method." The Kitakyushu city officials designed their unique regulations to reduce environmental burdens; however, they did not force the regulations on private companies, but instead took counsel with workers, residents, and intellectuals to make their regulations effective. Through conferencing, the city office secured antipollution agreements with private companies and established a funding system for improving ecological performance of factories. Although a concept of cooperative social responsibility for contamination was not common at that time, private companies took prompt actions to follow the ecological agreement because of the cooperative altitude of Kitakyushu city and its good management. This desirable relation between the city office and private companies continued after 1980 and contributed to the success of ecological projects in later days.

Similarly, the IBA Emscher Park Company played a highly important role in the area revitalization in the Emscher area. It is notable that, unlike the Kitakyushu case, the IBA Emscher Park Company did not have political power. Despite this difficulty, and the fact that the target area contained 17 different local governments and a population about twice that of Kitakyushu (about 2 million versus 1.1 million), the company achieved great success during the first ten years and established the regional identity of the Emscher area in later days.

As mentioned above, the main business of the company was evaluating the projects that were collected from the public, providing the information and financial support, and coordinating the entire program.

The company held international competitions for urban design and building programs, and consulted with specialists in open conferences and workshops when an unexpected problem occurred. This project management procedure was one of the most important roles of the IBA Emscher Park Company, and it contributed to the steady implementation of sustainable development.

Unlike the Kitakyushu case, this system collected ideas from the public; thus, private companies and other actors had no obligation to participate in the program. However, many projects were suggested, not only from private companies, but also from public organizations and individuals. Regarding reasons why people were eager to suggest projects, Kasugai (2002)[25] pointed out the importance of public relation. The IBA Emscher Park Company publicized adopted projects using their network in the Emscher area. This support contributed strongly to improving the image of a presenter of a project; moreover, it raised social credibility. Thus, improvement of image was an important benefit for a presenter, especially for a private company. This gave them great motivation to join the IBA program although it was not their duty.

Compared to the approach of the Kitakyushu city office, the IBA Emscher Park Company used different methods to achieve area revitalization. However, the facts presented above indicate that the advanced management ability of the unified organization was an important factor to establish an ecologically friendly society.

3.2 Symbol of revitalization

The second key factor in achievement of an environmentally friendly society was public consciousness for a symbol of good ecology. Both the Kitakyushu region and the Emscher area suffered from severe water contamination in the middle of the last century (fig. 3 and fig. 6). However, the water problem was solved in these two areas in the latter part of the last century, and this recovery of the water system raised the

expectation of an ecologically friendly society in the future.

The pollution of Doukaiwan Bay was caused by the wastewater from the factories, and contamination peaked in the 1960s. No life could survive in the bay,[x] so Doukaiwan Bay was called the Sea of Death or the Champion of Pollution.

Action by a local women's association was started against this environmental pollution, and this was a trigger to solve the environmental problem in Kitakyushu.[11] The women's association widely publicized the seriousness of environmental disruption through unique methods like homemade movies, fieldwork at factories, and scientific research (fig. 7). Residents had endured the pollution before the movement, but the association's effort changed the public sense about the environment and helped smooth promotion of the antipollution measures by Kitakyushu city. The most important achievement of the environmental department was the cleaning operation of Doukaiwan Bay. The dredging operation was planned in 1966, based on the national laws for preserving water quality and regulation of wastewater. The operation was carried out in the 1970s in cooperation with private companies, drastically reducing the contamination of Doukaiwan Bay (fig. 6(b)).

Some reports and investigations have mentioned that the public awareness of the environment was improved after the Doukaiwan Bay project (e.g., Shikata 1991).[11] The Kitakyushu city authority maintained an uncompromising attitude to pollution by private companies and monitored the environmental burden from industrial activities. This strict position of the city office was reported by the mass media, strongly increasing the public awareness. Additionally, the cooperative framework established during cleaning operations between city office and private companies led to the ongoing policies for growing ecological industries in later years.

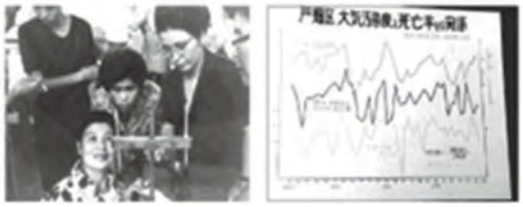

Fig. 7. Scientific research by women's association against public disruptions (data from: http://www.city.kitakyushu .lg.jp/kankyou/file_0269.html)

In the Emscher area, the destruction of the Emscher River was caused by construction work from the early 20th century, and the river's ecological system was completely dead by the middle of that century. With the recession of heavy industry, the Emscher River was considered the negative legacy of declined region. A turning point for the river was IBA Emscher Park Project, and the quality of the water and the surrounding environment was recovered.

Salian and Anton (2011)[20] gave a detailed explanation of the revitalization process of the Emscher River. They mentioned that local demand and political pressure from residents were important motivations for promoting the recovery project. As a result, the IBA Emscher Park Company put major emphasis on the reconstruction of the water system.

From the perspective of area regeneration, the reconstruction of the river made a large contribution toward changing the public awareness of residents for their home town. Salian and Anton (2011)[20] and LaBelle (2001)[27] mentioned that the living environment in Emscher area was extremely bad before the IBA project; however, with the recovery of the river, the citizens acquired confidence in their town. In addition, they indicated that this transition of public sense is the most important outcome of the project because the social consensus for evolving an ecologically friendly society is raised, and this helps the smooth promotion of later eco projects in the Emscher area. In the IBA Emscher Park Project, a number of works were carried out for improving the landscape. At first, many people questioned whether a large amount of money should be spent for this rather than housing and other social needs; however, the achievement of the Emscher River rehabilitation persuaded them, and following projects were conducted successfully. As a result, the landscape of the Emscher area is now drastically improved, and not only residents but also visitors enjoy ecological tours and other outdoor leisure activities.

In summary, the historical contexts of Doukaiwan Bay and the Emscher River were similar (table 3), and both are considered symbols of area revitalization, inducing a social consensus that has led to later challenges to improve the environment. In consequence, the regional identity of the Kitakyushu and Emscher areas in the present day is attributable to the symbolism developed in the late 20th century.

Table 3. Water pollution and process of ecological activities in Kitakyushu and Emscher areas

	Kitakyushu	Emscher
Motivation	Pressure from women's association	Political pressure by nongovernmental organizations (NGOs) and citizens
Project	Cleanup operation of Doukaiwan Bay	Renaturation of Emscher River
Ripple effect	Rise of public awareness for environment Development of ecological technology	Change in the sense of citizens Assurance of budget for ecological projects

3.3 Legacy of heavy industry

The third factor of success in the Kitakyushu region and Emscher area was effective use of the legacy of the past. The ecological businesses of Kitakyushu, like the recycling business, developed in relation to heavy industry; on the other hand, the main ecological businesses in the Emscher area, like green tourism, were not directly linked to heavy industry. Although these two areas encouraged different ecological industries, both used local resources that were made in their "golden age" of heavy industry.

One of the most important achievements of Kitakyushu is Eco-Town. There are 26 Eco-Towns in Japan, and the one in Kitakyushu is known as the most advanced case.[28] It has been deemed that the connection between ecological industries and local resources contributed to the growth of Kitakyushu's Eco-Town. Akimoto (1994)[29] presented six requirements for formation of a recycling business: a large amount of waste material, usefulness of the waste material, homogeneity of waste, a system for collecting waste, an established technology, and demand for recycled materials. In accordance with his study, it was beneficial for a recycling business to locate near an industrial area because a large amount of homogeneous waste materials produced in factories could be collected easily. Furthermore, there was a relatively large demand for recycled goods in the Kitakyushu area,[24] and thus Eco-Town in Kitakyushu had a large advantage in the recycling business.

In addition to these factors, it was considered that both hard and soft regional resources were used well in Kitakyushu. In tangible aspect, the traffic infrastructure designed for heavy industry promoted smooth transportation of materials and products for a recycling business.[28] In intangible aspect, the Kitakyushu city office provided a hospitable support system for new ecological businesses. The notable point is that the city office promoted ecological industries and simplified the admission procedure to start a new business. Furthermore, the city office dispatched a support staff to a company that intended to start a new business, and this staff had all the responsibility for negotiations between the city office and the company. These systems reduced entry barriers and contributed to the development of Eco-Town. This committed altitude and useful system were associated with the experience of overcoming public environmental disruption through the cooperation with private companies. Thus it is considered that the network and relation of mutual trust relations between the city and the companies, as established several decades ago, had a large influence on the current situation of Kitakyushu.

On the other hand, the Emscher area used the legacy of the past in a different way from Kitakyushu. One of the major concepts of the IBA Emscher Park Project was the use of old industrial buildings, and a number of factories and industrial bases were reused as regional resources for sightseeing.

A successful case was the Zollverein Coal Mine Industrial Complex in Essen, which was considered the most beautiful coal mine in the world and was registered as a world heritage site in 2002. The complex was built in the middle of the 19th century and halted operations in 1986, three years before the IBA Emscher Park Project began. The coal mine remained as the original feature, representing the region's history and identity as an industrial region (fig. 8(a)).[30] Similar to this coal mine, a number of renovation projects were conducted on closed-down factories and industrial bases. They were repurposed to such uses as an art museum, cafeteria, green leisure, and education facility for local history (e.g., the coal factory in Dortmund, fig. 8(b).[30] These reused buildings of heavy industry helped to rediscover regional culture and became the pride of residents. In addition,

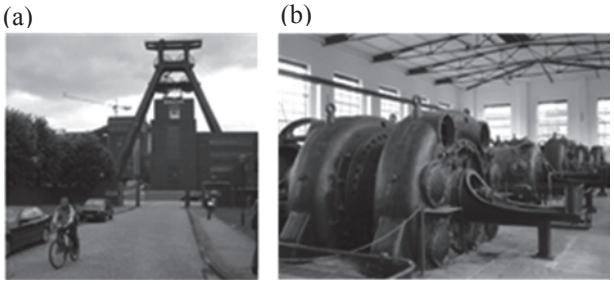

Fig.8. (a) Heritage of the Zollverein Coal Mine Industrial Complex (b) Coal factory in Dortmund (photographs from Motooka and Tanaka 2006[30])

Table 4. Key measurements in achieving a sustainable society in the Kitakyushu and Emscher areas

	Key essence and measurements		
	Unified leading organization	Symbol of revitalization	Use of past legacy
Kitakyushu	·Ecological agreements and projects with private companies · Long-term design to establish sustainable society	·Cleaning project of Doukaiwan Bay ·Public awareness of the importance of environment	·Regional characteristic as a heavy industrial area ·Mutual understanding between city office and private companies
Emscher	·A five-measure framework for ecological society · Management of a variety of projects sought for the public	·A series of projects for Emscher river renaturation ·Encouragement of residents' consciousness of their town	· Renovation of relics of heavy industry facilities · Creation of new types of ecological businesses

these repurposing projects improved the landscape of the Emscher area, increasing the number of visitors seeking green tourism.

Compared to the case of Kitakyushu, the main feature of the use of the past legacies in the Emscher area was to introduce new businesses like sightseeing and green tourism. A number of remaining buildings were renovated and had new functions, different from what they had in the past. In other words, the Escher case indicates that old tangible legacies can be used by adding new intangible values.

4. How can we apply the knowledge to developing countries?

So far, the historical background of the establishment of an ecologically friendly society in Kitakyushu and the Emscher area was reviewed (chapter 2), and the reasons for their success were revealed (chapter 3, table 4).

For the last several decades, industrial areas in developing countries have been growing rapidly owing to large investment from developed countries. As Akamatsu (1962)[31] mentioned, developing countries try to catch up with developed countries, but the competition among developing countries is severe in the global market; thus it is difficult to hold onto a competitive advantage. Therefore, a new industrial area in developing countries may possibly be confronted with an economic recession similar to those suffered by Kitakyushu and the Emscher area in the middle of the last century. For this expected problem, the experience of Kitakyushu and the Emscher area seems to provide many useful suggestions for regional-level adaptation. For this reason, in this chapter I discuss whether the knowledge presented above is applicable to developing countries.

The environment authority of the Kitakyushu city office gradually expanded over 50 years, accumulating experience in pollution management, and that experience made a large contribution in establishing an ecologically friendly society. Similarly, the IBA Emscher Park Company took advantage of the experience and methods developed in past IBA projects.

The environmental legal system and political organizations of developing countries have recently reached high standards. However, as Hiraoka (2005)[32] pointed out, industrialization proceeds extremely quickly in developing countries through large, rapid investment from developed countries. Thus, human resources in developing countries do not have time to acquire practical skills and methodologies of ecological governance. For this reason, environmental contamination continues in the present day even when a high-standard social system has been introduced. Moreover, according to the Kitakyushu and Emscher cases, a lack of human resources with enough experience in ecological management may delay area revitalization after the decline of heavy industry. Hence, we can conclude that the know-how and practical skills of Kitakyushu and the Emscher area should be shared as soon as possible to train local human resources. Furthermore, it is desirable for local people to acquire an ability to design future plans for their towns by themselves.

Regarding symbols of area revitalization, it is expected that the importance of a symbol is greater in the present day than in the past. The reason is associated with the current remarkable development of information technology. The revivals of Doukaiwan Bay and the Emscher River were widely publicized by mass media in Kitakyushu and by the IBA Emscher Park Company. As a result, these two water systems played a very important role in building social consensus for clean environment and inducing follow-on projects of an ecologically friendly society. According to the review by Taguchi and Shida (2010)[33], some recent research has pointed out the importance of sharing information to achieve ecological development (e.g., Dasgupta et al. 2002[34]). Well-developed information technologies enable not only large organizations, but also individuals, to spread their opinions, and thus it is expected that a symbol of clean environment will greatly assist to promote the ecological movement.

Regarding the use of past legacy, it is difficult to predict how industrial areas in developing countries can use legacy in the future because they are growing in the present day; thus, the legacy for the future is being created now. However, what is important is that a variety of ways exist to use legacy in regard to both tangible and intangible values. Therefore, it is required that people suggest unique and free ideas for using their regional resources when they work on area revitalization.

5. Conclusion

In this study, I examined cases of two pioneers of ecologically friendly societies, Kitakyushu and the Emscher area. Through this comparison, I tried to discern why and how these two regions became the most advanced models of a sustainable society.

First, the historical background of these two regions over the last 100 years was analyzed, and it was revealed that they had very similar historical contexts. Moreover, their histories were divided into four time periods: dawn of heavy industry; golden age and ecological problems; decline of heavy industry and economic recession; and area revitalization. The regional identities of these two regions were established with development of heavy industry in the early 20th century, and they achieved remarkable economic development in the middle of the last century. Although they suffered from economic recession and poor living standards from the1960s to the 1970s, they achieved area revitalization and now are well known as pioneers of ecological society.

In the third chapter, the procedures of area revitalization in the late 20th century were analyzed in detail. Three key factors in the success of area revitalization—management organization, symbol of clean environment, and legacy of the past—were presented. In both cases, a unified organization promoted area revitalization with strong leadership. The leadership

conducted many projects, building consensus among residents through a symbol of clean environment, and this attitude induced follow-on ecological projects. Effective use of the heavy industry legacy of the past reinforced regional identity and raised the pride of the residents.

Finally, I discussed whether the teachings extracted from the experiences of Kitakyushu and the Emscher area are applicable to developing countries. In the present day, developing countries have high-level legal systems and organization, but lack people with enough practical knowledge and skill in ecological governance. Thus, personnel exchange is greatly needed to raise the abilities of local people. In regard to symbols of area revitalization, it is expected that symbols and models will play an extremely important role for promoting revitalization projects owing to the current high standard of information technologies. It is difficult to presume how the legacy of the past will be used in the future, but there are a variety of ways to use it, so unique and free ideas are desirable.

Notes

i. Minamata disease, Yokkaichi asthma, Ouch Ouch disease, and Niigata Minamata disease are considered the four major pollution-related illnesses in Japan.

ii. Mu and Zhang (2013)[4)] investigated the influence of air pollution on human health in Beijing during January 2013. They estimated the economic loss at 23 billion Chinese yuan.

iii. The investigating committee at that time presented seven requirements: military safety, a transport system, a supply of raw materials, a supply of industrial water, abundant labor power, and sufficient factory tools and sales contacts.

iv. Jensen and Lonergan (2013)[19)] explains: "The system's major aim, after strengthening coal production, is to restore steel manufacturing to drive Japanese industry as a whole. Steel is, in turn, given to coal mines, to help accelerate the extraction of more coal, and to other industrial and export businesses."

v. Wakamatsu, Yahata, Tobata, Kokura, and Moji.

vi. Translated from Japanese to English by the author.

vii. For example, the acceptable value for chemical oxygen demand (COD) was 120 ppm in national law, but the maximum limit in Kitakyushu was 15 ppm.

viii. The IBA is a traditional architectural competition for urban planning and development. So far, IBA programs have been conducted in Darmstadt, Stuttgart, and Berlin.

ix. The idea of "working in the park" meant the construction of attractive, green, modern working places, in combination with cultural heritage and old coal and steel production facilities if possible.'

x. A survey conducted at that time measured dissolved oxygen in Doukaiwan Bay at 0%.

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