Scope of Technology for Urban Environmental Problems in Osaka and Kathmandu*

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1. Introduction

In 1960s, industrial cities in Japan experienced worst environmental problems. Since the City of Osaka was developed and prospered as the commercial hub of the West Japan from Meiji era, it was the most seriously affected city- in particular by air pollution. But before it was too late, the city administration designed measures based on scientific methods and obtained support from the general public, media, as well as the business groups. The story of Osaka in overcoming environmental problems can be guidance to emerging Asian cities, such as the Kathmandu Valley of Nepal which is experiencing serious form of pollution, similar to the 1960s scenario of Osaka.

2. Osaka and Kathmandu

The City of Osaka is the third largest city of Japan with population of about 2.6 millions in 2000[1]. It is located at the center of the second biggest economic region- the Kinki region (Figure-1). The City extends into the Osaka Plain, and its west side faces Osaka Bay. It covers about 220 square kilometers. Historically, soil and sand sediment from the Yodo River or Yodogawa formed the Osaka Plain.

Figure-1 Location of Osaka City

The Kathmandu Valley is the political hub of Nepal (Figure-2). It covers an area of about 667 sq. km[2]. The Valley is bowl shaped with rivers draining towards the center of the basin. There are currently five municipalities, including the capital city of Kathmandu, and several villages. The population of the Valley in 2001 was about 1.6 millions[3]. It covers only 0.45% area of Nepal but holds almost 7% of the total population of the country. The population growth rate of the Valley from 1991 to 2001 was 4 % per annum against the national growth of 2.24 %.

Figure-2 Location of the Kathmandu Valley

The Kathmandu Valley is not an administrative unit like Osaka, but it is fast developing into a large combined settlement. It is predicted that the Valley will be developed in a large urban area in near future. In terms of area, it is 3.3 times larger than Osaka. But, Osaka exceeds the Kathmandu Valley in population by more than one million. As a result, the population density of Osaka is almost 5 times more than that of the Kathmandu Valley.

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3. Complexities of Osaka's Problems

The pollution problems of Osaka were the outcome of the post-war economic revitalization and economic growth after the World War II (1939-1945).

Urban infrastructures such as sewage treatment plants with activated sludge method and incineration facilities were already developed in the pre-war period. So the main environmental problem was air pollution. Besides medium and large factories, automobile ownership, which increased dramatically in the 1970s, was also responsible for the deteriorated state of Osaka.

Because Osaka is an industrial city, the nature of environmental problems is complex and requires measures with technological backup. Even the history of Osaka's fight against air pollution shows the use of both social and technological planning. The City of Osaka, with the help of Osaka Prefectural Government, took measures for soot and smoke control at the early 1900s, which included social measures, such as public awareness among industries and citizens, and technological measures, such as improvement of coal combustion method, monitoring of dust fall and research on effects of pollution on economy[4].

A major success of technological measures was the use of monitored data which enabled the City to calculate the degree of each factory's contribution to pollution, and then make a persuasive and scientific argument to the factory owners to implement pollution control measures. A combined use of social and technological measures was also carried out in the form of encouragement to the large factories to design poll

ution control plan by themselves, and financial and technological support to small factories. Following the measures of pollution control, the concentration of dust fall decreased steadily since the observations began in 1954, and has remained unchanged since the mid-1970s.

Finding solutions to environmental problems is a continuous process. Even the sophisticated technological measures seem to solve the problems as planned, but in reality, it is the partial solution. Some problems are not solved in totality, but they are just transformed into different forms through which the problems change their nature and degree of risk. Such problems are generally new and research is required for correct diagnosis. So in the name of solving problems, there are situations when new problems are born. The success of technological measures lies in solving the problems rather than letting them transformed into other unknown and possibly dangerous forms (Figure-3).

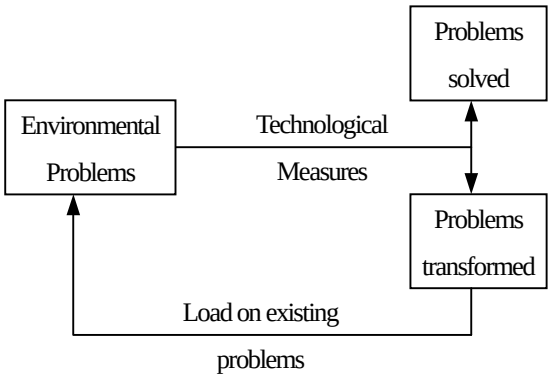

Figure-3 Technology and Problem Cycle

The transformation of problems instead of total solution can be considered as Osaka's inescapable fate since Osaka's geographical constraints and the scale of physical development do not allow much for the City to enjoy ecologically and economically sustainable solutions. The dependency on technology needs continuity in the case of Osaka. This is more visible in the case of flood control.

Since Osaka sits on an ancient floodplain formed by Yodogawa and other smaller rivers, it is susceptible to flooding. In fact, in over 90% of the city area, storm water should be discharged into the rivers and the sea by pumps[5] which consumes much energy. Furthermore, rapid urbanization has decreased the amount of farmlands and vacant lots which formerly served to retain storm water. This has led to a significant increase in storm water runoff rate, causing even area equipped with a sewer system to flood during heavy rainfall.

Because of the combined sewer system, during rain, some pollutants are directly discharged into rivers from pumping stations or storm overflow chambers together with storm water. Improvement measures against this problem include treatment of wet weather sewage and its storage. Accordingly, storm water with heavy pollutant load at the onset of heavy rainfall is temporarily stored at reservoirs, so that after it stops raining, the stored water will be subject to secondary treatment before discharging into the rivers. Such storm water reservoirs and infiltration facilities are advanced from of technological measures.

But the issue of cost and safety, in the case of disasters like earthquakes, cannot be ignored.

The issue of quality of drinking water in recent times has also put technology under question mark. According to the Department of Technology at Kyoto University, city water in Osaka and Kyoto contains dangerous substances[6]. Although both cities use the Yodogawa as their water resource and purify water by same means, Osaka has higher level of pollutants than Kyoto. People in Osaka drink water which has been already used and excreted seven times by people in Kyoto. It is more dangerous to use water at the lower delta because of the inflow of polluted water from the upper stream. Furthermore, despite use of sophisticated technology, pollutants exist in the city water of big cities, like Osaka. For instance, MX (mutagen X), a deadly cancer-causing agent, has been detected in the city water of Osaka and Tokyo[6]. It is to be questioned whether presence of such pollutants is because of the failure of treatment mechanism or the by-product of treatment procedure itself.

Because of rapid development and urbanization, environmental problems in big cities like Osaka have become too complicated to be managed by simple, natural measures. For instance, the rise in built-up area of the city and subsequent decrease in green spaces have caused the city temperature to rise. Large consumption of energy has already become an inseparable part of urban life. Future plans may include measures like creating rooftop green spaces to fight against warming. But such solutions are just mechanical solutions, and will not be able to satisfy nature's reaction to excessive human interference in nature's settings. It is to be noticed that despite the seriousness of Osaka towards its environment, the use of technology in fighting against pollution has brought mixed results in terms of success and sustainability.

4. Lessons for Kathmandu

Osaka's fight against air pollution is the most valuable lesson for Kathmandu which has the most serious problem in air quality. In fact, Osaka was one of the cities selected by United Nations Development Program (UNDP) for transfer of knowledge to some Asian cities including Kathmandu.

Rapid urbanization triggered by population boom has brought various environmental problems in the Valley. Like Osaka in the past, the main problem is air pollution though the Valley is not an industrial area. Between 1980 and 1990, when the population increased by 44 %, the number of vehicles doubled and the number of registered brick kilns tripled in the same decade. The pollutant concentrations in Kathmandu often substantially exceed the World Health Organization's Air Quality Guidelines (WHO AQG). The reason for the Kathmandu Valley to worry more about its air is its bowl-like topography and generally low wind speeds during the winter season which create poor dispersion conditions. Studies show that the number of foggy mornings increased from 35-40 days around 1970 to more than 60 days in 1993[7].

About half of the population in the Valley is exposed to a Total Suspended Particles (TSP) concentration above the average annual value of WHO AQG. It is estimated that health impact of air pollution on Kathmandu residents causes approximately 85 pollution-related premature deaths, 1.5 million days in which people experience respiratory problems and 475,000 restricted activity days due to pollution-related illness[7].

Learning from the experiences of Osaka in air quality management, the Kathmandu Valley can also adopt the socio-technological measures though because of low level of development, the technological aspect is not likely to emerge as strongly as in the case of Osaka. The important lessons from Osaka include the use of scientific methods, such as monitoring of air quality, analysis of trend and design of pollution control mechanism. Other measures are more social- such as relocation of polluting industries, strict rules and regulation, polluters pay policy (PPP), financial and technical support to industries, technical empowerment of municipalities, and public awareness. A cooperative system, such as among state, public and private parties, is inline with the tradition of Kathmandu where social mobilization has been a major factor in its developmental efforts. Likewise, the coordination between the Osaka Prefectural Government and Osaka City is an example of working together for common cause which is missing in the case of the Kathmandu Valley where different line agencies and governmental bodies work for the similar goals but without no or less coordination among themselves. Pollution due to large factories is not very difficult to assess because of the number of large factories in the Valley is very few. The main concern is the

growing number of unregistered brick kilns which use low-quality of fuels, and vehicles.

Because of the geographical features of the Valley, surface water easily drains out of the Valley under gravity flow. Hence the situation is different from Osaka where storm water has to be pumped off. This is an advantage for the Valley. Likewise, though both the quantity and quality of drinking water are poor, water in the Valley is not the reused water as in the case of Osaka. Therefore, water in the Valley does not undergo a series of after-use treatment, and the chances of any serious consequences resulting from treatment shortcomings are minimized.

5. Conclusion

Since the technological solutions are tend to be costly in terms of financial and technical aspects, and it cannot be said for certainty that the results will not be counter-productive, Kathmandu should choose solutions which are simple, manageable and safe. Both success and failure of Osaka provide valuable assistance to the future endeavors of Kathmandu. For Osaka, the main concern would be to lessen uncertainties in its technology, and if possible, to find out a more natural way of dealing with problems.

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