Special Session
New Era of Waste Management: Population Change and Aging

Tomohiro Tasaki[1*]Tomonori Ishigaki[1*], Rokuta Inaba[1], Ryo Tajima[1], Kosuke Kawai[1]

1: National Institute for Environmental Studies, 16-2 Onogawa, Tsukuba, Ibaraki 305-8506, Japan

*co-session organizers: tasaki.tomohiro@nies.go.jp; ishigaki@nies.go.jp

ABSTRACT

Waste management requires to adjust social changes because different societies produce different wastes and treat them differently. While lack of waste management system's capacity (from collection to recycling/treatment facilities) against rapidly increasing waste caused by population increase is a main challenge for developing countries, population decrease and aging in some countries cause a new challenge to shrink/shift waste management system to a proper size and structure. Population aging, which many Asian countries will face in the near future, is also a new challenge.

This special session will argue current situations of such social changes and possible solutions as well as a concept of waste management that covers different stages of population change and aging.

Keywords: waste management system, population onus, aging society, economic growth

INTRODUCTION AND OVERVIEW OF POPULATION CHANGES IN THE WORLD (Tasaki)

Waste management has focused on how to properly collect, dispose of or recycle waste, and effectively reduce increasing waste generation. To do so, it is necessary to establish sufficient capacity within the waste management system. Population has been an important factor in determining the amount of waste generated. While rapid population growth is still a challenge for waste management in emerging economies, several countries are facing population decrease and aging. Many countries expect to face this issue in the coming decades. According to UN population statistics (2017), the expected population change rates of 233 countries from 2015 to 2030 ranges from -0.82% to 5.06%, and 34 countries of these countries (15%) will face a population decrease during this period. Population decrease in Japan is expected to be the largest (6.4 million). Japan projected a decrease of more than 20% from 2010 to 2040, which accounts for 68.6% of municipalities (IPSS 2013). Population decrease usually occurs due to the aging of the population. Many developed countries have already exceeded 14% of the population being aged 65 and older, and several developing countries in Asia will exceed it at a very rapid pace. According to He et al. (2016) and Ohizumi K. (2007), the years needed for the percentage of the population aged 65 and older to double from 7% to 14% were 115 years for France, 85 years for Sweden, 69 years for U.S., and 45 years for U.K. while the year of Japan was only 25 years and the years of Malaysia, China, Philippines, Thailand, Brazil, Indonesia, South Korea, and Vietnam were predicted between 17 years to 24 years (see Tasaki et al, 2019).

The following three presentations examine/explain actions of waste management responding to these changes, respectively: aging, population decrease, and population increase. After them, the session will discuss what should be aware of in waste management for these changes and what kind of management

should be taken with a long-term perspective that covers different stages of population increase to population decrease appropriately.

CHALLENGES OF WASTE MANAGEMENT IN AGING SOCIETY (Tajima)

Aging can impact 3R and waste management in various ways. In terms of waste generation, the amount of disposable diapers is expected to increase, because they are widely used for caring and supporting elderly peoples' daily life. Material recycling of diapers is partially introduced in Japan (e.g. Fujiyama et al., 2012).

In terms of 3R behavior, the UK study of Pickerin and Shaw (2015) showed that older generations demonstrate greater pro-environmental waste management (3R) behavior than younger generations, partially due to the attitudes and subjective norms held by the elderly. The tendency of elderly having higher intention to separate is also seen in Japan; however, Shinoki (2017) presented that separation behavior increased until the age around 60 and decreased after that, possibly due to decreased behavioral control. This is in line with the result of Suzuki et al. (2019) showing that Major neurocognitive disorder has negative impact on waste separation. Some Japanese municipal governments have introduced waste separation exemption policy for elderly people who feel segregation is too difficult.

In terms of waste management, there are at least two age-related challenges observed in Japan; difficulty in taking out the trash (Kojima and Tajima, 2019) and maintenance of waste collection points (Suzuki et al., 2019). The core issue related to taking out the trash by the elderly is that increasing numbers of elderly people find it difficult to take out the trash but are unable to receive the support they need. The inability to take out the trash by elderly people can lead to three different consequences: a) storing the trash in the house, b) taking out the trash improperly, and c) continuing to take out the trash even though it is too difficult. In Japan, as of 2015, 23% of local governments offered programs supporting collection of ordinary waste, recyclable materials, and bulky waste. Maintenance of waste collection point is a task undertaken by community-based organizations in Japan, and aging is considered to have negative impact on these activities since these organizations are commonly steered by elderly people.

POPULATION DECREASE AND INTEGRATION OF WASTE TREATMENT FACILITIES (Inaba)

The Japanese population is predicted to decrease as mentioned, especially in rural areas. The financial state of local municipalities and renewal of municipal solid waste (MSW) management facilities would become more difficult in the near future. Reduction of waste treatment cost and improvement of the operation rates are expected. An option is to integrate waste management facilities. Possibility and effect by integration of incinerators, recycling facilities and other treatment facilities between neighboring municipalities were therefore examined.

Regarding the possibility, the statistical data on flows and facilities of MSW in each municipality and all prefecture's plans on large-scale waste treatment were collected. Then, the operation rates of each facility and the required capacity of waste incinerators based on the estimated population decrease were calculated. Finally, large-scale blocs where the closure of more than one incinerator would occur by 2030 were identified because integrating facilities requires years of planning and strategic thinking. Figure 1 presents an example of the results of identified large-scale blocs.

Regarding the effect of integration, three scenarios of integrating incinerators in a region were created. The scenarios are that the focused incinerators in a municipality are integrated with one of three adjacent municipalities. Environmental and economic effectiveness of the scenarios as well as non-integration scenarios was then evaluated, considering population changes. Estimated the CO_2 emissions and costs of each scenario were compared. All the three integration scenarios showed 2-4% of cost reduction as shown in Figure 2. The total CO_2 emission in the whole survey area decreased. The result confirmed effectiveness of the integration of incinerators.

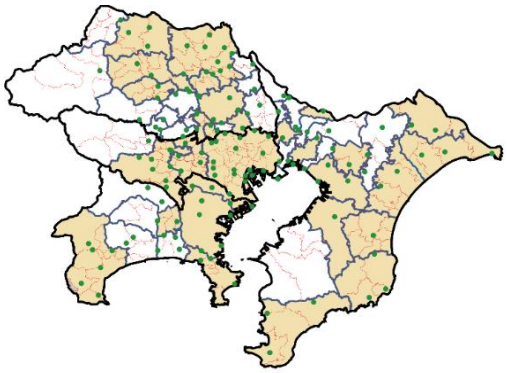

Figure 1 Large-scale blocs where incinerators can be integrated by 2030 (shaded areas) in the southern Kanto region in Japan

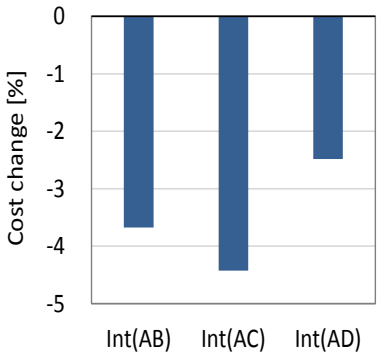

Figure 2 Total cost changes by integrating nearby incinerators in a certain region in Japan

The integrated treatment of MSW and sewage sludge was evaluated as another type of facility integration. Both integrated and individualized scenarios for treatment facilities of actual cases were assumed, and their greenhouse gas (GHG) emissions and their costs as the environmental and economic effects of process integration were compared. As a result, GHG and cost at the construction process were reduced by the integrated treatmnet. In addition, the energy efficiency and GHG reduction of the entire scenario was improved.

RAPID POPULATION GROWTH AND WASTE MANAGEMENT IN DEVELOPING COUNTRIES (Kawai)

Unlike developed countries with depopulation, developing countries are experiencing rapid population growth; the population in both urban and rural areas is increasing in developing countries. Urban areas are confronted with more rapid population growth due to the migration from rural areas for seeking opportunities for jobs and educations. An increase in population leads to an increase in waste generation, and the upward trend in waste generation in line with population growth will be estimated to continue for decades especially in urban areas.

Waste generated in developing countries is commonly transported to landfill or dumping sites without any treatment beforehand. Municipalities of developing countries rapidly growing in the population are struggling to secure enough capacity for waste disposal and looking for alternative waste management technologies to reduce the volume of waste to be disposed of. Incineration and recycling are effective technologies that can contribute to the reduction of waste disposal and solve the lack of landfill sites caused

by population growth and massive waste generation.

If municipalities can afford, incineration should be the most powerful technology to reduce waste volume drastically. Everyone must be aware that it is necessary to control flue gas and ash produced from the incineration process. Otherwise, the pollutants such as heavy metals and dioxins are released to the environment. If municipalities cannot afford, recycling can eventually reduce the volume of waste to be disposed of. Composting is such a recycling option treating organic waste such as food waste and producing compost which contributes to improving the soil condition of farmlands. Successful composting depends on collaborative source separation by citizens and enough demand for compost. Material recovery facility (MRF) can treat and separate the residual waste into several types of products, for example, combustibles, ferrous, non-ferrous, and inert materials. MRF, based on the good source separation of waste, can reduce the waste to be disposed of as much as possible.

Major cities in developing countries are facing emerging waste generation caused by rapid population growth. However, most of the cities have serious difficulties in cope with the issue due to lack of knowledge, personnel, experiences, legal systems, etc. There remains much room for technically supports for the developing countries by international cooperation agencies and developed countries to establish sustainable waste management systems in developing countries.

REFERENCES

Fujiyama, A., Sakurai, T., Matsumoto, T., Cho, T., Lifecycle inventory analysis on material recycling system of disposable diapers, Journal of Life Cycle Assessment, Japan, 8 (1), 37-44, 2012.

He, W., Goodkind, D., Kowal, P., An Aging World: 2015. U.S. Census Bureau, International Population Reports, P95/16-1, 2016.

IPSS (National Institute of Population and Social Security Research), Regional Population Projections for Japan, 2013.

Kojima, E., Tajima, R., "Let's Take Out the Trash!": A Guidebook for Local Governments and CBOs to Support Elderly People, National Institute for Environmental Studies, 2019.

Ohizumi, K., Aging Asia (Oite-iku Asia). Chuko-Sinsho 1914. Chuokoron-Shinsha, Inc., 2007. [In Japanese].

Pickerin, P. L. and Shaw, P.J., Age and ageing as factors influencing waste management behavior, Proceedings Sardinia 2015, 2015.

Shinoki, M. A study of factors affecting recycling and waste reduction: a time-series analysis from Sendai, Japan 2005-2015.

Suzuki, K., Tajima, R., Tasaki, T., The relationship between aging and maintenance of waste collection points-based on a questionnaire survey in Tsukuba city-, Proceedings of The 30th Annual Conference of Japan Society of Material Cycles and Waste Management, 103-104, 2019. [in Japanese]

Tasaki, T., Inaba, R., Kawai, K., Kojima, E.., Tajima, R., Suzuki K., Kubota R., Waste Management in the Era of Population Decrease and Aging. Sardinia 2019, 17th International waste management and landfill symposium proceedings, 2019.

United Nations, World Population Prospects: The 2017 Revision, 2017.