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Community-Based Recycling Society as a Social Innovation in Urban Household Waste Management

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Abstract
This study aims to analyze and explain the process of social innovation in urban household waste management. Social innovation is forming social relations based on the assumption that success will be enjoyed equally in society through the further dissemination of new ideas. Social innovation through program replication is believed to be an effective way to overcome social problems in other different communities. Replication of programs that are considered successful and then reproduced, not only shows that the program can be applied elsewhere. Social innovation as a replication process was carried out by the Depok City government in household waste management by taking the innovation process of the Osaki System as the originator. The qualitative method was used in this research with a descriptive approach. Data collection was conducted through a literature review, in-depth interviews with stakeholders, and the collection of government documents. Data analysis is carried out through a source triangulation process, as well as to gain validity in the research results. The results show that social innovation in the recycling community in Depok City has begun to form, although it has not been effective enough to reduce the volume of waste disposed to landfill. For this reason, consistency in policy and implementation is needed. This consistency is needed to maintain the sustainability of the initial momentum of the growth of the community-based recycling society in Depok City.

Keywords
Social innovation, Recycling Society, Urban waste, Community-based

INTRODUCTION

In recent decades, social innovation has received a lot of attention. International organizations such as the United Nations (UN) and the Organization for Economic Co-operation and Development (OECD) have highlighted the importance of social innovations and recommended the development of strategies to enhance them, as well as academics, who seek to define the object of study and develop theoretical disciplines that can explain the development of the phenomenon (OECD, 2021). There is also philanthropy, which calls for the improvement of the lives of groups of people, including their scaling, around the world (Westley et al., 2014). Moreover, in recent years, concerning the achievement of the 2030 SDGs, UNDP believes that social innovation has an important role to play in integrating what has been done effectively at the local level as sustainable solutions in the global economy.

Social innovation refers to the development and application of new ideas in addressing common needs. According to Nicholls et al., social innovation in practice, can be in the form of specific new ideas; certain actions; the creation of frameworks, models, systems, processes, services, arrangements; and others. Social innovation is a process of

forming social relations based on the assumption that success will be enjoyed equally in society, even the global community through further dissemination of these new ideas (Westley et al., 2014).

There are various definitions of social innovation, including social innovation as "*the development and implementation of new ideas (products, services, and models) to meet social needs*" (Nicholls et al., 2015). Another opinion states that social innovation "*refers to the generation and implementation of new ideas about how people should organize interpersonal activities, or social interactions, to meet one or more common goals*" (Nicholls et al., 2015). Similarly, Torfing states social innovation is the development and implementation of new ideas that emerge as a result of network-based collaboration between public and private stakeholders who together possess the necessary motivation, ideas, skills, and resources to craft new public solutions that seem to outperform previous practices or to meet hitherto unfulfilled demands (Torfing, 2016). However, these definitions emphasize the creation of products, processes, programs, projects, specific actions, ideas, and their diffusion.

The emphasis can be on new social processes, including the development of network-based collaboration, or on new social outputs and/or outcomes, including increasing efficiency and improving service quality. More technically, social innovation arises when a particular individual or organization identifies a specific social need and responds creatively with a new solution. This response grows in response to a crisis caused by social market failure in the provision of a needed public good or routine activities that cannot solve the problem.

Social entrepreneurs believe that social programs can provide greater benefits, both for beneficiaries in the program location and in other locations. Therefore, program replication is believed to be an effective way to address social problems in different communities. Replication of programs that are deemed successful and then reproduced, not only shows that the program can be applied elsewhere but will also provide better results (Summerville and Becca, 2009). If successful, replication of social programs has the potential to drive progress, not only for individual beneficiaries, but also for specific community groups, entire cities, and even nationally.

Program replication is a challenge for both originators or "exporters" and adopters or "importers". For originators, replication is an attempt to articulate, communicate new knowledge, or explain why the innovation works. For the adopter, replication is an attempt to understand the success of the innovation by studying the key enabling factors, and how they can be applied and adapted to a new context. In this case, replication is a conscious effort made by adopters (or individuals in organizations) who seek to improve their performance by actively seeking successful ideas, policies programs, and best practices that they can adopt (Robert, 2009).

Any scaling up/replication in a new setting must take into account the uniqueness of the new setting, including the different complexity of the problem, and therefore, requires its adaptation strategy. Haxeltine et.al. reminds us that Replication is not about copying and pasting exact replicates of the original model but rather a process of adapting the most relevant business components to the adopter's local context (Haxeltine, 2016). In this case, replication is more of a process of adapting to the adopter's local contexts (local adaptation). Therefore, successful replication requires seriousness from both parties, namely the originator and the adopter. Replication is more than just providing success information to others, it is a sharing of experience and exchange of knowledge, and therefore, the right people and approaches are needed to achieve effective, more doable, and high-impact replication.

In terms of addressing urban household waste, Osaki City Japan has successfully developed a waste recycling management system using non-incineration waste disposal, which has become known as the "Osaki System". This innovation has successfully increased the recycling rate to 83 percent in 2017 (Shizume, 2020), and increased the sustainability of using landfill sites for the next 50 years. Not only does the system provide economic benefits to citizens and the city government, such as in the form of sales of recycled products, the compost it produces, and the jobs it creates, but socially, it has also succeeded in increasing the participation of various social groups, especially the role of women and children. Due to this success, the Japanese Ministry of Environment designated Osaki City as the city with the highest recycling rate in Japan for 12 consecutive years since 2006. This success was then replicated in Depok City, West Java through facilitation and support from JICA.

The replication of the Osaki System in Depok City can be seen from two different interests. For Osaki City as the originator, this cooperation is more of an international promotion of their success in developing an efficient waste management system, which ultimately contributes to the achievement of the city's SDGs. UNDP as an international organization that encourages the implementation and achievement of SDGs at the lowest level of government, namely the city, highly appreciates this success. This promotion is also part of the Japanese government's efforts, through JICA, to assist its partner countries, in this case Indonesia, in the form of development cooperation. The cooperation is carried out through the "project for the promotion of sustainable community-based recycling society of Depok City, Indonesia". For the Depok City Government as an adopter, this replication is seen as an opportunity to learn strategies to achieve Osaki City's success in addressing the municipal waste problem by "adopting" it.

Behn argues that social innovations that prove successful can be adopted elsewhere (Behn, 2009). He stated that four terms can describe the adoption process from the most passive, namely diffuse, transfer, and propagation, to replication as the most active adoption process. Behn further explained that diffusion is an involuntary and spontaneous adoption process where the adopter only knows about a social innovation and tries to try it, while transfer is a form of exchange of ideas between two parties in two different settings, while in propagation the adoption or transfer is more planned. The use of the word replication emphasizes more on the conscious efforts made by adopters (individuals or organizations) who actively seek new ideas and best practices to adopt.

Community-based recycling society refers to a system where recycling activities are driven and managed by local communities in a specific region. The main objective of community-based recycling societies is to increase community knowledge and involvement in waste management activities in their area. Through activities such as educating residents about waste and recycling categories, communities can actively contribute to waste reduction efforts (Utami, Indrasti, & Dharmawan, 2008). In addition, these activities also increase economic opportunities and the local economy by creating value-added products from recycled materials. Therefore, community-based recycling societies play an important role in promoting environmental conservation, economic empowerment, and sustainable development at the local level (Syafruddin, Suprianto, & Pamungkas, 2020).

Specifically, several studies have been conducted on the potential and positive development of community-based recycling societies through the existence of waste banks and organic waste processing (Chaerul, & Aliyyu, 2020; Hidayat, & Wardhana, 2023; Sofia, 2017). Even research by Syafitri et al., concluded the positive impact of waste sorting on health, namely that children from families who do not sort non-organic waste are at 1.65 greater risk of diarrhea disease compared to children from families who do sorting (Syafitri et al., 2014). However, the positive development of waste banks has been able to encourage the growth of a community-based recycling society in Depok City.

This paper aims to find out how far the recycling society has been formed as a result of the replication of the Osaki System and how it will continue after the end of the cooperation between Osaki City and Depok City in 2015. Therefore, this research is more of an independent ex-post evaluation because it was conducted long after the old replication cooperation ended and was conducted independently, in the sense that it was not related to the interests of the parties involved in the cooperation.

MATERIALS AND METHODS

This research uses qualitative methods which can generally be used for research on community life, history, behavior, social activities, and others (Creswell, 2016). Researchers in this case not only examine the behavior of the researcher but also dive into the daily life of the researcher to find out how his behavior is in the process of building a community-based recycling society through a social innovation process.

In this study, the researcher used a snowball sampling technique that gave the researcher flexibility in tracing informants following the research objectives, the most important thing here is not the number of informants, but the potential of each informant to provide a better understanding of the experience in the community-based recycling society through the social innovation process.

Data were collected through a series of in-depth interviews, field notes, photographs, videotapes, personal documents, notes or memos, and official government documents. The data analysis is carried out by organizing data, breaking it down into units, synthesizing, compiling it into patterns, choosing which ones are important and which ones will be studied, and making conclusions.

In determining the validity of the data, researchers conducted source triangulation. to test the credibility of the data is done by checking the data to the same source with different techniques. For example, data obtained from interviews is then checked by observation and documentation. If the three techniques of testing the credibility of the data, produce different data, then the researcher conducts further discussions with the data source concerned or others, ensuring which data is considered correct, or maybe everything is correct, because the points of view are different.

RESULTS

This section describes the cooperation between Osaki City as the originator and Depok City as the adopter in replicating the Osaki System through the "project for the promotion of sustainable community-based recycling society of Depok City, Indonesia" from 2012-2015. The explanation in this section is intended to understand the differences in the characteristics of the two cities, both in terms of population, size of the area, waste management policies, and other important matters that support the achievement of the goal of creating a recycling society. As will be explained in more detail in the sub-sections below, Osaki is a small city with a population smaller than the average population of a neighborhood in Depok, whereas Depok is a large city with a population almost 200 times that of Osaki. However, in terms of area, Depok is only twice as large as Osaki, indicating that the population density in Depok is much higher than in Osaki. These and other factors will affect the level of complexity in solving the waste problem, including efforts to start a recycling society, as experienced by Osaki and other cities in the world that started recycling activities.

Understanding ‘Osaki System’ as the Originator

Osaki is a small town in Kagoshima Prefecture, southern Japan, with an area of 100.67 km2 and a population of 13,488 people (6,704 households). "Surprisingly", the city successfully developed a waste recycling management system using a non-incineration waste disposal system, which became known as the Osaki System. In 1998, Osaki City's recycling rate was only 0.8 percent, whereas in the same year, Japan's national average recycling rate reached 12.1 percent. However, in less than twenty years, in 2016 the recycling rate increased to 83 percent, far exceeding Japan's national recycling rate of 20.4 percent on average (Tamamura, 2019; Shizume, 2020), and with only 17 percent residual waste the city has managed to increase the sustainability of using landfills sites for the next 50 years.

Not only does the system provide economic benefits to citizens and the city government, such as in the form of sales of recycled products, the compost it produces, and the jobs it creates, but socially, it has also succeeded in increasing

the participation of various social groups, especially the role of women and children. Due to this success, the Japanese Ministry of the Environment designated Osaki City as the city with the highest recycling rate in Japan for 12 consecutive years since 2006. In addition, Osaki City exported its innovation success through the replication of the Osaki System in Depok City, West Java Province.

Until 2001, Osaki City was still fully utilizing landfill sites as municipal waste disposal sites. However, in 1998 when they realized that the landfill site would soon be full in the next few years, they began to make breakthroughs to overcome the waste problem. The result of this breakthrough became known as the Osaki System.

The system works in a participatory manner by involving the cooperation of citizens, city government, and recycling companies. City residents play a role in sorting household waste consisting of organic, non-organic, and residual waste. For non-organic waste, at first, they only separated bottles and cans in separate containers, but by 2013 they had managed to sort non-organic waste into 27 types. For organic waste, after drying, kitchen waste (food scraps, leftover vegetables, leftover dishes, fish, meat, fruit, sweets, shellfish, and other foods, etc.) is placed in buckets at collection points spread across 210 locations throughout Osaki City. Besides kitchen waste, they also collect other household waste such as leaves and tree branches, both of which are needed for composting. It is the recycling company's role to transport, process the waste, compost the organic waste, and further process the non-organic waste. In addition, they also collect used cooking oil which is used to make diesel oil to fuel the garbage trucks.

Meanwhile, the Osaki City Government plays a role in organizing various facilitation activities for its citizens to sort waste through socialization with the motto "recycling turns waste into a source of profit". Initially, socialization was conducted for each household through 153 local self-associations (Neighborhood level in Depok) 450 times for 4 consecutive months in the city center and gradually to the whole city. Socialization activities continue to be carried out 50 times a year until waste sorting activities become a new habit of the Osaki people. This recycling activity refers to the Act on promotion of separate collection and recycling of containers and packaging (Container recycling law) which requires local governments, through their citizens, to sort waste. This law has been gradually enforced since 1998.

There are several benefits of the Osaki System for citizens and the Osaki City Government. Economically, the system has provided benefits in the form of 1) sales of recycled products; 2) compost production; 3) employment opportunities for 40 people. Socially, the system has increased the participation of citizens in waste sorting activities, especially women, children the elderly, and local community groups. In the long run, the system has also succeeded in building environmental awareness from an early age where recycling has become a habit at home and has been incorporated into the primary and secondary school curriculum. These benefits ultimately contribute to the revenue of the Osaki City Government, through taxes collected, which are redistributed to the citizens of Osaki City in the form of social programs such as scholarships and provision of other educational facilities, such as rapeseed oil which has been used as an ingredient in school meals since 2003.

The further impact of the Osaki System is the increased achievement of SDG targets number 1, 2, 3, 4, 5, 8, 12, and 17, especially from activities involving young people and women. In 2017, it received an award from the Japanese Central Government and appreciation from UNDP. The Osaki System that uses recycling is more profitable than incineration. Osaki City's experience concludes that with recycling the cost of incineration is only 62 percent of the average cost of waste treatment in Japan which reaches 162 USD. Recycling is also the right choice for future generations.

Building on this success, shortly, the Osaki City Government plans to increase the recycling rate to 90 percent, reduce the volume of waste generated by residents, aim to reduce the use of single-use plastics and eliminate their use by 2030, accelerate circular economic activities, promote SDGs, develop renewable energy, and build a new social system (Shizume, 2020).

Lessons learned from Osaki City's experience in building a recycling society include: firstly, convincing and familiarizing citizens with waste segregation is hard work and time-consuming. It takes 20 years to build a recycling society in a small town whose population is smaller than the average population in one urban village in Depok City. Osaki City, with its low population and density, and the solid cohesiveness of small-town residents, enables a recycling society to be established more quickly. This is supported by the Osaki Government's consistent problem-solving and welfare-oriented policies, enabling efforts towards a "recycling society" with little environmental impact and integrated with multiple issues to be achieved. Secondly, although politicians are usually not interested in recycling, Osaki City has the following boosters to survive for 20 years: a) welfare-oriented policies, such as using the proceeds from the sale of recycled products for scholarships, are very helpful to citizens; b) continuous socialization by community group leaders (conducted 50 times a year); c) the Act on promotion of separate collection and recycling of containers and packaging (Container recycling law) strengthens the implementation of recycling at the local level.

Third, city residents, the private sector, and the government work together to segregate existing waste and try to reduce the amount of new waste generated by households and recycle it. In 1998 the amount of household waste generated reached 17,043 tons/year, dropped to 4,070 tons/year in 2004, and continued to drop to 3,135 tons/year in 2018. Thus household waste production decreased by 72 percent in twenty years. Fourth, the planning of the Osaki System began in April of Reiwa and will be revised every three years. Thus, achievements will be continuously evaluated and maintained for sustainability. Finally, the Osaki System can achieve its goals and maintain its sustainability through the consistency of its policies, and Yasuhiro Higashi, is the mayor who has consistently maintained it since 2001, and has now been elected for the fifth time.

Characteristics of Depok City as the Adopter

As a buffer to the capital city of Jakarta, Depok City is experiencing rapid population growth. At the time of its establishment in 1999, Depok City had less than one million inhabitants (828,870 people). This figure more than doubled in 2012 to 1,898,567 people and continued to increase to 2,406,826 people (522,613 households) in 2019 (Depok City in Figures 2020). With a fixed area of 200 km2, the population density increased rapidly from 9,479/km2 in 2012 to 12,017 people/km2 in 2019, and in some sub-districts the population density reached 18,000 people/km2. In addition to natural occurrences, this population growth is due to migration factors, including the presence of several universities in Depok City, and as a place of residence for those who work in the surrounding area. Therefore, the level of social and cultural diversity in Depok City is very high.

Table 1 Population Density by Subdistrict in Depok City, 2019

Subdistrict Name	Total Population (thousand)	Population Density (population/km2)
Sawangan	171,07	6.605
Bojongsari	138,07	6.977
Pancoran Mas	291,43	16.004
Cipayung	177,08	15.226
Sukmajaya	321,60	17.827
Cilodong	173,07	10.756
Cimanggis	334,99	15.786
Tapos	299,32	9.258
Beji	229,67	16.061
Limo	121,76	9.883
Cinere	148,77	14.222
Kota Depok	**2.406,83**	**12.017**

***Source*:** Depok City Regional Statistics, 2020

A high population and density will inevitably be followed by a high volume of waste generated, and the high volume of waste will also be followed by the need for waste storage and processing locations. As faced by major cities in Indonesia, Depok City with an area of only 200 km2 faces the limitations of these locations, and even the need for processing locations has urged the needs of the residents themselves. The situation can get worse if the residents do not realize that the waste problem can be a source of other major problems such as pollution, health, city beauty, etc., which are getting bigger and bigger.

As an illustration of the increase in waste volume, in 2012 waste production reached 900 tons per day (www.metro/sindonews.com 24/12/12), and eight years later reached 1,250 tons per day. The same thing happened at the sub-district level, where the population density increased and the volume of waste produced followed. The following are some of the largest waste-producing sub-districts in Depok City that correlate with the population based on 2019 data, including Sukmajaya Sub-district with a population of 321,600 people produces 146.92 tons of waste, Pancoran Mas Sub-district 291,430 people produce 137.46 tons, Cimanggis Sub-district 334,990 people produce 136.86 tons, Tapos Sub-district 299,320 people produce 141.33 tons (see table 1 for details)

In addition to the population and its density that affect the volume of waste generated, other factors include the development of people's income and consumption patterns. There is a tendency that up to a certain level, an increase in income will lead to an increase in the need for more compact packaged food products, compared to traditional food products that still use organic packaging. This pattern is predicted to result in a shift in the type of waste generated from the dominant organic type to the dominant non-organic type, and even greater residual waste. Data from 2019 shows that Depok City's per capita public consumption of 2,027. 984 IDR, 40.84 percent (828,172 IDR) is food expenditure and 59.16 percent (1,199,812 IDR) is non-food expenditure. Of the total food expenditure, 362,208 IDR (17.86 percent) was in the form of processed food. This means that the potential for non-organic waste production is quite large considering that most processed food is packaged in the form of plastic or paper.

Another factor that is expected to have a positive impact on recycling is the level of education. This is related to the formation of awareness of better waste disposal "habits". Based on the highest diploma held, Figure 1 shows that 59.3 percent of Depok residents have a high school education and above. If the assumption that education level contributes positively to the habit of "waste disposal" is true, then Depok City has the potential to become a city with better waste management.

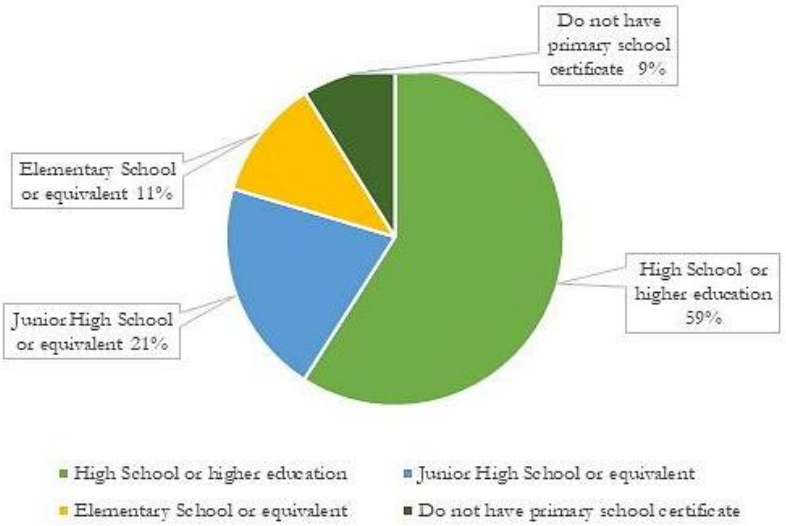

Fig. 1 Percentage of Population Aged 15 Years and Over by Highest Educational Degree in Depok City, 2019
***Source*:** National Statistics Bureau, 2019

Another interesting point is the increasing trend of the Human Development Index of Depok City, which tends to increase from year to year and has now reached a high Human Development Index of <80. The increase in the impact of "success" or the high HDI achievement has the potential to build better management awareness.

Table 2 Human Development Index of Depok City, 2019-2020

Components	2019	2020
1. Life Expectancy (year)	74,17	74,31
2. Expected Years of Schooling (year)	13,90	13,91
3. Average Years of Schooling (year)	10,85	11,00
4. Average Adjusted Per Capita Expenditure (thousand IDR)	15.262	15.696
Human Development Index	**80,29**	**80,82**

***Source*:** Depok City Regional Statistics, 2020

It is also important to know the factors that will influence the "waste disposal habits" of Depok City residents, both positive and negative, dominant or non-dominant. In addition to population density, it is necessary to know whether the income level, consumption patterns, average education level of the population, and the ever-increasing HDI achievements contribute to the amount and type of waste in Depok City. From there we can develop a comprehensive waste management policy, including how to build a recycling society.

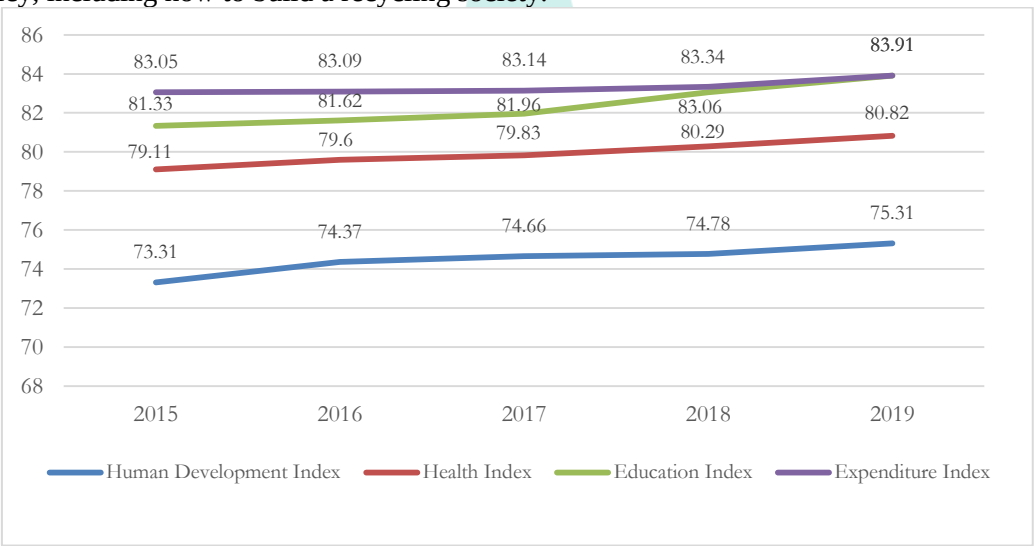

Fig. 2 Development of Depok City Human Development Index 2015 -2019 (by component)
***Source*:** Depok City Regional Statistics, 2020

Processes of Social Innovation

To be able to explain how the replication of the Osaki System was carried out, we studied the waste problem faced by Depok City at the time and the activities organized during the cooperation period of 2012-2015 and their results. The activities started precisely in August 2012 through the "Depok Sorting Out Movement" (*Gerakan Depok Memilah*).

As was the case in Osaki, the Cipayung landfill was no longer able to accommodate the 900 tons/day of waste generated by Depok residents in 2012. This is because all types of waste, including organic, non-organic, and residual, are dumped

into the Cipayung landfill. Therefore, it is necessary to separate organic and non-organic waste, so that only residual waste is disposed of at Cipayung Landfill, which is estimated to reach 10 percent of the total waste generation per day. Thus, the life of the Cipayung landfill can be extended as in Osaki. For this reason, a waste bank that can sort non-organic waste and a Waste Processing Unit that can process organic waste is needed.

From the results of the problem identification and the activities carried out, we analyze that these activities contribute, either directly or indirectly, to the replication objective of establishing a community-based recycling society as intended by the project "project for the promotion of sustainable community-based recycling society of Depok City, Indonesia". This can be seen from the number of active waste bank units that will affect the amount of non-organic waste collected and the resulting recycling rate, the number of Waste Processing Units that can process organic waste into compost, and how much residual waste is reduced. Based on the experience of Osaki City and the views of Depok City stakeholders, we define success in this replication as if the percentage of recycling rate is higher or equal to the residual waste.

Achieving a recycling society, characterized by an increased recycling rate, requires activities that produce the five outcomes described below. Meanwhile, the impact of making Depok City a zero-waste city in 2020 was not explicitly stated by stakeholders, although some stakeholders expressed this hope. The Depok City Government in the 'Depok City Government Performance Accountability Report 2019' (Local Government of Depok City, 2020) officially stated the achievement of "Depok as a zero waste city" in a different sense.

Transfer of Knowledge

Transfer of knowledge plays an important role in the replication of the Osaki System. In this case, Osaki as the originator facilitates activities that enable the transfer of knowledge to Depok as the adopter regarding the Osaki System and its supporting technical activities. Some activities related to knowledge transfer include: 1). Conducted a comparative study to Osaki Town to participate in the "Training program to the JICA partnership in a project for strengthening of non-incineration type waste disposal technology and transfer in Indonesia at Osaki Town Japan" on 14 - 19 October 2012. The comparative study was conducted by 25 people in five departures, with participants consisting of Depok City government officials and community leaders who initiated waste banks; 2). Visit of the Mayor of Osaki to Depok as the originator to see the development of the replication of the Osaki System; 3) assistance of the technical team from Osaki City; 4) facilitation of activities by JICA.

To find out whether a transfer of knowledge occurred, we conducted interviews with Osaki alumni who are still actively involved in handling waste problems today and other parties who participated in the training and composting. The result is that the understanding of Osaki-style composting is understood and still implemented today even though it does not produce compost optimally. Similarly, the waste bank is still running now although its contribution is still difficult to move up.

Socialization

As in Osaki City, the role of citizens in the implementation of the Osaki System is very important. Therefore, socialization is conducted by the Osaki City Government, either directly by the government, volunteers, or through community groups, to build awareness about sorting. We identified that the Depok City Government has conducted various intensive socialization activities on the establishment of waste banks and waste segregation, whether conducted by Depok City Environment and Hygiene Agency, sub-districts, wards, neighborhood associations, master waste banks, and even schools; as well as through the annual waste bank competition which is still working properly.

In improving early childhood education, until 2020 the Depok City Government has conducted socialization to students in 134 schools. Among these, six schools have received the National Adiwiyata Award: The Anyelir I State Elementary School; Pondok Cina The I State Elementary School; The 8 State Junior High School; The 2 State Junior High School; The Lazuardi Islamic Junior High School; The 2 State Senior High School; The 4 State Senior High School. In encouraging environmental awareness in the school environment, the Depok City Environment and Hygiene Agency encourages the Environmental Care and Culture Movement in Schools (*Peduli dan Berbudaya Lingkungan Hidup di Sekolah*), to realize learning and environmental awareness for teachers, students, and other workers (Interview, 1/12/2020).

To get information on how the socialization on waste segregation was conducted, we interviewed the waste bank administrators and members who participated in the socialization, there was indeed an explanation and hands-on practice of segregation, and some skills were given. However, the awareness of the importance of waste segregation is still low and not evenly distributed to all groups in all areas. The lack of sorting awareness is also shown by the decreasing number of waste banks, the number of existing ones compared to the ones that should be formed, or inactivity and dissolution.

The establishment of Waste Banks and Waste Processing Units

As in Osaki City, the formation or activation of existing community groups is an important factor in the socialization and practice of waste segregation. Similarly, in the practice of waste sorting and processing in Depok City, during the cooperation period, the following activities were carried out: 1) activation and establishment of new waste banks and their sorting procedures; and 2) activation and establishment of Waste Processing Units and various other supporting facilities such as buckets, transportation equipment, and others.

Although some waste banks were already established before the replication, most of the waste banks in Depok City were established during the replication. In 2013 the number of waste banks had reached more than 50 units and peaked in 2015 at 483 units, then dropped to 428 units by the end of 2017, and in 2020 dropped again to 317 units with two parent waste banks (Depok City Environment and Hygiene Agency 2020).

Activities carried out by waste bank members are sorting waste into three categories: organic, inorganic, and residual waste. Organic waste is collected by households using lidded bucket containers which are then collected by officers to be processed by the Waste Processing Unit. This organic waste collection activity is known as the bucket program or "bucket party movement" which began in 2014. Inorganic waste is sorted into several categories such as paper, plastic, metal, and glass to be deposited at the local unit waste bank which is then sent to the Parent Waste Bank or collectors. However, the sorting results from households are then regrouped by the waste bank according to the demand from the processing industry based on the following categories: 1) plastic (aloy, bottle, bucket); 2) paper (cardboard, duplex, newspaper); 3) metal (tin, metal, cabin); 4) glass and shard bottle.

In terms of the flow of inorganic waste collection from the waste bank to the main waste bank, can be explained as follows. The waste bank unit manager collects inorganic waste from its members on a predetermined day and records it. Information about the amount and type of inorganic waste that has been collected by the waste bank is submitted by the waste bank unit manager to the village coordinator. After recording the information from all the waste banks the sub-district coordinator further conveys the information to the district coordinator. After the sub-district coordinator receives the information from all sub-district coordinators in the sub-district, the sub-district coordinator will convey the information regarding the amount and type of inorganic waste for the entire sub-district with details of the names and addresses of the waste banks to the management of the waste bank unit to be picked up at each waste bank address. And so on until the parent waste bank sends it to the inorganic waste processing industry (Interview, 3/12/2020).

The reverse flow for payment to the waste bank. After the waste bank receives the inorganic waste, the payment is passed on to the sub-district coordinator to be further passed on to the village coordinator and finally to the waste bank and its members. Waste bank members can receive the results per month or year on certain days such as Eid al-Fitr for example.

Regarding waste processing units, 18 waste processing units were established before 2011, and 19 units were built in 2011. In 2013 Waste Processing Units, Depok City activated 13 Waste Processing Units and in 2015, there were 18 Waste Processing Units that actively managed compost based on the Osaki System. For organic waste, the flow of collection and processing is as follows. In households close to the Waste Management Unit location, a closed bucket is provided to be filled with kitchen waste and other categories of organic waste that will be picked up by the Waste Management Unit officer on a predetermined day, for example once or twice per week. The Waste Management Unit officer will process it into compost using the Osaki method. After processing for approximately 4.5 months, the compost is ready to be used and given away for free to residents who contribute organic waste or to the city government. The budget for making this compost is still fully covered by the city government (Interview, 1/12/2020).

DISCUSSION

Social innovation is new approaches, strategies, and solutions, that address social challenges and contribute to positive social change (Ibrahim, 2022). The concept involves the development and implementation of new ideas, products, services, and models that improve the well-being and quality of life of individuals and communities. Social innovation can take many forms, including successful new ideas that achieve social goals. It often arises from collaboration between various stakeholders such as non-governmental organizations, government agencies, community groups, and private companies, leading to holistic and sustainable solutions to complex social problems.

Social innovation is essential because it helps create new and better ways to solve problems that affect society. then involves different groups of people working together to find common ground and solve social problems effectively. By focusing on social innovation, organizations can change and improve to meet the evolving needs of society, ensuring long-term benefits for society (Moridu, 2023). Social innovation promotes learning and growth, showing how important it is to continuously get better at addressing social problems. It can assist in creating value for society as a whole, not just for individuals, by addressing broader social issues. Social innovation is versatile and can occur at different levels and in different sectors, making it a flexible approach to driving positive change (Ibrahim, 2022).

In many cases, social innovation involves three sectors of society: civil society, public, and private. These three sectors each have different ideas, skills, and resources that can be exchanged through a process of mutual learning and collaboration in creating innovative solutions. Therefore, multi-actor collaboration becomes the main tool in creating innovative solutions that can solve problems together. In this case, social innovation requires the participation of the wider community because they have certain identities, competencies, knowledge, and interests as referred to by former British Prime Minister David Cameron as the "*hidden wealth of society*" (Torfing, 2016). Meanwhile, the private sector needs to be involved to make social innovation more efficient and competitive. This is possible because they have competencies, access to technology, and assets that can facilitate innovation activities. Similarly, the government or public sector has a key role in supporting and enabling social innovation to address complex social problems with its various facilities. The involvement of these three sectors is very important because social innovation involves complex system changes related to social relations, institutions, and people's behavior, from the beginning of social innovation, the development period to the scaling stage.

Social innovation in communities is carried out in various ways (Sukmana, 2023) firstly, community collaboration and participation includes collaboration between the government, business sector, and civil society as well as community participation in every stage of development to develop effective social innovations. Members within communities often possess valuable local knowledge that can help customize innovations to fit the specific context of their region. Active community participation fosters a sense of ownership and responsibility, leading to increased motivation and dedication to the success of social innovation projects. Community involvement promotes inclusiveness and democratizes decision-making, giving a voice to those directly affected by the innovation.

Secondly, the use of innovative and renewable technologies. Technological innovation can contribute to social innovation by improving people's lives through new inventions and technological advances. Social innovation focuses on finding new ways to address social problems and improve society, while technological innovation involves creating new technologies or improving existing ones. By integrating technology into social innovation initiatives, organizations and communities can empower individuals, improve access to resources, and encourage collaboration. Ultimately, the relationship between technological innovation and social innovation is about using technological advances to create positive social impact and address social challenges (Indiarma, 2023). Third, environmental management. Environmental management plays an important role in driving social innovation as it focuses on sustainable practices that benefit society and the environment. By integrating environmentally friendly policies and practices, organizations can drive social innovation by addressing pressing environmental issues and creating positive social impacts simultaneously. Effective environmental management strategies can lead to the development of innovative solutions that not only protect the environment but also improve people's quality of life. Social innovation, driven by environmentally conscious practices, can result in the emergence of new technologies, business models, and social initiatives that promote sustainability and meet the needs of society (Ardhiyansyah et al., 2023).

Economic changes resulting from social innovation can also serve as indicators of its success, such as the diversification of livelihoods and the formation of unique political economy typologies within a community. Success can be measured by the effective implementation of policy innovations aimed at promoting social cohesion and sustainable development within communities. Overall, improvements in the living standards and welfare of community members can be a significant indicator of the success of social innovation efforts (Hartati, Rahman, & Ibrahim, 2023). One important measure of success is the establishment of new institutional relationships or collaborations within the community as a result of social innovation. Another important indicator is increased community capacity, which refers to the ability of communities to overcome challenges and take advantage of opportunities in their environment. Improving community well-being is an important measure of social innovation success. This includes improving the overall well-being and livelihoods of community members as a result of innovation initiatives. Long-term effects and sustainability are important factors when assessing the success of social innovations.

The ability of the innovation to have a lasting impact and benefit the community over time is a key aspect to consider. The contribution of various forms of capital also serves as a measure of success (Sihombing & Hutagalung, 2023). This capital also includes natural, cultural, social, physical, and political capital. Overall, the success of social innovation in a community can be measured by its ability to drive positive change, improve community well-being, establish sustainable practices, and utilize various forms of capital to improve the overall quality of life in the community.

Social innovation helps create positive change to solve social problems and improve the conditions of society. Implementing social innovation can achieve sustainable community development. Social innovation initiatives promote economic improvement by improving livelihoods and increasing income opportunities for the communities involved. Environmental benefits are also a key aspect of social innovation by promoting environmental sustainability. The collaborative nature of social innovation programs, fosters a sense of community engagement and empowerment, leading to long-term sustainable outcomes (Firdaus, 2024). In general, social innovation contributes to achieving sustainable development goals by addressing social, economic, and environmental aspects simultaneously, ensuring a holistic approach to positive change in society.

Social innovation that focuses on sustainable practices will help in creating long-term solutions that consider both environmental and human well-being (Khayubi, 2023). By engaging communities, social innovation fosters a sense of ownership and responsibility among individuals. This active engagement contributes to the sustainability of the project as people are more likely to continue supporting the initiatives they have helped create. Implementing sustainable practices through social innovation promotes environmental conservation and reduces negative impacts on nature. Social innovation often leads to the development of innovative and efficient solutions to complex social and environmental challenges. By continuously improving processes and finding creative ways to tackle problems, sustainability is enhanced over time. Collaboration and cooperation among various stakeholders are critical to the success and longevity of sustainability initiatives.

Figure 3 suggests an understanding of how social innovation encompasses a broader set of actions than the individual actions of different actors. In the last concept, social innovation includes new products, processes, or organizational changes, even when the goal is to meet social and environmental needs (OECD, 2021).

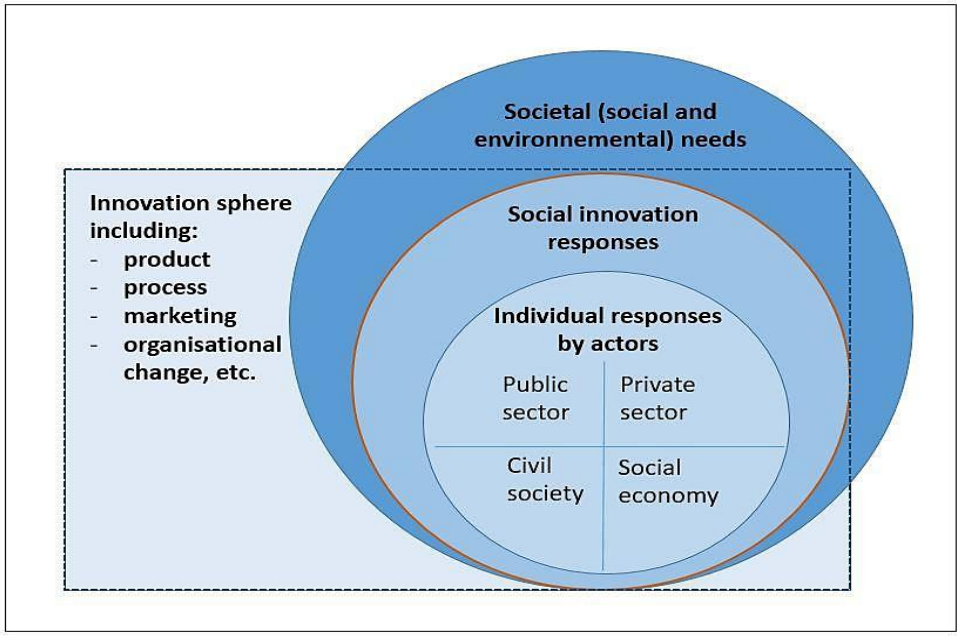

Fig. 3 Representation of Social Innovation
Source: OECD, 2021

When all actors work together towards a common goal, it strengthens the overall impact on society and operates sustainably. Social innovation involves integrating various actors into an interconnected system, where communities play an important role in contributing to the overall process. Community participation in social innovation is critical to the success and effectiveness of these programs, as they provide the human capital, knowledge, and resources needed to drive positive change in society and the environment (Ashari, Puspaningtyas & Firaldy, 2021). Social innovation encourages a shift in mindset towards more sustainable practices by raising public awareness and promoting environmentally friendly behaviors. Community involvement in social innovation programs displays collective efforts toward sustainable development and environmental conservation.

The importance of community engagement in driving positive change and social innovation is critical to building a sustainable future. At a time when the entire society prioritizes well-being, social innovation not only addresses direct environmental issues but also affects improving social welfare, economic stability, and the overall quality of life of the community, as well as sustainability (Prasetyo, 2022). This holistic approach ensures that the benefits of sustainability go beyond the environmental aspects and create positive outcomes in different areas of people's lives.

CONCLUSION

In general, the Osaki System and Depok System are social innovations in environmental issues that are quite successful in addressing the waste problem, although the Depok system is still not effective enough to reduce waste disposal to landfills. Nevertheless, these innovations have proven to be beneficial to citizens and the city government, have been recognized by many parties, and have been awarded again. The Osaki System and Depok System were built in a participatory manner by involving three pillars (multi-actors): all citizens, including foreigners, recycling companies, and the city government. The systems integrate environmental conservation with socio-economic development and are even linked to the creation of a new urban identity. The system has been quite successful in promoting environmental preservation, while also providing social and economic benefits.

Furthermore, the system has provided benefits to the residents and the city government socially and economically, such as in the form of sales of recycled products, organic food produced from self-made compost, and jobs created. Socially, the system has also succeeded in creating a healthy environment for all residents; increasing the participation of the wider community, especially women and children; and becoming a medium for children to learn about environmental issues, both through school curriculum and home practice. These benefits ultimately contribute to the city government's revenue, through the levies collected, which are then redistributed to the citizens in the form of social programs such as the provision of other educational facilities, such as green vegetables used as food ingredients in schools. Furthermore, this system has transformed the city's identity into a clean and environmentally friendly city.

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CONFLICT OF INTERESTS

No conflict of interest.

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