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# Co-Production Analysis in Waste Management: A Local Perspective

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## ABSTRACT

This research aims to analyze co-production practices in waste management through the Waste Bank and Reuse, Reduce, and Recycle Waste Management Area (TPS 3R) in Semarang City on the grounds that Semarang City is the largest waste generate in Central Java Province. Qualitative descriptive was used as a method with data collection techniques using interviews with 11 informants, documentation and observation. Community-based waste management practices are analyzed using the concept of co-production. The findings of this research are that co-production in waste management is motivated by environmental problems, the lack of waste services and government encouragement. Resource sharing occurs between communities, government and Non Government Organizations (NGOs) although the quality of relationships needs to be improved. Waste banks and 3R TPS apart from providing services to residents, is also able to enter "spaces" that the government cannot reach through reducing waste, educating citizens and as a data collector for the government.

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## INTRODUCTION

Rapid population growth and urbanization, waste production is also increasing (Wowrzeczka, 2021). The increasing amount of waste is also caused by the discovery of new products, technology and also depends on people's income, culture and geography (Chandrappa & Bhusan Das, 2012). Not all cities are able to respond to these problems as well as cities in countries such as Pakistan, India and Negeria (Abubakar et al., 2022). Poor waste management is caused by a weak and less standardized management system (Massoud et al., 2021), poor policy implementation and low public awareness

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(Dethier, 2017). In addition, in cities in developing countries, open dumps such as landfills (TPA) and simple waste dumps are the most common processing methods for municipal solid waste considering the ability to invest and operate cheaply (Abubakar et al., 2022). This has resulted in several landfills in cities in developing countries, such as Semarang, experiencing excess capacity (Pradana et al., 2020). Finally, poorly managed waste has a huge impact on health, the environment and the economy (Hoornweg & Bhada-Tata, 2012).

The city of Semarang, as one of the largest cities in Indonesia, is experiencing the same problem, namely related to waste management. Semarang City's waste generation reached 431,534.65 tons/year or 16.9% of the total waste generation in Central Java Province, namely 2,552,624.16 tons/year. Based on the source of waste, households are the largest contributors of waste, namely 44.62%, followed by markets 26.36%, areas 10.83% and the rest from offices, commerce, public facilities and others (SIPSN, 2023b). Meanwhile, the waste entering the landfill weighs 310,762.52 tons/year (72% of the total generation) and only 1.9% is processed. If left untreated, the landfill capacity will quickly run out due to overload. At this point, a waste reduction program aimed at the source is an important option because it will extend the operational period of the landfill and reduce the level of environmental pollution and risk of danger (Hayashi et al., 2022). Considering that households are the largest contributors of waste, community involvement in waste management is important. The community is not only a producer of waste but is encouraged to manage waste in the household and environmental scope. This is in line with the concept of co-production, where the community becomes the main actor in producing public services through the resources it has amidst limited government resources. Community-based waste management has become a practice in Indonesia, such as through Waste Banks and 3R TPS. These two entities carry out waste management activities at the household and community level which are run by the community.

There have been many studies that have discussed Waste Banks, including looking at the business model aspect (Dhewanto et al., 2018), Waste Banks as social engineering (Muljaningsih et al., 2022) and as social innovation (Barsei et al., 2023). From a management perspective, aspects of motivation and commitment to manager performance have also been discussed (Meutia, 2017; Winda et al., 2022). Previous research has also examined the weaknesses or obstacles in waste bank management, including low responsibility and negligence of managers (Satibi et al., 2021) management that is still conventional (Khair et al., 2019), lack of infrastructure and also difficulty marketing production results (Ahmad, 2022;Setiadi et al., 2020). Regarding the (Setiadi et al., 2020). Regarding the contribution of the Waste Bank, it has also been discussed regarding its influence on environmental awareness (Khair, 2019; Sekito et al., 2020; Wulandari et al., 2017), contribution to residents income (Gunartin et al., 2020; Sekito et al., 2018; Setiawati et al., 2023) and its impact on reducing waste in landfills (Jamaludin et al., 2023) have also been discussed. The last one is about the application of co-production in Waste Banks (Irkham et al., 2019), but it only goes to describing the principles, not to the extent of factor analysis and the co-production process being carried out. In a broader scope, the concept of co-production has been used as an analytical tool in various public services, including child care and services. (Campomori & Casula, 2021; Sicilia et al., 2016), clean water management (Mangai & De

Vries, 2018) education and health services (Nemec et al., 2019), climate and environmental services (Baztan et al., 2020; A. L. Putra et al., 2022; Sarr et al., 2021), sanitation (Pillai & Narayanan, 2022) and city park management (Raap et al., 2022).

Based on existing studies, no one in this research has positioned waste management as a public service, where the community is the party served and also the party involved in providing public services. Although nn the context of public services, it is quite complicated to determine whether waste is a public, private or semi-both product and service (Cavé, 2014). This means that waste management cannot be carried out only by the government. There are other actors outside the government who have an interest in waste that has economic value or as a commodity. In addition, waste management is a long activity to achieve waste that is safe for the environment and human health (Tchobanoglous & Kreith, 2002). He further explained that in solid waste management there are at least several elements that need to be considered, namely; 1). How waste is generated. 2). Handling and separation of waste, storage and processing at the source. 3). Collection. 4). Relocation and transportation. 5). Separation, processing and transformation of solid waste. 6). Disposal (Tchobanoglous & Kreith, 2002).

The involvement of the community as actors outside the government in waste management is becoming increasingly interesting to study. The mixing activity of regular producers (government) and consumers (society) in the production of services is conceptually known as co-production (Parks et al., 1981). Co-production refers to voluntary efforts by individual citizens in which citizens produce their own services at least part of the production or implementation process (Brandsen & Pestoff, 2006). Conceptually, co-production is rooted in theories of public management and service management, co-production does not challenge the basic premises of theories about public service delivery, because it can only occur at the behest of, and be controlled by, the government (Brandsen & Pestoff, 2006). In co-production, the government is referred to as a "regular producer" based on professionalism while the community is a "citizen production" based on volunteerism (Pestoff, 2012) and community involvement in these activities can be as individuals, groups and collectives (Bovaird et al., 2015; Nabatchi et al., 2017).

One of the key concepts of public governance is co-production, actors in public services are no longer the government and the private sector independently, but also involve citizens. Waste Bank and TPS 3R as entities in waste management that are formed and managed by the community can be an appropriate illustration for this. Government resources have so far been used more for waste transportation (Pradana et al., 2020), but has not been able to effectively reduce waste through waste processing at the household level. This condition causes the amount of waste generated to continue to increase. Thus, cooperation and cohesion between government and society play an important role in the success of waste management (Kalra, 2020). The assumption of the co-production approach is that the public services enjoyed by citizens will be of better quality when citizens, especially those gathered in citizen-owned organizations, participate in the public service process (F. Putra, 2012). As well as at a simple level, the community can contribute in the form of time, energy, money or goods (Mangai & De Vries, 2018) n implementing a program or activity which ultimately provides group or collective benefits. The limitations that the government has in providing public services have an impact on the quality and effectiveness of the services themselves. Therefore,

there are several benefits from co-production, namely (1) overcoming social challenges, (2) designing and providing public services (3) democratic practices (4) encouraging consumer control, (5) encouraging affective attachment between actors, and (6) reducing the prevalence of selfishness (Khine et al., 2021). In addition, according to Bovaird, co-production implies a redistribution of power among the actors involved, and recalls issues related to accountability, democratic ethos, and citizens' trust in government (Sancino, 2016).

Based on previous reviews, this research aims to analyze co-production practices in waste management through the Waste Bank and 3R TPS in Semarang City. Considering the breadth of the co-production study area, namely; general context, antecedents, collaboration management, and outcomes (Cepiku et al., 2020). Furthermore, this research only emphasizes the antecedents area where the focus is on the background of citizen involvement, motivation for management involvement (Waste Bank and 3R TPS) and resource sharing between waste management actors. From a scientific aspect, this study is useful for enriching the study of Waste Banks and 3R TPS from a public service perspective through co-production. From a practical aspect, it can be an input for the government in community-based waste management which is not only seen from empowerment but the community becomes an important actor in public services through waste management, especially in the aspect of waste reduction.

## METHOD

Qualitative method with case study approach was used in this research, while data collection was conducted through observation, interviews, documentation and literature study. Non-participant observation was conducted by conducting direct observation of waste management activities in 5 Waste Banks and 3 TPS 3R selected. In-depth interviews were conducted with managers of 5 Waste Banks, managers of 3 TPS3R, 2 employees of the Environmental Service (DLH) and 2 assistants from the Bintari Foundation. The informants were determined using purposive sampling technique, taking into account; having knowledge of waste management, being directly involved in waste management and active management of Waste Banks and TPS 3R. Finally, documentation was conducted on documents that had been documented as well as documents in the form of field activity records of the two entities. Literature study was also conducted through journals both national and international.

The analysis technique in research goes through 5 stages, namely Compiling, Disassembling, Reassembling, Interpreting and Concluding (Yin, 2016), These stages are shown in Figure 1;

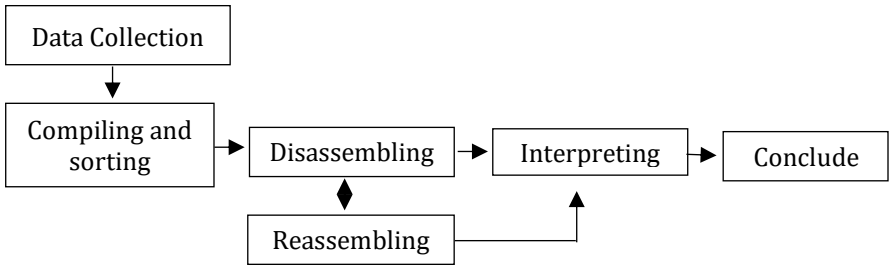


**Figure 1**. Data Analysis (Yin, 2016)

From Figure 1, the data analysis process begins with data collection through interviews, observations and documentation and continues with: first, compiling and

sorting the collected data. Second, organizing data from various sources from the field that are relevant to the topic and questions into a database. Third, sorting according to the theme and rearranging and recombining the data. Fourth, the data is rearranged according to the substantive theme and elaborated with the concept of co-production and relevant literature so that it becomes an analytical part of the article. Finally, concluding the data that has been interpreted. Semarang City was chosen as the research location considering that it has the largest waste generation in Central Java Province in the last five years.

## RESULTS AND DISCUSSION

### Co-Production Motivation

Motivation can be defined as an internal process that influences individuals to act or behave in achieving certain goals (Deci & Ryan, 2000). Motivation in this context is the community's motivation to be involved in managing the Waste Bank and 3R TPS. Based on research findings, the motivation for residents' involvement in the management of the Waste Bank is more intrinsic motivation, while TPS 3R is more extrinsic motivation as can be seen in table 1. For Waste Bank managers, involvement in Waste Bank management is more about the desire to improve environmental conditions amidst weak community behavior in processing household waste. However, the Tinjomoyo and Ngudi Lestari Waste Banks were formed from government encouragement through the City Without Slums (Kotaku) program in 2018. The Kotaku program is a program to accelerate the handling of slum settlements in Indonesia through the Ministry of Public Works and Public Housing. Even though the activities carried out are not comparable to the economic benefits obtained, they still have a commitment to be involved in managing the Waste Bank until now.

Based on research findings, TPS 3R managers are faced with the problem of operational costs used for waste transportation, sorting, and processing. The source of income only comes from residents' contributions, without any operational assistance from the Semarang City Government. Only TPS 3R Pedalangan managers receive incentives even though the value is still below the Semarang City UMK. Meanwhile, TPS 3R Dadi Resik and Ngesrep do not receive incentives like those received by TPS 3R Pedalangan managers. Incentives for managers are related to the number of customers served and the performance of TPS 3R, this is evident from the assessment of the functionality of TPS 3R Pedalangan which received a very good score in the Semarang city masterplane (The Regional Development Planning Agency (Bappeda) of Semarang City, 2022). Motivation for Involvement in Waste Bank and TPS 3R Management is shown in Table 1 below;

**Table 1**. Motivation for Involvement in Waste Bank and 3R TPS Management

| Entity | Background | Impact | Motivation |
|---|---|---|---|
| Resik Sejahtera Waste Bank | Disposing of rubbish in open areas | The appearance of mice and flies, Poor environmental aesthetics | Initiatives for environmental improvement (Intrinsic-prosocial) |
| Kemijen Waste Bank | Disposing of rubbish in open areas (ponds or mangroves) | Garbage enters residential areas during tidal floods | |

| | | | |
|---|---|---|---|
| Melati Waste Bank | Disposal of rubbish in open drains | Floods and smoke from burning rubbish | |
| Tinjomoyo Asri Waste Bank | Government encouragement | Establishment of a Waste Bank | |
| Ngudi Lestari Waste Bank | Government encouragement | Establishment of a Waste Bank | |
| TPS 3R Pedalangan | Temporary Disposal Site (TPS) is not available | Burning and illegal blooming | Ability to finance TPS 3R operations (extrinsic) |
| TPS 3R Dadi Resik Pedurungan | Temporary Disposal Site (TPS) is not available | Dumping rubbish in the river | |
| TPS 3R Ngesrep | the compost house program is not running | Abandoned facilities in the form of buildings and waste processing facilities | |

*Source:* Data Processed by Author, 2024

Based on the findings of this research, citizen involvement does not always come from the citizens' own initiative as a response to poor environmental conditions, but is also motivated by government encouragement. This is in line with previous research that in crisis conditions and requiring quick action co-production can be top-down (Miao et al., 2021; Weng & Zhang, 2020). Furthermore, citizen involvement in co-production includes at least several motivations, namely extrinsic motivation, intrinsic motivation and prosocial motivation (Deci & Ryan, 2000; Grant, M Adam, 2008; Ryan & Deci, 2000), normative motivation (Eijk & Steen, 2016). Waste Bank managers are more inclined towards intrinsic and pro-social motivation where there is a desire to improve the environment as a result of bad waste management behavior. The findings of this research are in line with previous research which states that people's involvement in co-production is not solely motivated by personal interests, but also by social values (Hattke & Kalucza, 2018; Pestoff, 2012) and pro-environmental behavior (Passafaro & Livi, 2017). For managers, the activities of the Waste Bank are more of a social activity, this can be seen from the commitment in managing the Waste Bank until now without receiving any monetary reward.

The findings related to the intrinsic motivation of managers are supported by previous research that Waste Banks only receive income from the difference between the purchase price of waste from customers and sales to collectors with a relatively small value because the economic value of waste is low (Sekito et al., 2018). Although the Waste Bank is beneficial for household income (Wulandari et al., 2017). However, the results of the latest research actually reveal that the Waste Bank has no effect on household income variables (Setiawati et al., 2023). These findings indicate that the turnover of money in the Waste Bank is relatively low, so it is unlikely that the manager's motivation is influenced by rewards. In the case of volunteers for refugees in the Netherlands, it shows almost the same thing, that financial factors do not affect the involvement of residents as volunteers (W. Voorberg et al., 2018).

Meanwhile, TPS 3R administrators initially had more normative motivation, where the normative motivation was a sense of responsibility to collaborate with the government in providing public services (Eijk & Steen, 2016; Lee & Na, 2023; Tyler, 2011). However, after the operation of TPS 3R, the complexity and intensity of operational activities require a lot of funding. The main source of TPS 3R's income

comes from payments from residents as customers. However, it is not easy to get customers because TPS 3R must compete with other transportation service providers that have existed before. While the results of waste processing such as compost do not have a promising market. From the results of observations, it shows that TPS 3R which is active until now is TPS 3R which meets its own operational needs. This is proven by the 16 TPS 3R managed by the community, only 3R Pedalangan is considered the best managed (Bappeda of Semarang City, 2022). Therefore, TPS 3R managers are more motivated in fulfilling operational needs which include incentives or extrinsic motivation to support the sustainability of TPS 3R even though what managers currently receive is not comparable to the activities carried out.

Co-production is understood as the active and voluntary contribution of both individuals and collectives from outside the government in various stages of public services (Khine et al., 2021). The availability of clean air and environment, waste transportation are public needs that must be fulfilled. However, it is relatively difficult to fulfill these public goods and services if poor waste management is caused by a lack of personal responsibility, awareness and inadequate waste collection services (Sewak et al., 2021; Wang et al., 2018) as well as the public's willingness to practice it Recycle, Reuse and Reduce (Sinthumule & Mkumbuzi, 2019; Yusof et al., 2019). Even though the two entities mentioned above have different motivations, the co-production carried out still has similarities, namely the value of self-efficacy (Bovaird et al., 2015) namely the obligation or role to create improvements in environmental quality through reducing household waste, both with routine operational activities and education to residents.

**Resource Sharing**

In the co-production, resources can be defined as anything that is provided or utilized by various actors, be they individuals, organizations, or communities, to jointly create or produce certain value or output (Osborne & Strokosch, 2013). The resources that actors have can be time, knowledge, skills, labor, facilities, assets and finances (Benjamin & Brudney, 2018; Khine et al., 2021; Mangai & De Vries, 2018). The actors in this case are the community, the government through DLH and third parties, namely Non-Governmental Organizations, in this case the Bintari Foundation. Sharing resources is one of the keys to co-production, the resources owned by integrated actors are then used to produce services thereby creating more optimal public services (Osborne et al., 2021). Based on research findings, the resources owned by their residents are in the form of time (2 to 3 hours/activity), energy/effort, skills in the form of sorting, weighing, recycling and processing waste as well as socialization and education skills and even money, food items that they consume together during the activity. The operational hours of the Ngudi Lestari Waste Bank are once every 2 weeks, namely the second and fourth weeks of every month, while the other Waste Banks are once every week and for TPS 3R managers every day except Sundays.

From the government, the resources it has are authority, budget and information. In 2023, DLH will provide assistance to the Waste Bank in the form of 64 scales, training for 475 Waste Bank administrators, 5 Waste Bank buildings, 5 units of 3-wheeled vehicles and assistance for TPS 3R in the form of 3 units of 3-wheeled vehicles. Meanwhile, from the BINTARI Foundation, through funding from USAID through the Clean City Blue Ocean (CCBO) program, the resources are in the form of facilities,

knowledge, skills and abilities in carrying out community development. Intensive assistance to the Waste Bank and TPS 3R in strengthening institutions, forming educational teams and providing trash bins and waste sorting bags, initiating organic waste processing through magot cultivation, as well as 1 unit of three-wheeled and four-wheeled vehicles each.

From the resource sharing that has been explained above, it has an impact on increasing the capacity of Waste Bank and TPS 3R managers increases in three aspects, namely knowledge, technical skills and administrative abilities. The three aspects of each entity can be seen in Table 2 below;

**Table 2.** Capacity of Waste Bank and 3R TPS Managers after resource sharing

| Aspect | Waste Bank | TPS 3R |
|---|---|---|
| Knowledge | a. Environmental knowledge<br>b. Waste utilization<br>c. Waste sorting<br>d. Handling family waste | a. Knowledge about the environment<br>b. Waste utilization<br>c. Waste sorting<br>d. Handling family waste |
| Technical skills | a. Sorting<br>b. Weighing<br>c. Recycling<br>d. Used goods creation skills<br>e. Socialization and educational skills | a. Sorting<br>b. Recycling<br>c. Making compost and liquid fertilizer<br>d. Magot cultivation<br>e. Socialization-educational abilities |
| Administrative capabilities | a. Register book<br>b. Customer book<br>c. Cash book<br>d. Managed waste report to DLH | a. Management administration (book keeping, waste balance),<br>b. Finance statement<br>c. Managed waste report to DLH |

*Source:* Data Processed by Author, 2024

Table 2 above shows that increasing capacity in both entities is impossible if carried out by the government alone, without other actors. Other research has stated that the lack of government capacity in public services is caused by, among other things, limited resources (Nemec et al., 2019), finances and infrastructure (Viljoen et al., 2021), inconsistent policies and implementation (A. L. Putra et al., 2022), the ability to socialize programs, mobilize and influence citizen behavior (Prastya, 2022). With limited government capacity, the government is faced with increasing complexity of social problems, inequality, climate change, so the involvement of various actors becomes important (Sørensen & Torfing, 2011). In public settings, co-production is seen as a strategy or means to solve existing problems in new and more effective ways by leveraging civil society resources (Osborne et al., 2016; W. H. Voorberg et al., 2015). this is in line with the New Public Governance paradigm, where services are often provided in horizontal networks, the government is not the main actor but the perspectives and experiences of citizen-users can be involved in the service delivery process together with public agents who regularly produce services (Radnor et al., 2014).

Community resources are not sufficient to carry out the two main roles, namely operations and education, because previous research results reveal that the Waste Bank is faced with management and organizational performance problems (Meutia, 2017) and low awareness, responsibility, behavior and attitudes of residents (Ahmad, 2022; Irkham et al., 2019; Pandebesie et al., 2019; Rahayu et al., 2018). On the other hand, government has a central role that includes mobilization, support and coordination (Nederhand & Meerkerk, 2018). However, it is less effective in achieving the desired

outcome, but only reaching the output in the form of the number of activities and assistance. Other research reveals that public institutions in co-production practices are often hampered by a lack of commitment (McLennan, 2020), competence (Pillai & Narayanan, 2022), weak institutions (Habermehl & Perry, 2021), low budget support (Nemec et al., 2019). Maintaining the sustainability of these two entities is not only related to technical operations, but market issues for the products they produce such as compost, liquid fertilizer and handicrafts and this has not been facilitated properly.

The existence of the Bintari Foundation, both in terms of physical assistance and strengthening the capacity of Waste Bank and TPS 3R managers, provides additional resources. With more intense and quality assistance, the activities carried out are more outcome oriented than output as is done by DLH. However, the Bintari Foundation has limited time because it is project-based and is unable to reach all 3R Waste Banks and TPS in Semarang City, which currently reach 574 units in 2023. DLH and the Bintari Foundation provide resources although with different amounts and intensity, this is because different approaches and values of public institutions and NGOs (Nemec et al., 2019). If the government is more on a normative-administrative approach, the Bintari Foundation is more outcome-oriented through more intensive assistance. Finally,through resource sharing, co-production can produce empowerment at the community, group and individual levels (Jo & Nabatchi, 2018).

**Production of Services in Waste Management**

Based on the findings, waste management by the Waste Bank and TPS 3R consists of waste processing, educating residents and reporting waste data. Waste processing at the Waste Bank is still limited to facilitating residents in sorting and collecting waste through a buying and selling system. The Waste Bank activities are carried out 2 and 4 times every month, with an operational duration of 3 to 2 hours. Meanwhile, TPS 3R activities are carried out every day (except Sundays), starting from collecting, sorting, processing organic waste to leaving residual waste which is then taken to the landfill by DLH. Based on SIPSN data in 2023, the contribution of the Waste Bank studied reduced waste by 19.5 tons/year. TPS 3R Pedalangan is capable of processing up to 338.08 tonnes/year of waste with a residue of 79.95 tonnes/year and TPS 3R Dadi Resik processes 827.12 tonnes/year of waste with a residue of 7.49 tonnes/year. For TPS 3R Ngesrep there is no waste processing data yet because it has just carried out institutional reorganization and strengthening. Waste Bank and TPS 3R activities can be seen in table 3 below;

**Table 3**. Waste Bank and TPS 3R Activities

| Entity | Operational Time | Activity | Business model | rewards |
|---|---|---|---|---|
| Waste Bank | • 2 to 4 times/month with a duration of 2-3 hours/activity.<br>• Education once/month | Weighing, recording, bookkeeping and providing education on waste processing on a regular basis. | Purchase and sale of inorganic waste | Very low (social values are more dominant) |
| TPS 3R | 5 – 8 hours/day except Sunday | Collection, sorting, processing of organic and inorganic waste and education on waste sorting (tentative). | Provider of inorganic and organic waste processing services | Incentives below the city minimum wage |

*Source:* Data Processed by Author, 2024

Research findings also show that the educational function is more dominantly played by the Waste Bank than the 3R TPS. The Waste Bank carries out citizen education regarding household waste management, waste utilization and clean lifestyles by utilizing community forums, such as monthly RT, RW and PKK meetings. Researchers consider that this activity is an instrument used to encourage changes in residents' behavior in managing household waste. Finally, in addition to the activities described above, these two entities are required to report the amount of waste managed every month and then submit it to DLH either directly or through the coordinator of each sub-district.

Other findings reveal that the income of Waste Bank managers is obtained from profits from buying and selling waste in different forms between Waste Banks, such as gifts of sheets or management clothes with a nominal value of less than Rp. 100,000/manager. Meanwhile, the TPS 3R manager's income comes from waste transportation fees from customers. Only TPS 3R Pedalangan is able to provide incentives for management and operators and even then it is still far from the current UMK for Semarang City, which is IDR 3,243,969. Meanwhile, in other 3R TPS, only the waste collection operators get incentives, the administrators only get IDR 200,000 to IDR 300,000/month and don't even get anything at all.

Based on the findings explained above, the involvement of residents as managers in waste management through the Waste Bank and TPS 3R is more about co-production in producing services in the form of services, namely services in facilitating the buying and selling of waste and driving the residents' economy as well as educating residents for the Waste Bank. Meanwhile, TPS 3R focuses more on providing waste transportation and processing services. This is in line with previous research that co-production is used in producing public goods and services or in making public policies (Khine et al., 2021). Not only that, the Waste Bank and TPS 3R also provide education to residents, so that this co-production becomes a catalyst for cultural change in the context of community empowerment (Steiner et al., 2023) dan building sustainable local communities (Berntzen & Johannessen, 2016; Vanleene et al., 2018). The presence of the Waste Bank and TPS 3R which are run by the community and are in the middle of the community is an advantage compared to the government which has limited time, procedures and resources in conducting education. Co-production through these two entities is very relevant, because in waste management it cannot only depend on the efforts of the local government or the private sector (Liddo & Vinella, 2020). The contribution of these two entities to waste reduction in Semarang City is still low, where the Waste Bank is 1.1% and TPS 3R is 7.1% of the total waste generation (SIPSN, 2023a) and in line with previous findings which revealed the low contribution of Waste Banks in reducing waste entering the TPA (Jamaludin et al., 2023)..

With the reduction of waste carried out, especially by TPS 3R, it provides efficiency for DLH where the amount of residue that is then transported to TPA is reduced. This is in line with Verschuere that co-production provides benefits in the efficiency and effectiveness of public services (Verschuere et al., 2012). Finally, the Waste Bank and TPS 3R also contribute to collecting data on waste reduction through monthly reporting to DLH regarding the amount of waste managed. This is in line with the opinion that in co-production citizens can play the role of data collector (Berntzen & Johannessen, 2016) or crowdsensing (Castelnovo, 2016) that is, citizens can act as

sensors or suppliers of data or information for the government. The government, in this case DLH, has an interest in this data as a form of monitoring or evaluation of Regional Strategic Policy achievements regarding waste management. Co-production in management is shown in Figure 2;

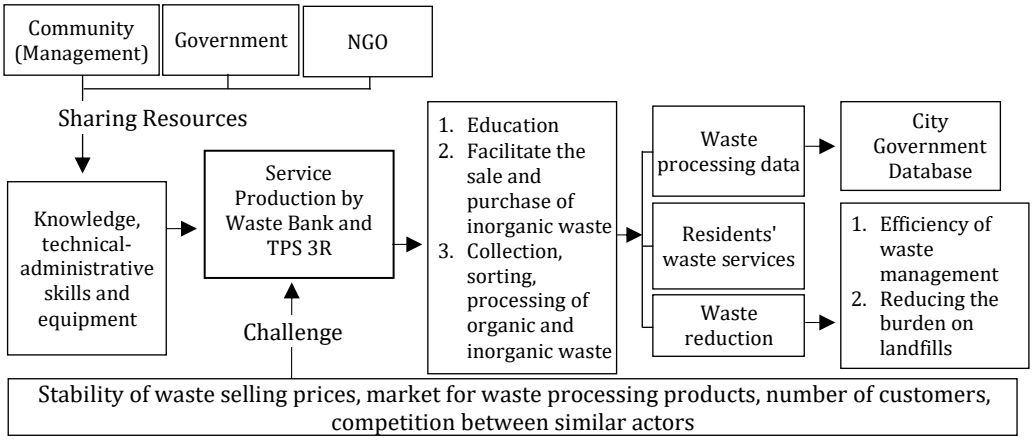


**Figure 2.** Co-Production in Waste Management (Data Processed by Author, 2024)

## CONCLUSION

Community-based management, which has been studied through the perspective of community empowerment and technical studies, can actually be studied through a public service approach through the concept of co-production. With this concept, society emerges as a new actor in producing public services for citizens when the government is unable to reach them in waste services. Through the Waste Bank and TPS 3R, it shows that the community has the resources and is able to play a role as more than just a recipient of services. Community participation can be carried out more deeply, namely replacing or strengthening the role of the government as the main actor in public services and co-production through the Waste Bank will not only benefit citizens but also the government. The penetration ability of the Waste Bank is much more effective than that of the government because its presence is in the midst of society so that it is able to encourage and influence increased awareness and responsibility of the community in waste management. Meanwhile, TPS 3R is able to play a role in reducing waste and waste transportation services at the household level, which so far the government has not been able to reach and public awareness in waste management has not yet been formed. It is felt that the resource sharing carried out so far has not been able to maintain the continuity of co-production in waste management, especially carried out by the government.

The implication of this research is the need to improve the quality of resources and quality relationships from the government to support the resources owned by citizens. The distribution of government resources must be measurable and based on outcomes rather than just normative-administrative and only on activity output. Because household waste management activities run all the time, the intensity of assistance needs to be increased and not hindered by time-limited work routines. The mentoring patterns carried out by the Bintari Foundation can be adopted by the government. Exploring the characteristics, motivation for citizen involvement and

variations in the overall activities of the Waste Bank and 3R TPS are the limitations of this research. The sustainability of citizens as co-producers with the motivational attribute of involvement can be considered for further study.

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