

Implementation of the Triple Helix Model in Increasing Economic Opportunities for Waste Management in Pangkalpinang City

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Abstract: This research reviews waste management problems in Pangkalpinang City, Indonesia, which is facing increasing waste volumes and suboptimal management. In an effort to overcome this problem, research uses a collaborative Triple Helix Model approach involving government, industry and universities. By combining the resources and competencies of these three parties, the research aims to develop a more effective and sustainable waste management model in Pangkalpinang. Through analysis of involvement and collaboration between government, industry and universities, this research explores the potential of the Triple Helix approach in overcoming waste management problems in the city. The research results show that the implementation of the Triple Helix Model has had a positive impact on waste management in Pangkalpinang City with various programs and initiatives that have been implemented. Recommendations for waste recycling programs are prioritized as an effective solution in maintaining environmental sustainability and creating new economic opportunities. However, there are still challenges such as lack of public awareness, limited resources, and technical obstacles that need to be overcome. By continuing effective collaboration between government, industry, academics and the community, it is hoped that waste management can continue to be improved and support sustainable development in Pangkalpinang City.

Keywords: Economic Opportunities, Waste Processing, Triple Helix

JEL: D2, H4, I5

1. INTRODUCTION

The waste problem is one of the problems faced by big cities in Indonesia, including Pangkalpinang. Based on data from the Pangkalpinang City Environmental Service, the amount of waste produced in this city reaches 250 tons per day. This number is predicted to continue to increase along with population growth and increased economic activity. Pangkalpinang is facing serious problems related to the increasing amount of waste and waste management in Pangkalpinang is still not optimal. This can be seen from the still high volume of unmanaged waste, which is around 70 percent (DLH, Pangkalpinang). This unmanaged waste is thrown into final disposal sites (TPA) uncontrollably, giving rise to various environmental problems, such as water, air and soil pollution. Population growth and industrial activity can be the main factors contributing to the increase in waste volume in this city. The Pangkalpinang City Government has made efforts to overcome the waste problem. However, the efforts made have not produced significant results. This is caused by various factors, including: (1) Lack of coordination and cooperation between stakeholders, such as government, industry and universities. (2) Lack of resources, both in terms of finance and labor. (3) Lack of public awareness of the importance of waste management. Therefore, efforts are needed that are more integrated and involve all stakeholders to overcome the waste problem in Pangkalpinang.

Industry, as a potential producer of waste in large quantities, can have a significant impact on waste management problems (Singh et al., 2014). However, industry involvement in waste

management initiatives may not yet reach its full potential. Universities have a strategic role in producing knowledge and innovation (Broström et al., 2021). However, the extent to which universities are involved in creating sustainable solutions for waste management in Pangkalpinang needs to be explored further. One approach that can be used is the triple helix approach, which is an approach that involves collaboration between government, industry and universities (Danson & Todeva, 2016).

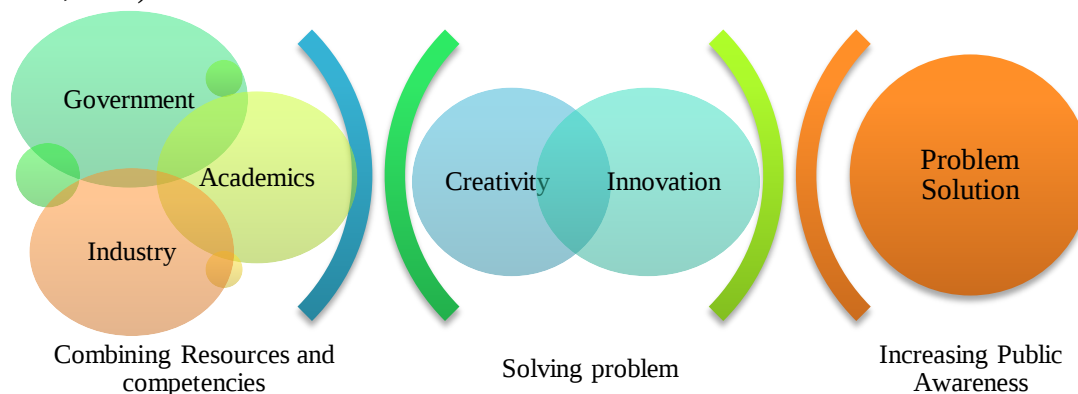


Figure 1. Triple Helix Model
Source: Processed From Various Sources, 2023

Figure 1 explains the Triple Helix Model. First, the triple helix approach can combine various resources and competencies from various parties (Gachie, 2020). Both triple helix approaches can encourage innovation and creativity in solving problems (Razak & White, 2015). Third, the triple helix approach can increase public awareness of the importance of the problem (Rodrigues & Melo, 2013). Based on this, this research aims to develop a waste management model in Pangkalpinang using a triple helix approach. This research will analyze the involvement of government, industry and universities in waste management in Pangkalpinang. By adopting the Triple Helix approach, this research will explore the potential for developing a waste management model that involves active collaboration between government, industry and universities. While the importance of collaboration in waste management has been recognized, there has been no research that systematically evaluates the level of collaboration between the government, waste processing industry and academics in Pangkalpinang City. Although there is evidence of the benefits of Triple Helix collaboration in other contexts, such as technological innovation, there has been no research that specifically measures the impact of Triple Helix collaboration on the effectiveness of waste management in Pangkalpinang City. Although there have been efforts to implement the Triple Helix Model in waste management in Pangkalpinang City, there has been no research that explores in detail the obstacles and constraints faced in the implementation process. The Triple Helix model emphasizes the roles of government, industry and academia, the role of society as an important stakeholder in waste management also needs to be considered (Anuardo et al., 2022). Therefore, this research will analyze how the government, industry and universities are involved in waste management in Pangkalpinang? And what is the waste management model in Pangkalpinang using the triple helix approach? By integrating the roles of government, industry and universities, it is hoped that this research can produce recommendations and implementation models that can have a positive impact on waste management and support sustainable development in Pangkalpinang. Through this research, it is hoped that a better understanding will be achieved on how to increase the effectiveness of waste management by involving all main stakeholders in a collaborative Triple Helix framework.

2. LITERATURE REVIEW

The Triple Helix approach, which involves collaboration between government, industry and academia, has proven effective in overcoming various problems, including waste management (Anttonen et al., 2018). Triple Helix provides a collaborative framework that allows combining resources and competencies from various parties to create sustainable solutions in waste management (Etzkowitz & Leydesdorff, 2000). The government has a crucial role in formulating policies, regulations and infrastructure needed for waste management (Chotimah et al., 2021). Research shows that the success of waste management programs often depends on the commitment and capacity of local governments to lead the effort (Spoann et al., 2018). The waste processing industry has an important role in processing and recycling waste into valuable products. Research shows that the waste processing industry can create jobs, reduce environmental pollution, and generate additional income through waste reuse (Li et al., 2020).

Academics have various roles in waste management, including research, education, training and outreach to the community. Collaboration between academics and other stakeholders can increase the efficiency and effectiveness of waste management programs in urban areas (Mogaji & Nguyen, 2022). Applying the principles of reduction, reuse and recycling (3R) in waste management can reduce the accumulation of waste and turn it into commodities that are beneficial for the environment (Le et al., 2018). This approach aims to provide understanding and abilities to the community in managing waste, thereby raising social awareness to change behavior in waste management (Younis & Mamdouh, 2021). Waste that is not managed properly can cause environmental pollution and impact public health, thus emphasizing the need for an integrated urban waste management system (Rodić & Wilson, 2017). Furthermore, research shows that waste management using the 3R approach is popular in Indonesia and effective in managing household waste (Fatimah et al., 2020). In addition, community-based waste management, such as the establishment of community waste banks, has proven to be an effective strategy in reducing and recycling waste (Kubota et al., 2020). Community involvement in waste management can create a cleaner, healthier and more sustainable environment (Purwendah & Wahyono, 2022). Apart from that, waste management can be done through the development of new technology, such as using waste as a renewable energy source (Nižetić et al., 2019). The use of spatial planning systems and community-based waste banks can also contribute to effective waste management at the city level (Purba et al., 2014). In addition, community participation in waste management can start from the source, encouraging active involvement in waste sorting and recycling (Xiao et al., 2017). Waste management using the triple helix approach involves the application of the 3R principles, community involvement, technological innovation, and spatial planning systems to achieve effective and sustainable waste management. This collaborative approach can result in a cleaner environment, reduce pollution, and improve public health.

3. METHOD

The research will use qualitative research methods with a case study approach to analyze the waste processing system in Pangkalpinang. This allows for a deep understanding of existing practices and the influence of interactions between actors in the system. This research involves direct observation of the waste processing process from collection to final disposition. This observation will help in understanding in detail the process and challenges faced. Then interviews were conducted with various related parties, such as local government, waste management companies, the community, and educational or research institutions. The interviews will provide insight into the perspectives and roles of each party in the waste processing system. Furthermore, document analysis was also carried out in this research. Collect and analyze related documents, such as government policies, company sustainability reports, and scientific publications related to waste management in the area. The data analysis technique in this research uses the Triple Helix analysis framework to understand the interaction between government (center), industry (left), and academics (right) in the context of waste management in Pangkalpinang. This will involve identifying collaborations, relationships, and dynamics between actors in the system. Then analyze the findings from a Triple Helix perspective and provide an in-depth understanding of the relationships between actors and the implications for waste management in Pangkalpinang.

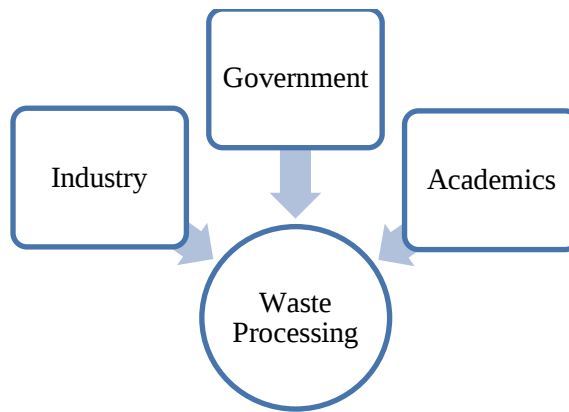


Figure 2. Triple Helix Model for Waste Processing
Source: Authors, 2023

The Triple Helix model of waste processing depicts collaborative interactions between three main entities: government, waste processing industry, and academia. The following is a further explanation of each element in the model image above:

1. The government has a central role in waste management. They are responsible for formulating policies, regulations and standards related to waste management. The government also provides the infrastructure and public services necessary for waste collection, processing and final disposal. In the context of the Triple Helix, the government acts as a liaison between industry and academia, and facilitates collaboration between them.
2. The waste processing industry is responsible for managing waste produced by the community and companies. They are involved in the process of collecting, sorting, processing and recycling waste. This industry plays a role in creating technology and innovation to increase the efficiency and effectiveness of waste management. In the context of the Triple Helix, the waste processing industry collaborates with the government and academia to develop sustainable solutions in waste management.
3. Academics, such as universities and research institutions, have a role in providing knowledge, research and trained human resources in waste management. They conduct research to develop new technologies and methodologies in waste management. Apart from that, academics also play a role in providing education and training to the community and industry regarding sustainable waste management practices. In the context of the Triple Helix, academics work together with government and industry to transfer knowledge and technology and facilitate innovation in waste management.

Figure 2 illustrates that collaboration between the government, waste processing industry and academics is needed to create a waste management system that is effective, sustainable and has a positive impact on the environment and society. With close cooperation between these three entities, it is hoped that a comprehensive solution can be realized in overcoming waste management challenges at the local level, as is the case in Pangkalpinang City.

4. RESULTS AND DISCUSSION

This study shows that the implementation of the Triple Helix Model has become an important foundation in efforts to improve waste management in Pangkalpinang City. Through collaboration between the government, waste processing industry and academia, various programs and initiatives have been implemented to overcome waste management challenges in this city. From the results of the analysis, it appears that the Pangkalpinang City government has been active in formulating policies and providing direction for waste management. They provide guidance, assistance and training to waste processors and manage funds for programs to improve waste management. The waste processing industry also plays an important role in implementing technology and processing waste into valuable products, while academia provides the necessary knowledge and innovation through research and education. The importance of recycling programs in waste management has also

been widely recognized. Recycling not only helps reduce environmental pollution and dependence on limited natural resources, but also creates new jobs and economic opportunities for communities. Through the adoption of the Triple Helix model, various stakeholders have succeeded in working together to increase the efficiency of waste management, reduce the volume of waste disposed of, and create a cleaner and healthier environment for the residents of Pangkalpinang City.

The limited resources possessed by each stakeholder, both academics, waste processors and the government, make it important to determine priorities for the sustainability of increasing waste processing in Pangkalpinang City. The Triple Helix aspect needs to be considered as a priority because it has an impact on the sustainability of increasing waste processing in Pangkalpinang City, so it is necessary to develop a Triple Helix strategy. The results of the study regarding waste processing regulations, the Tri Dharma of Higher Education and the desires of waste processing actors in Pangkalpinang City, revealed several aspects of the Triple Helix related to the sustainability of increasing waste processing, as in table 4 below:

Table 1. Triple Helix Strategy in Improving Waste Processing Pangkalpinang City

No.	Program	Stakeholders		
		Government	Academics	Waste Processor
1.	Waste processing guidance services	Providing Guidance to Waste Processors	Providing Guidance to Waste Processors	Implementing the results of guidance provided by the government and academics
2.	Accompaniment	Providing Assistance to Waste Processors	Providing Assistance to Waste Processors	Implementing the results of assistance provided by the government and academics
3.	Coaching/Training	Providing guidance/training to waste processors	Providing guidance/training to waste processors	Implementing the results of coaching/training provided by the government and academics
4.	Fund	Providing financial assistance to waste processors	-	Manage funds provided by the government for waste processing improvement programs
5.	Technology	Providing technological assistance to waste processors	-	Using technology provided by the government
6.	Information	Providing information assistance to waste processors	Providing information assistance to waste processors	Receive information and manage information

Source: Authors, 2023

Waste processing in urban areas involves collaboration between government, society, waste processing industry, and academia to achieve sustainable development goals in terms of waste management. Each stakeholder has a crucial role in this effort, which complements and supports each other. The government has the primary responsibility for formulating policies, regulations, and providing the infrastructure necessary for waste management in urban areas. The "Good Governance" theory emphasizes the importance of government in providing effective direction and coordination for

waste management. Research by Li et al. (2020) show that the success of urban waste management programs often depends on the commitment and capacity of local governments in leading such efforts. The community has an important role in waste management in urban areas, both as waste producers and as stakeholders who participate in recycling and other waste management programs. The "Community Participation" theory emphasizes that active community involvement can increase the effectiveness of waste management programs.

Research by Xiao et al. (2017) found that community participation in waste sorting at the household level can significantly reduce the volume of waste entering landfills. The waste processing industry has a vital role in processing and recycling waste into valuable products. The "Circular Economy" theory highlights the importance of changing the paradigm from linear processing to closed cycles, where waste is reprocessed into raw materials for new products. Research by Fatimah et al. (2020) shows that the waste processing industry can play an important role in creating jobs, reducing environmental pollution, and generating additional income through waste reuse. Academics have various roles in urban waste management, including research, education, training and outreach to the community. The "Knowledge Transfer" theory emphasizes the important role of academics in transferring the latest knowledge and technology in waste management to government, industry and society. Research by Singh et al. (2014) shows that collaboration between academics and other stakeholders can increase the efficiency and effectiveness of waste management programs in urban areas. Increasing waste processing is prioritized in the recycling program, because it has a significant impact in maintaining the sustainability of the environment and natural resources in Pangkalpinang City. Based on observations in Pangkalpinang City, there are several reasons why the waste recycling program is important:

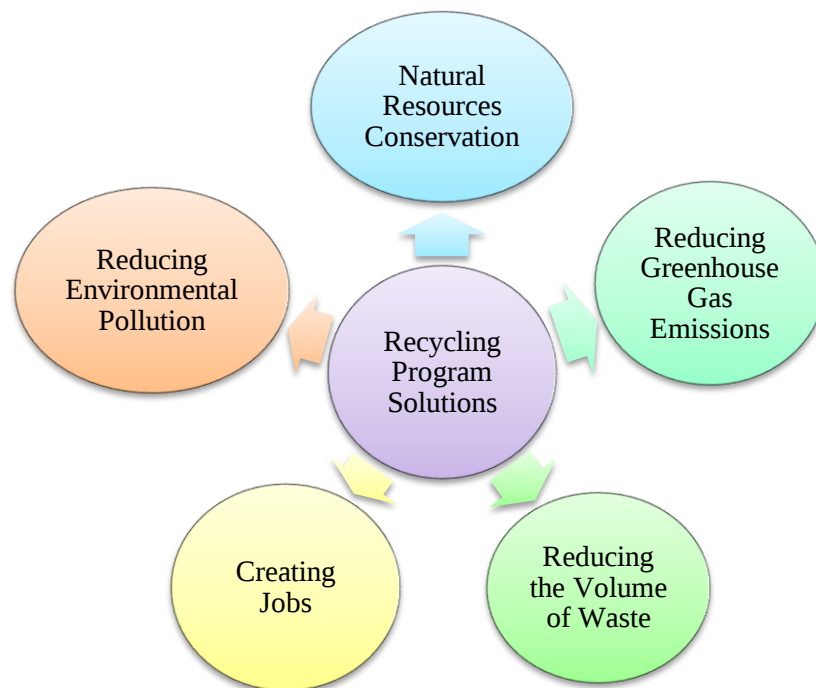


Figure 3. Recommendations for Waste Management Programs in Pangkalpinang City
Source: Authors, 2023

The recommendation for a waste processing program in Pangkalpinang City has several important reasons. The following are the reasons why waste recycling is important in Pangkalpinang City.

1. Conservation of Natural Resources: Recycling waste helps reduce the need for limited natural resources. By recycling waste, raw materials such as paper, plastic, metal and glass can be reused, reducing dependence on processing new raw materials. This helps preserve valuable natural resources.

2. **Reduce Environmental Pollution:** Waste that is not managed properly can pollute the environment. Solid waste that is thrown into landfills or thrown away carelessly can damage soil, groundwater and natural ecosystems. By recycling waste, the waste produced can be reduced and controlled properly, reducing negative impacts on the environment.
3. **Reduce Greenhouse Gas Emissions:** Processing and production of new raw materials often involves high energy use and produces greenhouse gas emissions. Recycling waste helps reduce the need for the production of new raw materials, thereby reducing greenhouse gas emissions that contribute to climate change.
4. **Reducing the Volume of Waste:** By recycling waste, the volume of waste thrown into landfills can be reduced. This helps reduce pressure on limited waste disposal areas and prevents excessive waste buildup.
5. **Job Creation and Economic Empowerment:** Waste recycling programs can create jobs and provide new economic opportunities. The recycling industry requires workers to collect, sort and process waste into recycled products. Apart from that, recycled products can also be a source of income for people involved in waste collection and processing.

By implementing a waste recycling program, you can contribute to maintaining environmental sustainability, reducing excessive use of natural resources, and creating a cleaner and healthier environment for future generations. However, the waste recycling program also faces several problems in Pangkalpinang City. Collaboration between government, industry and academics in the Triple Helix Model has proven its success in improving waste management in Pangkalpinang City. With effective coordination between these three entities, various programs and activities have been implemented well, including guidance, assistance, training and application of technology. The importance of recycling programs is also highlighted in this discussion. Recycling not only provides significant environmental benefits, but also contributes to local economic development and job creation. By changing the paradigm from linear processing to closed cycle, the waste processing industry in Pangkalpinang City has succeeded in turning waste into valuable resources. However, there are still several challenges that need to be overcome in implementing the Triple Helix Model. Lack of public awareness, limited resources, and technical barriers may be some of the factors that influence the effectiveness of waste management programs. Therefore, further efforts are needed to increase community participation, improve access to resources, and overcome existing technical barriers. Overall, the implementation of the Triple Helix Model has had a positive impact on waste management in Pangkalpinang City. By continuing effective collaboration between government, industry, academics and the community, it is hoped that we can continue to improve the efficiency and effectiveness of waste management and support sustainable development in Pangkalpinang City.

5. CONCLUSION AND SUGGESTION

Waste management in Pangkalpinang City, like many large cities in Indonesia, faces serious challenges that require holistic solutions. The ever-increasing volume of waste, lack of effective management, and adverse environmental impacts are some of the problems faced. This research highlights the importance of a collaborative approach between government, industry and universities, known as the Triple Helix Model, in addressing these issues. In the context of the Triple Helix Model, the government plays a role in formulating policies and providing direction, industry is responsible for waste processing and recycling, while universities provide knowledge and innovation. This research shows that the implementation of the Triple Helix Model has succeeded in increasing the efficiency of waste management in Pangkalpinang City. Collaboration between these three entities has resulted in various programs and initiatives, including guidance, mentoring, training and technology development. Then this research recommends strengthening the waste recycling program as a top priority. Waste recycling not only helps reduce environmental pollution and the need for limited natural resources, but also creates jobs and new economic opportunities. However, there are still several challenges that need to be overcome, such as lack of public awareness, limited resources, and technical obstacles. By continuing effective collaboration between government, industry, academics and the community, it is hoped that we can continue to improve the efficiency and effectiveness of waste management and support sustainable development in Pangkalpinang City. Further efforts are needed to increase community participation, increase access to resources, and overcome existing

technical barriers to achieve this goal.

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