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RESEARCH ARTICLE

The Contribution of Community Social Capital in Resolving the Environment: Case Study in Regional Landfill Area of Piyungan, Yogyakarta, Indonesia

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Abstract. Domestic waste has been a major problem faced by Indonesia since time immemorial. One of the significant ways to deal with this problem is to implement a system and build an integrated waste management facility. The regional landfill area of Piyungan, Yogyakarta, Indonesia, a waste disposal site covering Sleman and Bantul regencies, and Yogyakarta City still experiences complicated problems with this management process. At the landfill, waste management is reduced by the local community through social capital, namely "Mardiko." Therefore, this study aims to determine the role of social capital in managing the regional landfill area of Piyungan. This is a quantitative and qualitative research with data collected from 200 respondents comprising government officials, community leaders, groups, and community members using the purposive random sampling method. The results showed that the stronger the role of social capital in the community, the better the efforts to serve the environment and the lesser the amount of waste disposed of as residue in the Piyungan regional landfill area. In conclusion, the social capital conducted by the community plays a significant role in managing the environment and reduces waste by 20%.

1. Introduction

Humans and the environment are inseparable due to their capability to influence and benefit from each other (Whyte, 2020). Hence, humans must protect the environment to avoid disasters which is leads to adverse impacts. Irrespective of the importance of environmental balance, ironically, the relationship between both parties has not materialized in a system as humans greedily destroy the environment for their interests. The environmental damage is unavoidable and impacts humans (Broska, 2021).

According to preliminary studies, humans must be concerned for the surrounding environment, especially through cleanliness, to maintain nature conservation (MacGillivray, 2018; Das et al., 2019). However, as the population of Indonesia increases, the amount of waste produced also rises, thereby leading to difficulty in its management (Mahyudin, 2017). The five alternative criteria used to reduce environmental damage due to waste are by minimizing (1) water pollution, (2) air pollution and odors, (3) soil pollution, (4) habitat for disease germs, and (5) aesthetics/beauty of the environment. Of the five criteria, minimizing the habitat of disease germs is the most important factor in waste management in the community.

Environmental factors and community behavior are determinants of public health (Setyowati & Mulasari, 2013). These two factors determine the degree of public health, hence maximum attention related to how the community manages the cleanliness of their environment is needed. Healthy behavior factors of the community are expected to maintain and improve health, which invariably protects them from the threat of disease (Cockerham, 2 2021). Therefore, a healthy community environment with a well-managed waste management system is expected to create a conducive, pollution-free environment that is healthy for settlements.

Healthy waste management is still challenging due to the lack of public awareness to actively participate in the process (Yunik'ati et al., 2019). Sari (2016) stated that the existing environmental pollution is exacerbated by inadequate places and locations for waste disposal, lack of awareness, and willingness of the community to manage the disposal process. Therefore, the community's active role supported by appropriate waste management facilities is key to realizing a healthy environment.

The Piyungan regional final processing site currently exceeds the local landfill area of 12 hectares with a maximum capacity of 2,700,000 m^3. This capacity was exceeded by 3,857,990 m^3 until 2020 when the evaluation material for local and provincial governments was used to overcome this problem (Sudibyo,2017). Organic waste is another problem that the waste bank and management groups need to manage properly. However, efforts to make compost as a plant medium or economic commodity to reduce the amount

of organic waste have not been conducted by garbage banks and environmental communities in the Piyungan local landfill area. This has prevented the volume of waste disposed of from reducing, thereby increasing climate change continuously.

A 2018 report obtained from the Department of Public Works, Housing and Energy and Mineral Resources in Special Region of Yogyakarta showed that the capacity of temporary waste dump sites (TPS) reached 364.88 tons, 500.00 tons, and 600.00 tons in 2004, 2018, and 2020, respectively. Meanwhile, the volume of waste handled in 2004, 2018, and 2020 was 405.34, 549.74 and 1,366.79 tons/day, respectively. From the data, it can be concluded that every year the volume of waste handled increases, which is not balanced with the capacity of TPS of approximately 600 tons (Sjamsinarsi, 2022). Currently, the waste management method at the Piyungan regional landfill is the sanitary landfill method, which removes disposals by piling up layers of garbage and soil daily (Zuchriyastono & Purnomo, 2020). However, the waste accumulation at the local landfill of Piyungan increases yearly without a rise in the disposal area.

This study proposes an evaluation and analysis to determine the role of social capital in managing the regional landfill area of Piyungan. A quantitative and qualitative methods were implemented in describing the data (Silalahi, 2015). The respondents was comprising government officials, community leaders, groups, and community members using the purposive random sampling method.

2. Methods

2.1 Study Area

Piyungan landfill is situated in Piyungan district, Bantul Regency, Special Region of Yogyakarta, Indonesia as showed in Figure 1. Geographically, the landfill site is located at -7°52'11.54" N and 110°25'39.88"E with total area of 12.5 Ha.

Data Collections

Data were collected from 200 respondents comprising community and religious leaders, and the head of the Mardiko community, using the purposive sampling method, which is the minimum sample size needed to reduce bias (Portes, 1998).

This is a quantitative study, with the qualitative approach used to obtain primary data regarding the role of social capital, which contributes to the environmental stewardship at the local landfill of Piyungan through questionnaires, and survey methods. Additionally, this study calculated the yearly population growth and amount of waste that enters the local landfill of Piyungan from Sleman and Bantul regencies, as well as Yogyakarta City. The calculation method aims to analyze the capacity of the local landfill of Piyungan in the coming year based on the data that has been measured.

Meanwhile, the qualitative approach was used to obtain more specific and in-depth information on waste management from the respondents. It also clarified the social conditions obtained through the arrangement of questions designed on the quantitative method. Qualitative data was obtained through in-depth interviews with informants, such as community leaders, village governments, important figures from the Mardiko community on managing and handling waste to serve the environment. The results of this in-depth interview were used as input to complete the data obtained from filling out the questionnaire.

Analysis Data

According to Silalahi (2009), data analysis is the process of simplifying data by grouping it in a form that is easier to read and interpret. This research was conducted using quantitative and qualitative data analysis. The quantitative process was carried out using a quantitative descriptive approach, while the qualitative method analyzed, interpreted, and concluded the obtained data.

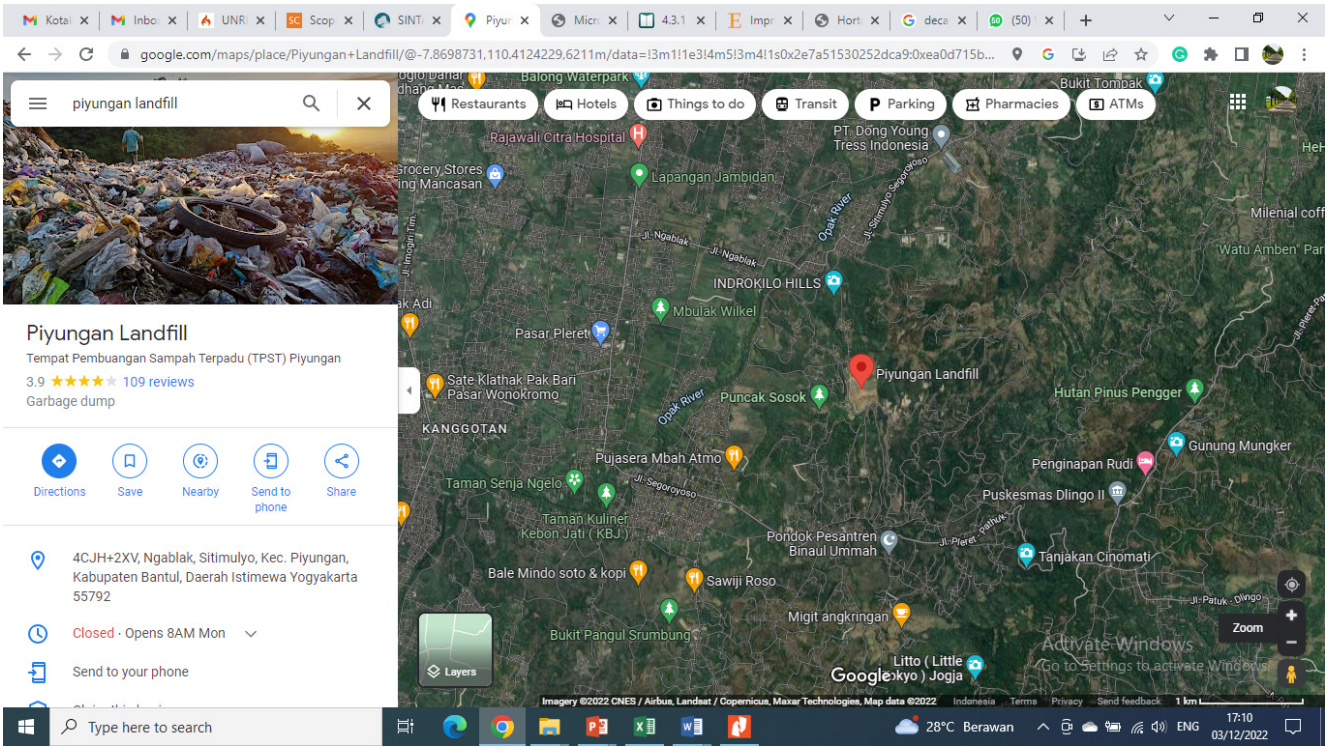

Figure 1.Maps of the study site (Source: https://www.google.com/maps/)

3. Results and Discussion

Piyungan landfill conditions

The local landfill of Piyungan is located in Ngablak Hamlet, Situmulyo Village, Kapanewon Piyungan, Bantul Regency, Yogyakarta Special Region. It was established in 1995 and started operation in 1996 on a land area of 12.5 hectares with a capacity of 2.7 million cubic meters of waste. Therefore, this area has been a garbage collector for all of Yogyakarta for the past 24 years (Sjamsinarsi, 2022; Sudibyo et al., 2017). However, it currently receives an average of 600 to 700 tons of waste per day, hence the amount generated over the past 23 years exceeds the capacity. For this reason, waste is increasingly piling up and even difficult to decompose, which in turn impacts the community and the surrounding environment.

The volume of waste is influenced by the population growth in Sleman, Bantul, and Yogyakarta City, as shown in Figure 2. The population growth from both districts and one city contributes to the volume of waste sent to the local landfill of Piyungan, as illustrated in Figure 3.

The data above shows that the volume of waste increases yearly in line with a rise in the number of residents in the local landfill of the Piyungan service area. Therefore, it is imperative to anticipate this outcome to create more ways to increase the landfill capacity to accommodate the waste and reduce its utilization by the inhabitants.

In 2016 alone, the capacity of the Piyungan local landfill was 2.26 million m^3, while the maximum waste was 2.7 million m^3. Ratya and Herumurti (2017) stated that with a solid waste density of 154.94 kg/m^3, it is equivalent capacity until 2016 was 350,164.40 tons, with a daily disposal rate of 500 tons. The estimated local landfill capacity obtained in 2020 is 353,664.40 tons, while 64,673.60 tons were collected after 2020. This means that a lack of anticipation will lead to waste disposal at the landfill and an overflow.

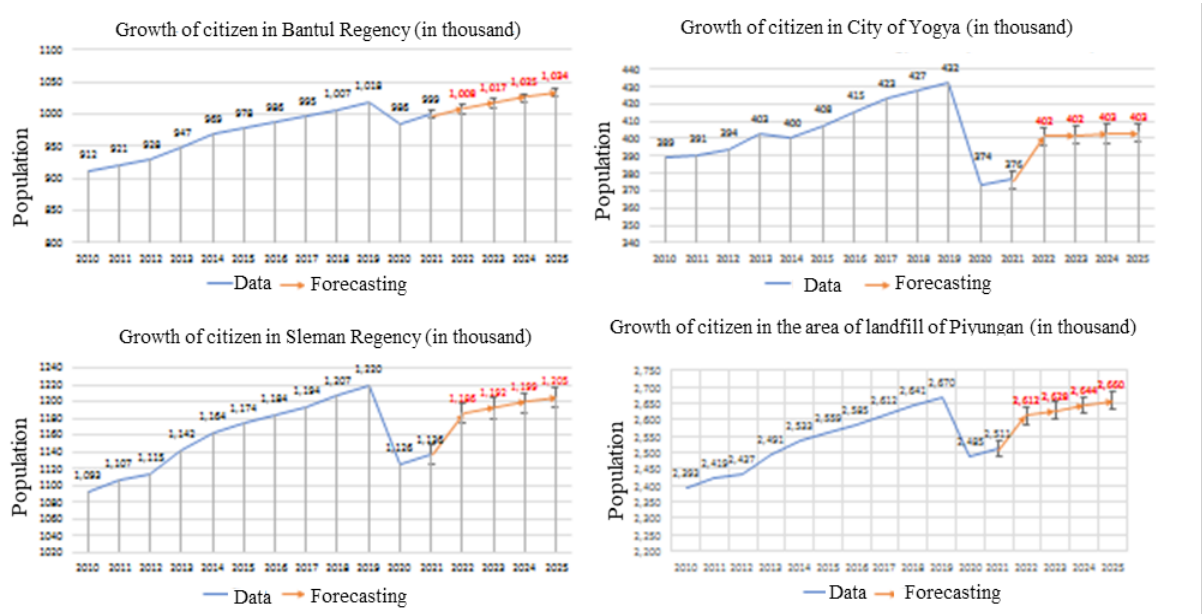

Figure 2. Population growth in the service area of Piyungan landfill. The data was adopted from BPS Yogyakarta (2022).

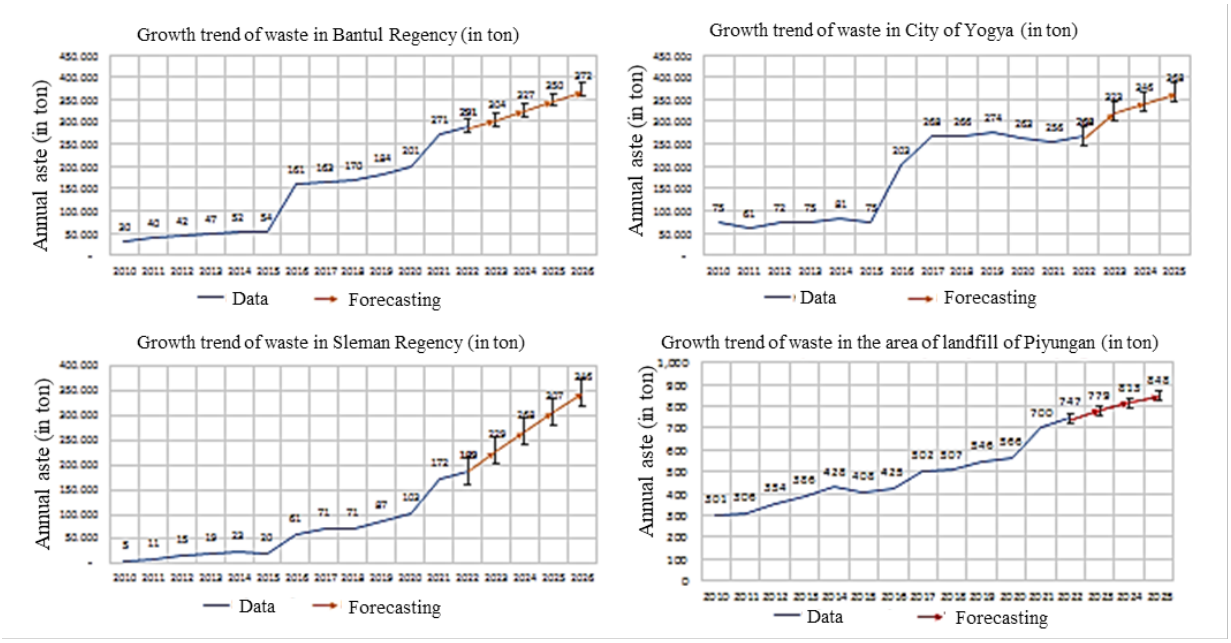

Figure 3. Growth of waste volume in service area of regional landfill of Piyungan

Waste impact on the environment

The waste in the local landfill of Piyungan is worrisome because it is likened to a house that no longer accommodates its inhabitants with a strong smell. This is due to the garbage trucks' disposal in the morning, scavengers who sort out the garbage, and the numerous cows looking for food on the pile of garbage. The local landfill of Piyungan was temporarily closed some time ago to repair road access damaged by port holes. During this period, residents complained about garbage littered all over the place. This indicates that the community depends on the continued operation of a local landfill to accommodate waste and earn a living. However, various health impacts are associated with landfill use for waste disposal, such as environmental aspects. The smell of garbage, which is likened to a dangerous gas, can cause the air conditioner to be no longer comfortable for people to breathe (Abdel-Shafy & Mansour; 2019). The smell of gas arising from the degradation of waste is getting worse. This gas pollution arises in large quantities, which makes the surrounding environment uninhabitable (Lokahita et al., 2019). The condition of the soil there is bad because it has been piled up with garbage for years, which makes it difficult to be reused. Damage to the soil is possible because of the content of the type of waste that can damage its structure (Khandelwal et al., 2019). Liquid waste pollutes people's wells and is dumped into rivers, and during the rainy season, the water pollution rate increases due to garbage decay.

The environmental conditions around the local landfill of Piyungan disrupt the comfort of the surrounding community because the volume of waste in the landfill increases, with the rise in the number of animals that disrupt public health. This water is also unhealthy to consume, and an unpleasant odor due to the gas emitted from the waste.

Furthermore, the Piyungan local landfill, which looks normal at the community location, has a significant health impact on the community. These include smoke from burning garbage often inhaled by scavengers and the pungent smell of decomposing substances that produce leachate. Additionally, the impact of air and noise pollution and pungent smells and flies make this place and the surrounding community unhealthy. This is because the inhabitants experience shortness of breath, itching, and coughing due to a lack of attention to the proper disposal of waste. In 2011, free medical examinations and medicines were given by the local landfill of the Piyungan Management Unit once a month, while the official monitored wells and water every three months. The water consumed by the community comes from the regional drinking water company (PAM), which is taken from the local landfill of Piyungan (Hartoyo et al., 2011).

Figure 4 describes the condition of water carrying capacity in the local landfill of Piyungan Area, which is only at a conditionally safe level. This indicates that water carrying capacity is still available to meet local needs, with a carrying capacity reserve of less than 30% of the total required amount. This implies that in the next few years, an increase in the growth in water demand, will lead to a continuous decrease in the availability of water carrying capacity until it is exceeded

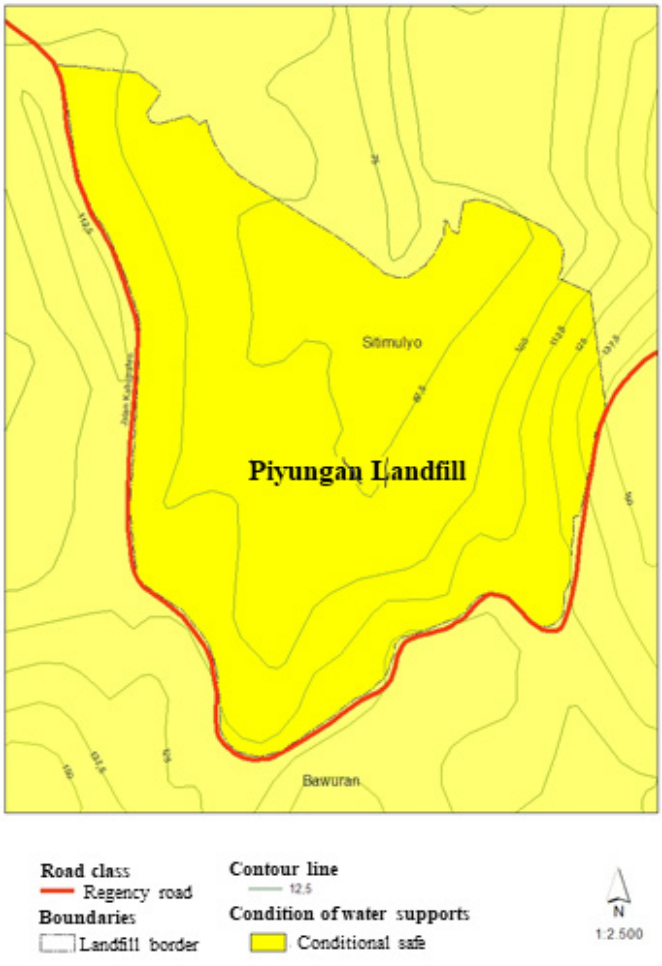

Figure 4. Map of water supports in the landfill.

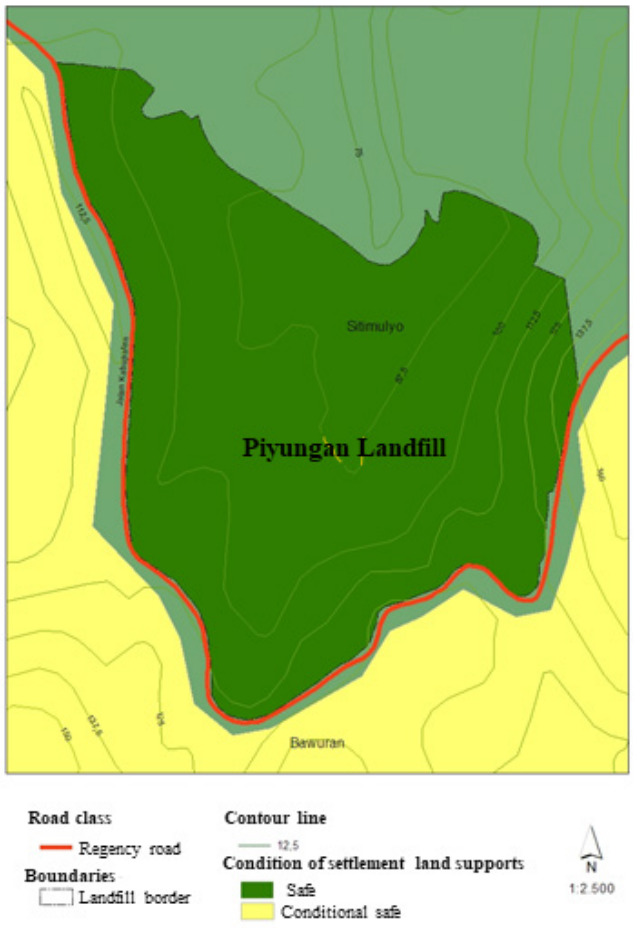

Figure 5. Settlement land support map in the area of local landfill of Piyungan.

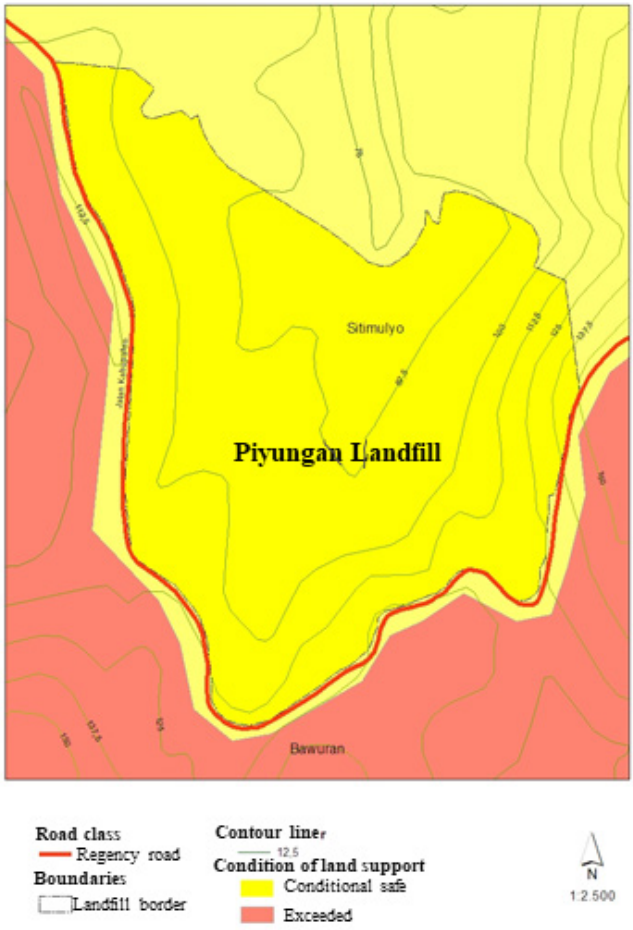

Figure 6. Agricultural land support map in the area of local landfill of Piyungan.

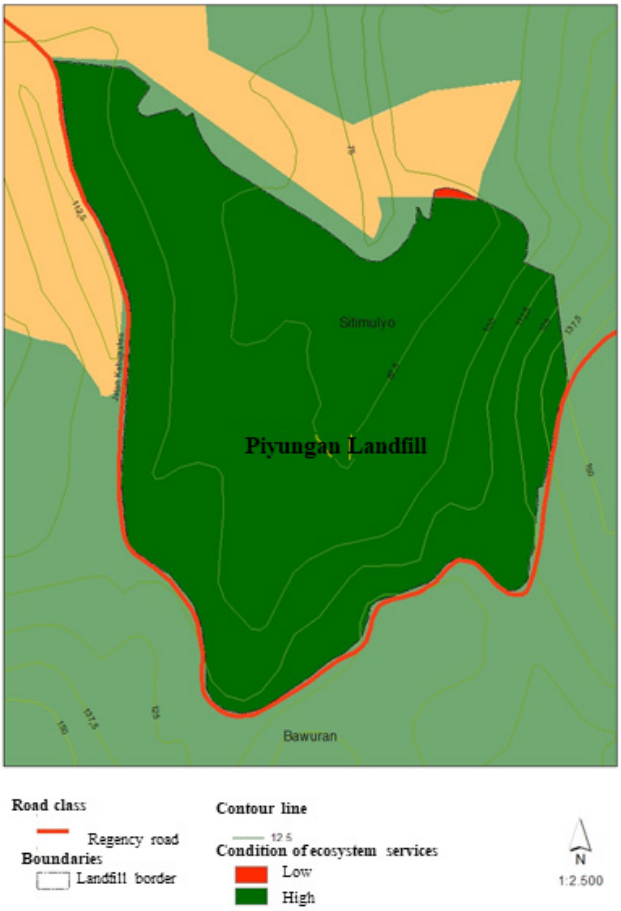

Figure 7. Map of ecosystem services for water purification in the area.

Figure 5 illustrates the condition of the carrying capacity of the settlement, which describes a decent space for housing compared to the total population. The carrying capacity of the settlements is still feasible, which means it quantitatively accommodates the growing population's residential space needs.

Figure 6 shows the availability of carrying capacity of agriculture in the study area, which meets the food needs of the local community. It is in the safe category meaning that the study area is still able to support the need for land for food agriculture. However, the availability of this reserve land is not more than 30% of the total carrying capacity of agriculture. This signifies that the carrying capacity has the potential to be exceeded in the distant future.

The map in Figure 7 illustrates the capacity of water purification ecosystem services, which is an estimate of the quality absorbed into the land. The study area has a very high water purification capacity, with a few areas of low capacity in the northeast.

The condition of the study area with high water purification ecosystem services contains a pile of waste material. When traced vertically, this water purification capacity helps leachate leaks and overflows. However, ecosystem services are a gift from nature that must be used sparingly because it has the ability to decrease when its usage exceeds the production threshold. Studies have not been on the quantitative value of the threshold for the production of ecosystem services.

Economic value at Piyungan landfill

A local landfill in Piyungan also has an economic impact, such as providing direct income for the people living around the landfill area. The following is the community's income from the local landfill of Piyungan.

Table 1 shows that the community's income sourced from the local landfill of Piyungan help to boost its economy. It provides a fairly large income due to the ability of the waste shipments to be resold to factories. The waste is usually in the form of plastic metal bottles, which have a fairly good selling value with large livestock income. People do not need to think about animal feed because it is taken from leftover food wasted in the lanfill and the surrounding grass. The existence of local landfill has resulted in the majority of people switching professions from farmers to scavengers and cattle breeders (Widyaningsih & Ma'ruf, 2017).

The increase in the volume of waste due to the rise in human life is unavoidable due to the increase in population and the establishment of large industries. Therefore, there needs to be awareness to educate industries on the need to ensure a limited amount of waste is produced by recycling their non-useful product to reduce the impact that will occur continuously (Kurniawan et al., 2021).

Since the incorporation of Piyungan landfill, waste has been estimated to increase yearly, thereby causing various negative impacts with the potential to pose risks (Joshi & Ahmed, 2016; Kristanto, & Koven, 2019). Some negative impacts include land use change, air, groundwater, and surface water. Others include a decrease in the number of terrestrial flora, aquatic flora, land fauna, level of public health, and environmental aesthetics.

Although the pungent smell is also disturbing when inhaled, most people living around the local landfill area are used to it and do not use personal protective equipment in

Table 1. Source of direct income at the local landfill of Piyungan

Income Source	Monthly income (IDR)	Annual income (IDR)
Scavenger	1,474,728	17,696,736
Junk collector	3,815,890	45,790,680
Collecting worker	999,900	11,998,800
Livestock	1,938,450	23,261,400
Employees of the Piyungan landfill	2,180,657	26,167,884
Total (IDR)	10,409,525	124,915,500

Table 2. Summary of findings on trust elements

Theorem	Findings	Implication
Trust approach in increasing social capital	1. Community around trust the ability of the Mardiko group to reduce the volume of waste in the landfill of Piyungan. 2. Trust grows as a result of the reciprocal relationship felt by the community. 3. Trust can lead to a low level of public pessimism, which reduces the volume of waste to the local landfill of Piyungan.	1. Willingness of community members to pay dues for environmental management. 2. The existence of a social network due to good relationships between the community because of the impact felt by the Mardiko in waste management. 3. Open job opportunities. 4. Reduces the volume of waste.

the form of masks. Based on these data, this study aims to determine efforts needed to eradicate the negative impact of waste disposal in the landfill.

The role of Mardiko as social capital community

The role of social capital can be implemented in an economic development process that has local content, such as in reducing poverty that occurs in the community, especially in waste management and handling (Prelikova et al., 2020; Wang & Zhang, 2022). Social capital is conducted with community empowerment which is a development process used to boost its economy (Pretty and Ward , 2001; Jones, 2009)

This is also in line with the efforts to overcome environmental problems that occurred in Kapanewon Piyungan, which is currently used as the location of local landfill of Piyungan. The scavengers accommodated in the Mardiko community are a group of workers who sort and reduce waste.

The Mardiko was formed to reduce the volume of waste up to 20%. Prior to the existence of this community as a waste self-help group, garbage was simply thrown away in landfills without any management process. The existence of this community can be used as a means of opening up employment opportunities and reducing the volume of waste (Wang & Zhang, 2022), which is properly managed to boost the economic value (Kurniawan et al., 2021. The findings on trust elements in the Mardiko community is summarized in Table 2.

The social network of those who are members of the Mardiko community has grown due to the mutual cooperation, sense of kinship, and solidarity between the community, the private sector (waste processing company), the local government. These kind networks developed social capital for improving life quality of the community (Bourdieu, 1986). Several universities aim to solve the disposal problem at once by reducing the volume of waste to landfills. The summary of findings on social networking in Mardiko community is shown in Table 3.

There is a cooperative relationship between the private sector local government and also universities facilitated through the community, with every activity analyzed based on mutually agreed consensus. This is carried out in order to improve the condition of the community by considering its diversity a sense of respect for the diversity of cultures and views is achieved.

The Mardiko community is expected to be able to develop the surrounding areas in order to improve their standard of living through proper waste management activities, decision-making, implementation, and evaluation processes (Kurniawan et al., 2021). Community participation in the implementation of program activities, in the form of energy, money, and materials, enhances the economy through the supervision and assessment of existing activities (Jones, 2009). Participation in this case can be in the form of suggestions or criticism through the implementation of various activities.

Elements of norms used as guidelines in waste management, include the minimization of deviant human behavior by institutions and decrease in exchange uncertainty. This occurs when the role of social capital in society is strong because it helps the community in conducting a mutually beneficial relationship or cooperation. Fukuyama in Hasbullah (2006) stated that social capital makes people align to achieve common goals on the basis of togetherness, bound by norms that must be obeyed. In the Mardiko community there is an unwritten norm in the form of the slogan "lightweight is shared" in the waste management process, as shown in Table 4. The existence of norms and values is used to create order among members managed by the community to overcome environmental problems caused by waste.

Table 3. Summary of findings on social networks

Theorem	Findings	Implication
The concept of a social network for the sustainability of the Mardiko community in reducing waste	1. The Mardiko community is a bridge between the people of the landfill area and the private sector, as well as the local government and universities. 2. The participation of group members is motivated by the benefits they receive. 3. There is a sense of kinship between the management and members of the Mardiko community. 4. The empowerment of scavengers in the Mardiko community container in the local landfill of Piyungan.	1. Increasing income through waste management and empowerment. 2. There is an information network that helps in understanding the benefits of waste management and utilization. 3. Increased trust in the surrounding community.

Table 4. Summary of findings on the norm

Theorem	Findings	Implication
Elements of norms as guidelines in waste management at the local landfill of Piyungan	1. There is an intention to protect the environment. 2. Emphasizes on the need to help each other in the waste management process. 3. The existence of informal norms as indicated by the motto "lightweight is shared". 4. There are disciplinary sanctions for violations.	1. The existence of informal norms can have an impact on good relationships among members of the Mardiko community to enable them to work together in waste management. 2. There is a sense of responsibility in managing waste. 3. Minimize conflicts in the waste management process.

Formal norms in society are regulated or created by institutions regulated by the community, which allows members to take care of themselves (MacGillivray, 2018). However, when members violate the rules, the consequences that must be accepted are sanctions or expulsion from the community.

All members must strictly obey existing regulations with the aim of maintaining waste management in order to overcome environmental problems. A sorting process is caried out for the existing management system, especially in the accumulation of a garbage with every member possessing a mutual understanding of the condition they are facing.

The purpose of the regulation is to minimize unexpected conditions from deviant behavior capable of harming other parties. Therefore the norm arises because of a mutually beneficial exchange, enjoyed by both parties. Due to several mutually beneficial and continuous exchanges a social obligation that must be maintained by the norm (Setyawati, 2015). The norm is a guide in maintaining relationships in society which prevents people from being separated from the network of interests (Broska, 2021; Wang & Zhang, 2022).

The increasing need for housing land and waste collection sites by scavengers, has resulted in the emergence of many beds/shacks for scavengers to live in, thereby leading to the formation of a slum environment and unplanned settlements.

4. Conclusion

The stronger the role of social capital in the community, the better the efforts to serve the environment in the landfill area, with the disposal of less waste residue in the Piyungan region. Therefore, the social capital carried out by the community play a significant role in managing the environment in the landfill area, thereby reducing the waste by 20%.

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References

Abdel-Shafy, H. I., & Mansour, M. S. M. (2018). Solid waste issue: Sources, composition, disposal, recycling, and valorization. *Egyptian Journal of Petroleum*, 27(4), 1275–1290. https://doi.org/10.1016/j.ejpe.2018.07.003

Bourdieu, P. (1986) The forms of capital. In J. Richardson (Ed.) *Handbook of Theory and Research for the Sociology of Education*. 241-258. Greenwood, New York.

Broska, L. H. (2021). It's all about community: On the interplay of social capital, social needs, and environmental concern in sustainable community action. *Energy Research & Social Science*, 79, 102165. https://doi.org/10.1016/j.erss.2021.102165

Cockerham, W. C. (2021). *The social causes of health and disease*. John Wiley & Sons, USA.

Das, S., Lee, S.-H., Kumar, P., Kim, K.-H., Lee, S. S., & Bhattacharya, S. S. (2019). Solid waste management: Scope and the challenge of sustainability. *Journal of Cleaner Production*, 228, 658–678. https://doi.org/10.1016/j.jclepro.2019.04.323

Hartoyo, F. A., Cahyadi, A., and Dipayana, G. A. (2011). Pemetaan Risiko Pencemaran Airtanah Di Kecamatan Piyungan, Kabupaten Bantul Menggunakan Metode Drastic Modifikasi, *Simposium Nasional Sains Geoinformasi PUSPICS*, Fakultas Geografi Universitas Gadjah Mada Yogyakarta, 27 Oktober 2011

Jones, N. (2009). Investigating the influence of social costs and benefits of environmental policies through social capital theory. *Policy Sciences*, 43(3), 229–244. https://doi.org/10.1007/s11077-009-9107-1

Joshi, R., & Ahmed, S. (2016). Status and challenges of municipal solid waste management in India: A review. *Cogent Environmental Science*, 2(1), 1139434. https://doi.org/10.1080/23311843.2016.1139434

Khandelwal, H., Dhar, H., Thalla, A. K., & Kumar, S. (2019). Application of life cycle assessment in municipal solid waste management: A worldwide critical review. *Journal of Cleaner Production*, 209, 630–654. https://doi.org/10.1016/j.jclepro.2018.10.233

Kristanto, G. A., & Koven, W. (2019). Estimating greenhouse gas emissions from municipal solid waste management in Depok, Indonesia. *City and Environment Interactions*, 4, 100027. https://doi.org/10.1016/j.cacint.2020.100027

Kurniawan, T. A., Avtar, R., Singh, D., Xue, W., Dzarfan Othman, M. H., Hwang, G. H., Iswanto, I., Albadarin, A. B., & Kern, A. O. (2021). Reforming MSWM in Sukunan (Yogjakarta, Indonesia): A case-study of applying a zero-waste approach based on circular economy paradigm. *Journal of Cleaner Production*, 284, 124775. https://doi.org/10.1016/j.jclepro.2020.124775

Lokahita, B., Samudro, G., Huboyo, H. S., Aziz, M., & Takahashi, F. (2019). Energy recovery potential from excavating municipal solid waste dumpsite in Indonesia. *Energy Procedia*, 158, 243–248. https://doi.org/10.1016/j.egypro.2019.01.083

MacGillivray, B. H. (2018). Beyond social capital: The norms, belief systems, and agency embedded in social networks shape resilience to climatic and geophysical hazards. *Environmental Science & Policy*, 89, 116–125. https://doi.org/10.1016/j.envsci.2018.07.014

Mahyudin, R. P. (2017). Kajian Permasalahan Pengelolaan Sampah Dan Dampak Lingkungan Di TPA (Tempat Pemrosesan Akhir). *Jukung (Jurnal Teknik Lingkungan),* 3(1). https://doi.org/10.20527/jukung.v3i1.3201

Portes, A. (1998). Social Capital: Its Origins and Applications in Modern Sociology. Annual Review of Sociology, 24(1), 1–24. https://doi.org/10.1146/annurev.soc.24.1.1

Prelikova, E. A., Zotov, V. V., and Yushin, V. V. (2020). Management of Local Community Social Capital when Solving the Problems of Urban Environment Pollution with Solid Municipal Waste. *IOP Conference Series: Earth and Environmental Science*, 459(3), 032065. https://doi.org/10.1088/1755-1315/459/3/032065

Pretty, J., and Ward, H. (2001). *Social Capital and the Environment*. World Development. 29(2), pp. 209-227.

Ratya, H., & Herumurti, W. (2017). Timbulan dan Komposisi Sampah Rumah Tangga di Kecamatan Rungkut Surabaya. Jurnal Teknik ITS, 6(2), C104-C106.

Setyowati, R., & Mulasari, S. A. (2013). Pengetahuan dan Perilaku Ibu Rumah Tangga dalam Pengelolaan Sampah Plastik. *Kesmas: National Public Health Journal*, 7(12), 562. https://doi.org/10.21109/kesmas.v7i12.331

Silalahi, U. (2009). *Metode Penelitian Sosial*. Bandung. PT Refika Aditama.

Sjamsinarsi, R. (2022). Histori TPA Sampah Regional Piyungan: Sebuh Pembelajaran bersama dalam pengelolaan sampah regional. Prensentation.

Sudibyo, H., Pradana, Y. S., Budiman, A., & Budhijanto, W. (2017). Municipal Solid Waste Management in Indonesia - A Study about Selection of Proper Solid Waste Reduction Method in D.I. Yogyakarta Province. *Energy Procedia*, 143, 494–499. https://doi.org/10.1016/j.egypro.2017.12.716

Wang, Y., & Zhang, C. (2022). Waste sorting in context: Untangling the impacts of social capital and environmental norms. *Journal of Cleaner Production*, 330, 129937. https://doi.org/10.1016/j.jclepro.2021.129937

Whyte, K. (2020). Too late for indigenous climate justice: Ecological and relational tipping points. Wiley Interdisciplinary Reviews: Climate Change, 11(1), e603.

Widyaningsih, T., & Ma'ruf, A. (2017). Eksternalitas Tempat Pengolahan Sampah Terpadu (TPST) Piyungan Kabupaten Bantul Daerah Istimewa Yogyakarta. Jurnal Ekonomi & Studi Pembangunan, 18(1), 86-102.

Yunik'ati, Y., Imam, R. M., Hariyadi, F., & Choirotin, I. (2019). Sadar Pilah Sampah Dengan Konsep 4R (Reduce, Reuse, Recycle, Replace) Di Desa Gedongarum, Kanor, Bojonegoro. *JIPEMAS: Jurnal Inovasi Hasil Pengabdian Masyarakat*, 2(2), 81. https://doi.org/10.33474/jipemas.v2i2.1122

Zuchriyastono, M. A., & Purnomo, E. P. (2020). Analisis lingkungan lahan tempat pembuangan sampah terpadu terhadap kesehatan masyarakat sekitar studi kasus: tempat pembuangan sampah terpadu piyungan (TPST). *Jurnal Kesehatan Masyarakat dan Lingkungan Hidup*, 5(1), 22-28.