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Change in community behaviour in supporting sustainable development: The case of the biogas program in Ponorogo Regency

Perubahan perilaku masyarakat dalam mendukung pembangunan berkelanjutan: Kasus pada program biogas di Kabupaten Ponorogo

Dinda Putri Agustin✉, Nunung Nurwati, & Aditya Candra Lesmana
Department of Sociology, Faculty of Social and Political Sciences, Universitas Padjadjaran
Sumedang, 45363, West Java Province, Indonesia
e-mail of corresponding author: dindaputriagustin11@gmail.com

Abstract

The change in community occupation to dairy farmers and the increase in the number of livestock have caused environmental problems. This research focuses on the program's function on changing the behaviour of the community in disposing of dairy cow manure from the phase of throwing it into the ditch to the phase of processing the manure into the biogas. This research was conducted using qualitative methods, with data collection techniques carried out through in-depth interviews, observation, documentation and literature review. The biogas problem launched by the government has proven to be able to change communities behaviour in the disposal of dairy cows manure. After receiving the biogas program, the community processed the cow dung into biogas. Interestingly, the factor that contributed the most to this behavioural change is economic. This shows that the social, environmental, and economic system have related functions and cannot be separated from each other in society. There is not much research on community behaviour change that is affected by environmental sanitation and motivated by economic factors. This study also alludes to the potential for corruption in the program. This study concludes that the biogas program is able to provide opportunities for the community to save on purchasing household fuel and minimize the waste of dairy cow waste into rivers. Apart from that, the biogas program could be a consideration for the government in creating new programs related to environmental sanitation, especially in the rural livestock industry.

Keywords: biogas program; change in community behaviour; dairy farming; environmental sanitation

Abstrak

Perubahan mata pencaharian masyarakat menjadi peternak sapi perah dan meningkatnya jumlah hewan ternak telah menimbulkan masalah lingkungan. Penelitian ini berfokus pada fungsi program pada perubahan perilaku masyarakat dalam membuang kotoran sapi perah dari tahap membuang ke selokan menuju tahap pengolahan kotoran menjadi biogas. Penelitian ini dilakukan dengan metode kualitatif, dengan teknik pengumpulan data yang dilakukan melalui wawancara mendalam, observasi, dokumentasi, serta kajian pustaka. Program biogas yang dicanangkan pemerintah terbukti dapat mengubah perilaku masyarakat dalam membuang kotoran sapi perah. Setelah mendapatkan program biogas, masyarakat mengolah kotoran sapi tersebut menjadi biogas. Menariknya, faktor yang berkontribusi terbanyak dalam perubahan perilaku ini yaitu faktor ekonomi. Hal ini menunjukkan bahwa sistem sosial, lingkungan, dan ekonomi tidak dapat dipisahkan satu sama lain dalam masyarakat. Tidak banyak penelitian mengenai perubahan perilaku masyarakat yang dilatarbelakangi oleh sanitasi lingkungan dan didorong oleh faktor ekonomi. Penelitian ini juga menemukan adanya potensi korupsi terselubung dalam program tersebut. Studi ini menyimpulkan bahwa program biogas mampu memberikan peluang bagi masyarakat untuk berhemat dalam membeli bahan bakar rumah tangga dan meminimalkan kotoran sapi perah yang dibuang ke sungai. Selain itu, program biogas bisa menjadi salah satu bahan pertimbangan bagi pemerintah dalam membuat program-program baru yang berkaitan dengan sanitasi lingkungan, khususnya industri peternakan di pedesaan.

***Kata kunci**: program biogas; perubahan perilaku masyarakat; peternakan sapi perah; sanitasi lingkungan*

Introduction

Animal manure from both poultry and ruminants such as cows and sheep often causes pollution that could add to the problems in the community environment day by day. Meanwhile, the amount of the cow manure that increases every day requires immediate handling so as not to cause further environmental pollution. The issue of wastewater sanitation has actually been regulated in the Regulation of the Minister of Environment No 11 of 2009 which states that the person in charge of the business and/or activities of cattle and pig farming must separate the wastewater drain from the rainwater drain

(Kementerian Lingkungan Hidup 2009). However, the presence of this regulation is not immediately complied because farmers choose to dispose of animal waste in the river because that is considered to be the most practical solution.

The problem related to environmental sanitation are also a problem in Pudak Village, Ponorogo Regency. The problem is caused by livestock waste that is not properly processed. Pudak Kulon is quite far from the city centre with a distance of 34 km from the centre of the Ponorogo Regency government. Pudak land is fertile. The population density in Pudak Kulon Village is 115 people/km². According to the Government Regulation in Lieu of Law Number 56 of 1960 concerning the Determination of Agricultural Land Area, the Daerah Istimewa Yogyakarta Health Office in 2024, this figure indicates that the village area is classified as having a less dense population density. As a village located in a highland area, water wealth in Pudak Kulon is known to be abundant, sourced from pure mountain water. This is inseparable from the topography of the Pudak Subdistrict, This is inseparable from the topography of the Pudak Subdistrict, which located in a highland area at 959 meters above sea level (Badan Pusat Statistik Ponorogo Regency 2024). Like other rural communities in general, Pudak used to be an agricultural and vegetable plantation area just like the people of Magetan and Malang. The garden produces vegetables such as petai, cabbage, and shallots. Pudak was also known to be one of the clove producing areas in Ponorogo Regency.

Currently, vegetable production in Pudak Kulon Village has decreased because the people have switched their professions to become dairy farmers. This change is due to the fact that in 2009—2010 vegetable farmers experienced an economic crisis because they were unable to compete with vegetable farmers in other regions such as Magetan and Malang Regency. Then in 2010, dairy cattle farming began to emerge in Pudak Kulon Village and brought profits so that the community was interested to joining the business and switching professions to become dairy farmers. The Ponorogo District Government saw the potential of dairy farming in Pudak Kulon Village and established a cooperative to promote the village's livestock activities and productivity. This was also reinforced by the emergence of a soft loan program for dairy farmers to develop their business in 2018.

The changes experienced by the people of Pudak not only cause positive consequences, but also have negative impacts. Environmental problems, especially river pollution, is one of the negative consequences of the progress of dairy farming in Pudak. Communities who are most affected by dairy cow manure waste are communities of Sooko sub-district, which is a sub-district with a topographic location below Pudak sub-district. River pollution causes restlessness among Sooko residents because the river is filled with dairy cow manure that emits a pungent odour and changes colour to greenish. The smell becomes more pungent during the rainy season because raindrops make the geosmin odour on the spores stronger. The community is worried that the cow dung could cause sedimentation along the river. In fact, the river also leads to the Bendo Reservoir (Pebrianti 2023). In addition, mounds of dairy cow manure also disturb the tourist destination of Pletuk Waterfall in Sooko sub-district. Pletuk Waterfall is one of the tourist destinations that used to attract tourists. Since the river water pollution, no tourists have visited Pletuk Waterfall. Thus, Pletuk Waterfall Tourism Destination was closed six years ago or since three years before the COVID-19 pandemic (Supriyanto 2022). From these cases, it can be seen that river water pollution due to animal dung can have an impact on other sectors such as agriculture and tourism if it is not resolved immediately.

In addition, it is important to pay attention to technology biogas production, including environmentally friendly manure disposal processes and obtaining good economic returns (Janczak et al. 2019). Biogas not only contributes to the reduction of environmental pollution, but also contributes to the demand for renewable energy. This is supported by studies from countries in Europe, Africa, and Asia. The depletion of fossil availability and climate change concerns due to fossil combustion have led to an increase in demand for renewable energy (Akyurek 2018). Biogas will be a major power supply in the future because it is a type of renewable energy (Capodaglio et al. 2016).

After knowing that the dairy farm has an impact on river pollution, the government of Ponorogo Regency through the Environmental Agency together with the community of Pudak Kulon Village tried to overcome the problem. One of which was through the Biogas Program. Through the Biogas Program, the community of Pudak Kulon Village quickly experienced changes in behaviour towards

environmental sanitation, especially in reducing dairy cattle waste. Biogas is a fairly new thing for the community in Pudak Kulon Village. However, changes in behaviour in environmental sanitation regarding livestock manure waste show very good results. Livestock manure waste is reduced and has a positive impact on the community. The adoption of new technologies such as biogas requires learning, adaptation, and development among users of the technology (Tigabu et al. 2015). One country that is fast in adapting biogas technology is India. In fact, biogas is predicted to be a transportation fuel, fuel cell, industrial level power plant, and heat generation in India (Minde et al. 2013).

This research will discuss the function of biogas in changing community behaviour regarding environmental sanitation, which also supports the Sustainable Development Goals (SDGs). Obaideen et al. (2022) in their findings stated that biogas has contributed to 12 of the 17 SDGs. The main contribution of biogas comes from its ability to increase renewable energy, improve waste management processes, reduce climate energy, and create jobs. There are many other studies found related to the biogas program such as those conducted by Shallo & Sime (2019) in Ethiopia, discussing the factors that determine the function of bio-digesters where the study focuses more on the operational functions of the biogas reactor equipment. Meanwhile, another study on the function of biogas regarding the Technological Innovation System (TIS) in promoting technology diffusion with the application of the 'function approach in innovation systems' in Kenya and Rwanda, as well as in the context of institutions that support renewable energy technologies (Tigabu et al. 2015, Tigabu 2017). Schmidt & Dabur (2014) expanded the innovation system approach of renewable energy technology by adding spatial dimensions such as technology transfer, knowledge, and financial resources. Meanwhile, Janczak et al. (2019) discussed the possibility of functioning biogas plants on poultry farms. The functioning of biogas plants on selected agricultural land of 35 ha was studied by Czekała et al. (2017). There are previous studies on biogas in various countries. However, the research discusses the biogas construction itself, the role of government, credit mechanism, and the role of institutions in sustainability energy (Landi et al. 2013, Wahyudi et al. 2015, Bourdin & Nadou 2019). This is supported by the results of Shallo & Sime (2019) research which states that follow-up and institutional support and service satisfaction of the biogas program have a positive effect on bio-digester function. Institutional factors play an important role in the sustainability of renewable energy (Carrosio 2013).

Although there have been many studies related to the Biogas Program, there is still the scope for study to clarify the position of the Biogas Program in changing community behaviour regarding environmental sanitation. This study aims to discuss: (1) The habits of Pudak Kulon community in raising dairy cattle; (2) The function and dysfunction of the biogas program in changing community behaviour regarding environmental sanitation; (3) The driving and inhibiting factors of community behaviour change regarding environmental sanitation. There are not many studies that discuss changes in community behaviour related to environmental sanitation in a dairy farming area motivated by government programs and reasons for behaviour changes from the economic side, especially in Indonesia. This study also discussed the existence of potential hidden corruption practices that the person in the village carried out. Therefore, it can be seen that this research discusses problems from a social perspective that are rarely explored by other studies. Whereas most studies on biogas programs are discussed in terms of techniques and financial mechanism.

This study will be discussed using functional structuralism theory. Talcott Parsons has presented his views on conventional functional structuralism theory earlier than Robert K. Merton. Talcott Parsons believe that every system in society is functionally integrated in a form such as equilibrium (Turama 2020). This view assumes that society will always be in a harmonious, stable, and balanced condition. There is a different view of functional structuralism theory by Robert K. Merton who believes that not all systems in a society will always be functional, sometimes a system will act dysfunctional or non-functional. This is similar to the findings in Pudak Kulon Village in this study that there are several systems that are dysfunctional in relation to the implementation of biogas programs. Therefore, the conventional theory of functionalism by Talcott Parsons does not fit the findings in this study. In order to examine the research problems, Robert K. Merton's Functional Structural Theory was used.

The use of Merton's Functional Structural Theory can see how a program has an impact on changing the behaviour of a community. In the context of the Biogas Program implemented in the Pudak Kulon Village community, it was found that there is a function that changes the behaviour of the community regarding environmental sanitation where the Pudak Kulon community become more protective of their environment after participating of the Biogas Program. In addition, this study also looked at the dysfunction that emerged as a result of both internal and external factors from the community of Pudak Kulon Village.

Research Method

This research was conducted in Pudak Kulon Village, Ponorogo Regency. The reason of Pudak Kulon Village was chosen is because it is the village with the largest number of farms in Ponorogo. People also value education even though they come from areas far from urban areas. This is evidenced by the concern of parents who make their children's education a priority. They do not force their children to continue their business as farmers. However, researcher found an interesting thing, that is the enthusiasm of the generation in Pudak Kulon to pursue education while helping their parents to raise livestock. This research uses a qualitative approach with descriptive methods, and the types of data used are primary and secondary data. Data was obtained from interviews with informants using purposive techniques; field observation; as well as literature reviews from journals, online articles, online news, books and supporting documents obtained during the research process.

Analysis consists of three streams of activities that occur simultaneously; that is data reduction, data presentation, data verification/conclusion drawing (Miles & Huberman 1994). The researcher conducted data reduction; including classifying data, organizing data, and sorting out the necessary data. When reducing data, researcher need to abstract or summarize the core and statements that need to be maintained. Data reduction can make it easier for researchers to find additional data in research. In addition, researcher also presented the data so that the reduction results could be arranged in pattern of relationship between one another. Researchers organized data that is relevant to the research topic so that the information that has been obtained has a certain meaning and can determine the follow-up needed to achieve the objectives of this study. In this study, researchers also conducted data verification or conclusion drawing process. The data validity test was carried out through triangulation by comparing and checking the degree of trust by comparing the results of interviews with the observations, comparing the suitability of the informant's body gestures when conducting interviews, comparing the insider's point of view with the point of view of the general public, and comparing the results of interviews with documentation taken by researchers in the field.

Results and Discussion

In this section, the research findings will be discussed in this several sub-bab: (1) Communities habits in raising livestock and the emergence of environmental problems; (2) The function of biogas program in changing community behaviour regarding environmental sanitation in Pudak Kulon Village; (3) The dysfunction of biogas program; (4) Driving factors of the change in community behaviour regarding environmental sanitation; (5) Inhibiting factors of the change in community behaviour regarding environmental sanitation.

Communities habits in raising livestock and the emergence of environmental problems

Like the general characteristics of the village community, where the majority of the population earns a living as vegetable farmers, there are also other professions such as employees, civil servants, traders, masons, carpenters, welders, builders, and other types of work. Then starting in circa 2010, they began to recognize the work as dairy farmers. The community of Pudak Kulon saw the potential in the livestock sector from one of the residents trying to raise dairy cattle. After knowing that the cattle business of one of the residents was developing very well, the community of Pudak Kulon then became interested in working as a dairy farmer as well. This interest then made Pudak Kulon transformed from a plantation area to a successful farming area. The profession as a dairy farmer is now considered quite promising

compared to being a vegetable farmer, thus making changes to the characteristics of the community in Pudak Kulon. As the profession is quite profitable, the community then began to invite their children to be able to work as dairy farmers, even spreading to other villages in Pudak Sub-district. This is as stated by one of the research informants, as follows.

> "Almost all young people also raise livestock. The parents raise livestock, the young people do too. Those who graduated from junior high school have been taught to raise livestock. The willingness to raise livestock grows on its own. From childhood, we have been close to livestock. Children as young as 12 years old can grazing the grass by themselves, and in the afternoon they bathe the cows." (Informant JAD).

For people in Ponorogo Regency, Pudak area is now well known as a developed dairy farming area. The people of Pudak area close to the livestock environment and are accustomed to livestock-related activities such as finding grass to feed the cows, bathing the cows, and cleaning the cowshed regularly every morning and evening. As farmers, the people of Pudak Kulon are very concerned about the development of their livestock business. Farmers in Pudak Kulon Village have a routine habit in carrying out their work. Every morning, they clean the cowshed using running water. Cleaning cow dung from the cowshed, watering cow dung, finding bulrush or cow food, and washing the cow's mammary glands with warm water to facilitate milking the cow are activities that have become a habit in farming. Farmers milk cows twice a day, in the morning and evening. After milking, the cow's milk is put in a container made of aluminium and stainless steel. The container is then placed in front of the house. After that, the milk collection business in Pudak Kulon will pick up the milk in the container at 8 am-9 am in the morning and at 6 pm in the afternoon.

Behind the success in transforming into a dairy farmer, Pudak Kulon Village has a worrying environmental problem. The topography of Pudak Kulon, which is located in the upper/upstream area, makes it rich in water with clean and clear water conditions. As a consequence of many Pudak communities turning into dairy farmers, the water condition has become polluted due to the amount of manure from dairy farms that is disposed of in the ditch, where the ditch is connected to the river. Water cleanliness has been regulated in the Minister of Environment Regulation No 11/2009 article 9g on Wastewater Quality Standard for Cattle and Pig Business and/or Activities, which states that the person in charge of cattle and pig farming business and/or activities must separate the wastewater drain from the rainwater drain. This means that wastewater and rainwater disposal drain must be separated so as not to pollute the environmental ecosystem.

Another sub-district affected by the water pollution is Sooko sub-district. Sooko's topography is below Pudak. So that the water flow from above (Pudak) flows down (Sooko). This is unfortunate considering that Sooko is one of the tourist attractions for mountain communities. Previously, there was Pletuk Waterfall in Sooko, which became a busy tourist area. People, whether young or old, male or female, children or adults, liked to travel to Pletuk Waterfall.

> "The biggest (impact) is indeed Sooko Sub-district. Those who feel the impact of pollution are usually Sooko residents. They often make complaints and protests. There are many water users from the river. Even from Pudak, they use the water source for cattle, which is quite a large water source. Well, the impact after being used to manage cattle is usually for bathing, for drinking, and so on. For irrigation, and so on. Well, Sooko is the next user, so the impact is also felt in Sooko. Sooko's topography is low below Pudak area." (Informant HAR).

Based on the explanation from informant, the people of Sooko are the most affected by the pollution of the river flowing from Pudak region. The mountain water is used for cooking, drinking, bathing, and irrigation of rice fields so its existence is very important to sustain the lives of the Sooko community. However, since there has been a dairy farm in Pudak, the water has become murky and causing environmental and social problems in the Sooko area. The obvious environmental problem is river pollution as described above. The pollution is detrimental to the Sooko community in terms of environment and economy because the mountain water flowing from Pudak is used for various household needs, rice field irrigation needs, as well as the needs for the advancement of Pletuk Waterfall tourism in Jurug, Sooko sub-district.

> "Formerly (protested/complained) in the past, several years ago. It even reached the mass media. It wasn't the government (who protested), it was the people there (who protested). Especially maybe some of the NGO's from the Sooko people uploaded it to social media. Around 2020 or 2021 before the Foot and Mouth Disease (FMD). On social media it was crowded. The complaint was that there was also a response from the government to provide assistance for waste processing machines." (Informant MAW).

While the social problem that arises is the protest of the Sooko community regarding river pollution in their area. The protest was carried out through the mass media. Based on information from informants, the protest also led to the realm of law. Then the government provided a solution in the form of waste processing machines that were not the assistance needed by the community. Based on information from informant MAW, the community needs a dung dryer to be used as fertilizer. The working system of the dung dryer is that the wet dung is then presses so that it is dry. So that the dried cow dung is easily lifted and taken to the field.

In the other case, regarding the Biogas Program. The government's attempts in the Biogas Program are actually appropriate, it's just that they have not been evenly distributed. The unevenness of the Biogas Program is based on the limited budget from the government and also the high cost of biogas-making equipment.

Based on information from informants, the price of biodigester (the biogas production technology) is quite expensive. The informant said that a biogas plant costs up to about IDR 12 million. Meanwhile, the community has other needs that must be fulfilled every day. Thus, they cannot afford to buy a biodigester independently. The Biogas Program in the form of digester technology assistance by the Environmental Department is the right step to help the community reduce sanitation problems regarding dairy cow manure waste.

The function of biogas program in changing community behaviour regarding environmental sanitation in Pudak Kulon Village

The behaviour of Pudak Kulon community in disposing of cow dung in the river is not of their own volition, but because they are forced to due to the absence of land used to accommodate cow dung every day.

> "The community's cowshed is limited. So, the back of the house is just for the cowshed. Mine and the village head's are the widest. The community is only suitable for cows, and it is attached to the house. Finally, they also throw it (the cow dung) into the ditch. There is no place to dispose of the manure." (Informant ITO).

Their land is used for planting vegetables and bulrush. They plant vegetables as a side job to being a farmer. From this, it can be seen that there is a change in the main occupation of the Pudak Kulon community from vegetable farmers to dairy farmers. However, the land that used to be planting the vegetables is now reduced because people change their crops to bulrush. The bulrush is used to feed their cattle. The lack of land to dispose of cow dung and the fact that people depend on dairy farming for their livelihoods has led them to dispose of their cow dung in the river.

The people of Sooko Village, whose topography is located downstream (below Pudak Village), suffered a loss in this regard. In the past, Sooko Village had a tourist area. However, the Pletuk Waterfall Complex currently tends to be neglected (Rois & Suprayitno 2019). Based on information from informant, Pudak Kulon society felt uncomfortable to throwing away the dairy cows dung in the river that flows into the Sooko Village area. However, they were forced to because there was no adequate place to dispose the dairy cow dung. Several Sooko resident also uploaded that condition of the river in their area which was full of cow dung, so that this was widely discussed among the people of Ponorogo Regency.

The attempts made by both the Ponorogo Regency Environmental Department and the Pudak Kulon Village community to overcome dairy cow manure waste pollution are using biogas. Biogas is a combustible gas whose composition consists of 60-70% methane and 30-40% carbon dioxide (Kumar et al. in Shallo & Sime 2018). In addition to reducing pollution, biogas can be used as household

fuel for cooking for the community. Therefore, in response to this, the Environmental Department launched the Biogas Program since 2010. Regarding how to get the program, the community must make a submission proposal sent to the Environmental Department. Then selection and direct field verification are carried out. The verification includes: (a) The economic condition of the prospective recipient community; (b) The number of cattle; (c) The type of private livestock or company. After that, the Environmental Department proposes the prospective recipient farmers to the district government and the Regent. If the budget is approved or issued, the next process is the construction of biogas. Until 2020, the Environmental Department has distributed a total of 37 biodigester units of permanent building construction type to Pudak Kulon Village area. As for the total of Pudak Sub-district, the Environmental Department has distributed a total of 104 biodigester units. One biodigester unit can be used by 3-5 households, so that the beneficiaries of the Biogas Program in the Pudak Kulon area are around 111-185 households, while for the entire Pudak Sub-district area it is estimated to be around 312-520 households.

The Biogas Program was created to realize a solution to environmental pollution due to cow dung waste from the Pudak Kulon community and communities in the downstream area (village below) who feel the impact of river pollution due to dairy cow dung. The purposes of the Biogas Program launched by Ponorogo District Environmental Department include: (a) To utilize methane gas; (b) To reduce the impact of water pollution; (c) Related to the utilization of cow dung left over from the biogas production process to be used as fertilizer material. However, the main purpose of the Biogas Program is to control environmental pollution, especially to reduce water pollution from cow dung that exceeds capacity. This reduced water pollution is related to the SDG 3 (good health and well-being), SDG 14 (life below water), and SDG 15 (life on land). In this regard, the reduction of river water pollution will impact the health of aquatic and terrestrial ecosystems.

> "The cow manure exceeds the capacity, so we throw it into the river. Actually, we also think about how not to pollute the river and others. But because of the situation and it's about life, there are school children to pay for, and so on, so what else can we do?" (Informant ITO).

Farmers in Pudak Kulon are not large-scale farmers who have subsidiary cattle companies elsewhere. They are local people who have to provide for their families. At the same time, environmental pollution due to dairy cow manure waste is increasing. Biodigester is a suitable technology to minimise pollution. However, the high cost of digesters makes farmers complain about the funds to build them. The equipment to make biogas can be up to IDR 12 million, depending on the cubic capacity. If the cubage is larger, the tool price is more expensive.

Regarding the strategy of managing funds to build biogas and for other needs, Wanta (2018) discusses the BIRU Program which includes the financial mechanism in the biogas program. BIRU (Renewable Energy Program/Biogas Small-scale Domestic Households) provides a subsidy of IDR 2,000,000 to farmers through the Development Partner Organization (CPO). Later the digester owner will pay in cash or credit to the CPO or dairy cooperative to pay the rest. In the one side, this payment mechanism will make it easier for farmers to own a digester, but on the other side, the loan provided is in the small category. This is because the cost of making a biodigester is not cheap, which is around IDR 12,000,000. From this, it can be seen that such a loan mechanism is not enough to facilitate all farmers to have digester technology. Therefore, the researcher believes that the Biogas Program by the Environmental Department is more effective and beneficial to the community than a loan mechanism such as the BIRU Program with the Development Partner Organization (CPO).

The Biogas Program has positive impact on reducing environmental pollution. However, in accordance with Robert K. Merton's statement/criticism to the thoughts of previous figures regarding the Structural Functionalism approach that this approach cannot solve all social problems (Nugroho 2021). This study supports the research results from Nugroho (2021), that in the context of this study conducted by researcher, the Biogas Program has not been able to eradicate environmental problems in Pudak Kulon. However, the Biogas Program has an impact on reducing the pollution of dairy cow manure waste in the river. This is in accordance with the main goal of the Biogas Program, which is to control pollution. Biogas is used to reduce the waste that settles along the river.

Although biogas has not been able to completely eradicated waste problems in the environment, it has a function to reduce pollution and is beneficial for the household needs of the community. “Functions, according to Merton, are defined as “observable consequences that encourage/produce the adaptation or adjustment of a particular system” (Ritzer & Stepnisky 2019)”. The function of biogas in this study resulted in the finding that there were changes in community behaviour regarding environmental sanitation between before and after using biogas.

This finding is proven by the change in people’s behaviour regarding environmental sanitation that in the past, morning and evening when farmers clean their cowsheds, they drain the cow dung into the ditch that flows into the river so that the river in Pudak Kulon is full of dairy cow manure. In the past (before there were dairy farms), the river water was clean. However, after dairy farming, the water in the river is very murky and full of cow dung that overflows to the outside of the river. The dung that accumulated downstream even turned greenish. The behaviour of the community is disposing of dairy cow manure greatly affects the ecosystem in the river, such as sea plants and fish. Moreover, although people in Pudak Kulon feel uncomfortable with other residents in downstream village, but the people of Pudak Kulon do not feel disturbed by the environmental pollution. It is the people in the downstream village that is Sooko who feel the impact and are disturbed by the bad sanitation of the river as a result of the bad sanitation of river water flowing from upstream to downstream, that is from Pudak to Sooko area.

Changes in community behaviour regarding environmental sanitation can be seen from before the Biogas Program, every morning and evening Pudak Kulon community directly threw their dairy cattle dung into the river so that the river was full of cow dung. The cow dung even filled the side of the river along the flow. Slowly after the Biogas Program, every morning and evening the dairy farmers in Pudak Kulon directly flow the dairy cow dung into the biodigester canal to be processed into biogas. The biodigester can be used for 3-5 households per unit depending on the cubication of the biodigester. Thus, there are 111-185 households in Pudak Kulon that have benefited from the Biogas Program launched by the Ponorogo District Environmental Department. They take turns filling the biodigester. There is no set schedule regarding who should fill the biodigester. However, anyone can fill it anytime in turn. This is included in the latent function of the Biogas Program, where changes in community behaviour regarding environmental sanitation are not the intended or desired function of the program maker, that is the Environmental Department.

Another latent function related to changes in community behaviour, which is also motivated by economic factors. Biogas used to be the fuel for cooking and lighting in Pudak Kulon area. In this regard, the biogas program contributes to the increase of existing renewable energy in the community, which is in line with SDG 7 (affordable and clean energy). The advantages of biogas is that it can save money and be renewable. So, the money that was used to buy LPG gas can now be saved or utilized for other needs. The economic benefits of biogas have increased the enthusiasm of the community to fill the biodigester.

Filling the biodigester with dairy cow dung is carried out through a hole connected to the biodigester construction. The construction of the biodigester in Pudak Kulon is a building that does not allow it to open and close at any time. However, the remaining manure/sludge from the biodigester making process will come out automatically. The biogas succeeded in changing the behaviour of the community in disposing of dairy cow dung into biogas, so that now dairy cow dung does not fill the entire river as before. This change in community behaviour in processing livestock manure is also proven to support SDG 6 (clean water and sanitation). Meanwhile, waste reduction is a manifest function of the Biogas Program where the program maker, that is the Environmental Department, wants or intends to reduce pollution along the river.

Biodigesters manufacturing has the advantage of reducing the pollution due to livestock waste and can produce fuel in the form of biogas and sludge (cow manure left over from the biogas installation) (Nurmalina & Riesti 2010). The sludge can be used as an ingredient for making organic fertilizer for agriculture or plantations. If it utillized optimally, this can increase the productivity and profit of the Pudak Kulon community.

The dysfunction of biogas program

In its implementation, the Biogas Program in Pudak Kulon can be said to be running well, which can be seen from the changes in community behaviour regarding environmental sanitation. However, it is known that not all people have received the program or in other words, it can be said that the program has not been evenly distributed. So far, the digester technology construction model used is the construction building model. The digester construction building model is made of concrete, bricks, cast cement, and so on. It is not manufactured equipment such as fiberglass or plastic. So, the digester construction building that has been made will forever remain in place (not portable). After the construction of the biodigester building is made, the Environmental Department fully hands over the biodigester to be maintained by the program recipient.

The factors that influence the not yet evenness of biogas technology in Pudak Kulon are financial, political, and institutional factors. This is also supported by research on sustainable energy provision in rural Africa (Amigun et al. 2012). Politics and finance that are interconnected in funding biogas are one of the most contributing factors to the not yet evenness of this program. Government budgets have to be divided among several programs at the same time. On the other side, the urgency of environmental sanitation in Pudak area and the villages below it (mountainous topography) cannot be delayed any longer.

Ritzer & Stepnisky (2019) wrote on the part of Functional Structuralism Theory in the Teori Sosiologi Modern Edisi 8 book (which has been translated into Indonesian language) that is important to note that one social fact can have negative consequences on another social fact. To correct this serious omission in the structural functionalism of beginnings, Merton developed the idea of dysfunction. This view reinforces the results of this study that although the Biogas Program in Pudak Kulon is running well. This view reinforces the results of this study that although the biogas program in Pudak Kulon is running well, it has undesirable consequences/dysfunctions in the form of uneven programs and the presence of the potential corruption.

The community's enthusiasm for the Biogas Program is relatively high, that bringing opportunities to corruption for unscrupulous individuals. The people of Pudak Kulon are still thick with eastern values such as "returning the favour". The sense of returning the favour is shown through giving something to people who have helped them. Giving in the form of money and promises to do an act that results in profit for himself or others related to the position he holds at that time is a form of corruption (Berek & Fridolin in Riawati 2015). In the community in Pudak Kulon, there was a helper for people who could not make a biogas proposal due to his limited knowledge of computer technology. The party helped in making the proposal and submitting it to the Environmental Department. After the proposal is approved, the biogas recipient and the party who submitted the proposal are called to the Environmental Department Office to take care of the acceptance letter and signatures. The Environmental Department also provides some money for Biogas Program recipients. The money was later used as wages for the workers who made the biogas pit (while the construction was made by the Environmental Department). However, the money did not reach the recipients of the program because it was requested by the person (who made the proposal). The recipients of the biogas program accepted this. They did not object to the money not reaching them because they thought the money was not worth the benefits of the biogas they would use later. They were already very grateful for being assisted in the proposal-making process because they thought if the proposal is not made so they could not have biogas or they will buy it by themselves for millions. This kind of "reciprocity" that can lead to act (indication of corruption) has become normalized in the community and if all parties are not aware, the culture of corruption will become more rampant. The findings regarding indications of corruption certainly need to be deepened again, given that corruption is a complex subject and requires strong evidence to validate it.

Through the 2022 Indonesian Corruption Watch Report, programs targeting rural communities are indeed more vulnerable to being used as a field of corruption for "small kings" in the village. 26.77% of the total corruption cases handled by law enforcement in 2022 were village corruption cases (Putri 2023). This proves that the government's development style directly supports a culture of corruption (Sasongko & Sulhin 2022). Development projects are implemented from the top to down, with external aid entering the village without active participation from its members (Dadu & Barron et al. 1997 in Sasongko & Sulhin 2022).

Driving factors of the change in community behaviour regarding environmental sanitation

Changes in community behaviour regarding environmental sanitation are encouraged by government support through the Biogas Program. The amount of dung produced in one day by one cow is approximately 10-25 kg (Latief et al. 2014). Meanwhile, the number of cows in Pudak Sub-district is 6247. So, the amount of dung in the river can be estimated at 62,470-156,175 kg/day. The amount of dung is an environmental problem that must be addressed immediately before other environmental problems arise. One way to solve the dung problem is to change the community's behaviour so that they do not throw all their cow dung into the river. This requires supporting factors that can change community's behaviour. Behaviour change for sanitation improvement requires stimulus to demand and motivation to make changes (Kvarnström & Mcconville 2007). Uniquely, the demands of economic factors became a supporting stimulus for changing community's behaviour regarding sanitation in Pudak Kulon.

> "There is already (used for) a lamp in this hamlet. The lamp is like a petromax. The heat from the biogas goes in, and then the light is here (while showing the lamp). This is petromax, if the lamp is like Philips (made by the manufacturer), it can't be used." (Informant MAL).

From that quote, biogas, which is one of the technologies to reduce pollution, can also change the behaviour of the community who initially threw dairy cow dung into the river to process cow dung into energy used as fuel for cooking and also used as fuel for lighting petromax lamps. However, currently the community only uses biogas as cooking fuel. Biogas as a petromax fuel is no longer used due to its difficult maintenance and the practicality of eclectic lights at this time. The use of biogas as cooking fuel for the community is considered functional because biogas fuel can be obtained for free and is renewable. Biogas is very helpful to the community from an economic side because since having a biodigester, they no longer need to buy LPG as fuel which was previously purchased regularly. The money that the community previously allocated to buy LPG, they can now save or allocate/use for other purposes. Therefore, the community's economy will indirectly improve. This proves that biogas is also supports the SDG 8 about economic growth. Economically, the use of biodigesters can reduce household fuel expenditure by 70% (Arruzi & Usman 2016).

Many institutions support businesses with biogas (Arruzi & Usman 2016). Nestlé is one of the parties that supports livestock farming in Pudak with biogas. In addition, the condition of Pudak which is rich in abundant water, green grass, and cool air needs to be maintained so that its natural beauty is preserved even though there are dairy farms that contributed to the increase of animal dung waste.

Inhibiting factors of the change in community behaviour regarding environmental sanitation

The community hopes that the biogas program can be distributed evenly to all farmers. This is because in addition to reducing pollution, biogas also helps the community from an economic perspective. The Environmental Department describes several criteria for biogas recipients, that is: (1) the economic condition of the program recipients; (2) the number of cows; (3) the type of private or corporate business. However, the COVID-19 pandemic has caused the government allocation of funds for biogas to be diverted to other more emergency matters related to the COVID-19 pandemic. The government budget from the regency is posted for many department offices; for example Health Department, Environmental Department, Social Department, and so on. After that, the incoming funds will be allocated by each department into their programs. For example, the funds allocated to the environmental department will be used for programs that exist in each village. Meanwhile, the budget that the Environmental Department has is limited, so they adjust the budget capabilities of the local government. Whereas, this year there are several points that are targeted to receive biodigester technology by the Environmental Department.

Finance is being a limiting factor for Biogas Programs. High capital and lack of financial mechanism rank high among all barriers (Mukeshimana et al. 2021). Finance is also a factor in not yet evenness distribution of Biogas Program assistance to all farming communities. The biogas digester construction program has not been carried out continuously due to high cost of digester construction (Sonbait & Wambrauw 2011).

The uneven distribution of this program due to financial factors from the government is unfortunate because in reality the community is very enthusiastic in welcoming this program. The enthusiasm of the community is partly influenced by the factor of their inconvenience to dispose of dairy cow dung in the river. Meanwhile, if they have biogas, they can comfortably process dairy cow dung into biogas and utilize it, so that cow dung does not accumulate in the river connected to the village downstream. Indirectly, the existence of biogas can prevent the bad feelings of the Pudak Kulon community towards the Sooko community for contributing to the pollution of rivers and waterfall in their area. Public nonconformity can have the manifest and latent functions of changing standards of conduct and values that become dysfunctional for the group (Merton 1968). So, in this case, the uneven distribution of biogas due to government finances has become dysfunctional in this program.

The high cost of making biodigesters and the lack of significant impact on the company also made Nestlé switched from subsiding digesters to subsiding animal feed. This is also due to the high cost of the animal feed, which includes wheat in the dairy cattle feed concentrate. On closer examination, Ukraine is one of the world's largest producers of wheat. Ukraine's recent unstable security and political conditions has also been a factor in the high price of wheat. Therefore, the company diverted funds to subsidise animal feed instead of the biodigester. This is unfortunate given the community's enthusiasm for the Biogas Program.

Conclusion

This study found that biogas program have a function in changing the behaviour of the community with regard to how they disposing, processing, and utilizing the dairy cow dung. These behavioural changes can directly reduce sanitation pollution of the river that flows into the neighbouring sub-district of Sooko. The economic factors contribute the most to changes in community's behaviour regarding environmental sanitation. There are funds saved after they use biogas for example funds to buy LPG gas which can then be saved or used for other purposes. The community realizes that this economic conditions play a vital role in sustainability of their lives and behavioural changes in environmental sanitation. This shows that the environmental and economic systems in farming communities cannot be separated from each other. Both exist and have a real function in changing community behaviour regarding environmental sanitation. In addition, this changes in community behaviour has proven to support the several SDGs that the government has been working towards.

The government also plays an important role in changing the community's behaviour regarding environmental sanitation. Its program provides opportunities for communities to save money that they use to buy household fuel and minimize dairy cow manure that is dumped into the river. In directly, the government has helped the farming community to save money. This is in line with the latent function in the theory used in this article. The government's role in providing a soft loan program provides an opportunity for the community to develop their farms more, thus achieving an increase in community income, which also supports SDG 8 on economic growth. This study can be used by the government to review the regulations of programs targeting village, both the regulations related to program funding and the program regulations themselves. Regulations related to program funding should be tightened because it turns out that even in small environment such as villages, potential of hidden corruption can be found, even though the people in the village do not mind it.

In addition, this research can also be used by those who have problems with environmental sanitation due to livestock waste, as the biogas program has been proven to reduce pollution. The number of SDGs achieved is also a plus point for this biogas program. Positively, the solution to the pollution problem, namely the use of biogas, also involves the community playing a direct and independent role in disposing, processing, and utilizing their livestock dung waste. So that the community's behaviour regarding environmental sanitation is slowly changing for the better. This study is relatively new and discusses the biogas program from a social perspective. However, the findings of this research are quite complex, that it turns out that various systems, for example social and economic systems, are interrelated in changing community's behaviour regarding environmental sanitation. The combination of several unified systems turns out to have contributed to changes in other systems. The findings in this research can be studied in more depth in further research.

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