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Managerial Skills Operations and Waste Treatment Methods to Decrease CO2 Emissions at TPA Bantar Gebang, Bekasi

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The objective of this research is to analyse the effects of waste treatment methods (bio gas versus sanitary landfill) and managerial skills on employees operation waste to the decrease CO2 emission at Bantar Gebang, Bekasi. The method used is the method of ex post facto.Ex post facto is used to examine whether there is influence of the independent variable on the dependent variable through measuring the occurrence of events already in progress, this is seen in the context of the current time without manipulation of the variables studied. The samples of the research were 60 field operators which were selected randomly. The data was analysed by using the Analysis of Variance (Anova) method. Findings of the research are based on the factors of high managerial skills, and a reduction in CO2 emissions in waste treatment technology by using biogas which is more effective than using the sanitary landfill technology. The minimization of CO2 emissions by using biogas technology is more relevant on managerial Final Disposal (TPA) which is supported by a high managerial skills. The factors of low managerial skills, decreased levels of CO2 emissions in waste treatment technology using biogas is lower than using sanitary landfill technology. Minimization of CO2 emissions by using technology more relevant sanitary landfill performed on managerial landfill supported by low managerial skills.

Key words: *CO2Emission, waste treatment methods, and managerial Skills.*
JEL Classification : M21, Q42, Q48, Q55, Q56.

Introduction

According to the collected data, one of the problems in Indonesia is waste from housing complexes and other non-housing areas. Over a three year period in 2008, the pollutant volume showed 29.413.336 m^3/year or 44 % on Java island and 916.163 m^3/year or 18 % from Kalimantan. In 2008, it showed that 22.2 million/year or 58 % of the rubbish volume came from housing waste. Especially in 2009, from the Jakarta Capital City Government or DKI Jakarta (Steinberg, 2007).

The number is increasing to 6.594,72 ton/day, and it is predicted that the number is going to continue to increase to 7200 ton/day in 2020. During this time, waste in Jakarta was dumped in Final Disposal (TPA) Bantar Gebang in Bekasi, which is built on an area of 110.5 hectares. The TPA has been managed by PT. GTJ since 1989. Up until now, the number of employees which was established by the cooperation between the province of DKIgovernment and the government of Bekasi City. Bantar Gebang TPA can accommodate to the DKI garbage to a volume of approximately 7,400 tonnes per day, compared to only 6,000 tons per day before. Garbage is managed by the system of Sanitary Landfill, composting and recycling (Ho, Chen, Lee, & Chang, 2011).

However, it cannot be denied that there are problems that have arisen with the presence of TPA Bantar Gebang Bekasi. Their solid waste causes environmental pollution, due to not having a waste burning process, this can interfere with human health. The inability of the managerial aspects in processing waste can be seen in the lack of accountability and uncooperative behaviours between directors, staff, officials, and the parties involved in the organization of the company (Gregg, Andres, & Marland, 2008).

All aspects involved in the enterprise are quite dominant factors in inhibiting the reduction in CO_2 emissions, in addition to waste management systems that are less effective. Likewise with both methods of waste processing, namely: methods of Sanitary Landfill and Biogas, both yet unknown level of his efficient in lowering CO_2 emissions. The situation is becoming critical to assess the effects of the methods of processing waste in Sanitary Landfill versus Biogas for the decrease of CO_2 emissions (Hasan, Mahlia, & Nur, 2012; Jensen, Martini, & Schwartz, 2001; Tiffany, Nelson, Tilman, Hill, & Polasky, 2006).

In the context of this regulation TPA Bantar Gebang is expected to meet the health requirements, especially in terms of CO_2 emissions . The problems in research include: 1) Is there a difference in the reduction in CO_2 emissions of waste between Biogas and Sanitary Landfill Technology?; 2) Is there an interaction effect between waste Treatment methods and managerial skills to the reduction of CO_2 emission levels?; 3) Based on the category of high managerial skills, whether the reduction in CO_2 emissions by the method of Biogas

Technology is higher than the Sanitary Landfill Technology?; and 4) Based on the category low managerial skills, whether the reduction in CO_2 emissions by the method of Biogas Technology is lower than Sanitary Landfill Technology?. The aim of research is to determine/produce the reducing number of CO2 emissions with biogas technology methods and Sanitary Landfill technology (Rao & Rubin, 2002).

Literature Review

Studies on the reduction of CO_2 emissions found that CO_2 is a heavy, colourlessgas, that is produced by the burning and the decomposition of organic material and products that have been processed chemically. These gases from the smoke are inhaled and expelled. This gas will not burn and is relatively non-toxic and non-reactive. This gas can cause a contaminated environment because oxygen is not present in large concentrations. A reduction in CO_2 emissions can be explained by the concept of efficiency. Efficiency is the acquisition of output as much as possible and the smallest amount of input by working precisely because of input scarcity of human resources, money, and equipment (Andersen, Mathews, & Rask, 2009; Ho et al., 2011; Rao & Rubin, 2002).

Efficiency means the use of material resources and energy as efficiently as possible to meet human needs so that nothing is wasted and turned into waste. Metabolic systems that efficiently apply the concept of how all forms of waste material flow when no pollutants are discharged into the environment and can also be used by nature itself (Demirbas, 2009; Matzen & Demirel, 2016; Tiffany et al., 2006).

In the research of waste management , the researchers focused on the following five aspects: (1) organization and management of aspects, (2) Financing aspects, (3) Setting aspects, (4) the role of community aspects and, (5) operational technique aspects. On the operational aspects, particularly distinguished on the type and method of waste processing. Significant decadal channel change 58–67years post-dam accounting for uncertainty in topographic change detection between contour maps and point cloud models. Biogas Technology is a modern, technology-oriented approach to shape the ecology by decay of organic material formed by putrefactive bacteria at a stable temperature. Combustion CH_4 and CO_2 are generally formed to produce biogas and slurry in the digester (Ho et al., 2011).

Biogas is defined as a methane or gas, usually produced from a bio-mass formation anaerobic digester. Biogas can be used to transport fuel to the fuel gas in the engine, produce heat, move industrial machinery and heat water. Biogas Technology is one of the treatments of waste that can eliminate or reduce air pollution, wherein the gas is combustible or flammable produced from the fermentation of organic materials by bacteria anaerobic i.e., bacteria that live in conditions of hermetic. Therefore, Biogas Technology is the processing of organic

materials that produce gas, to eliminate/reduce air pollution (Yu, Curcic, Gabriel, & Tsang, 2008).

Sanitary Landfill Technology is a system designed and built to flush solid waste into the ground and it is then covered with soil again, to minimize and removal environmental contaminants. The decomposition of the waste sanitary landfill will reduce methanogenic microbes, CH_4 and CO_2 are gradually decreased, resulting with the rise in oxygen levels again. CO_2 is a greenhouse gas (GHG) in the atmosphere, with other greenhouse gases namely: methane (CH_4) and nitrous oxide (N_2O), that determine the air temperature increase. The greenhouse gases withstand longwave heat radiation so that the heat causes the symptoms of raised earth as global warming (global warming) (Demirbas, 2009; Park, Pandey, Tyagi, & Tyagi, 2014; Yu et al., 2008).

Incoming solar radiation to the earth in the form of shorter waves that penetrate the Earth's atmosphere are then turned into a long wave when it reaches the Earth's surface. After reaching the Earth's surface, some waves are reflected back into the atmosphere to heat radiation that is retained in the atmosphere (Gerpen, Shanks, Pruszko, Clements, & Knothe, 2004).

In the aspect of managerial skills, these skills refer to an ability or skill an individual has in performing special tasks. As decision makers, executives use three basic skills that were called technical expertise, human and conceptual skills. The skills consist of three types of membership as follows: 1) Technical skills include the ability to use methods, tools and techniques involved in carrying out special tasks; 2) human expertise above shows the ability to work effectively with others, such as understanding the feelings of others and respecting others, including their subordinates; 3) Conceptual skills including intelligence, verbal ability, and the ability to see the entire company or organization as a unit operation. It can be synthesized that the purpose of managerial skills is an ability to carry out operational duties with respect, the ability to use the tools, procedures and techniques to work together, work at motivating others, and understanding all of the activities of the interests of the organization concerned (Wang & Lutsey, 2014).

Method

This research was conducted in Bantar Gebang in Bekasi, West Java, which is under the management of PT Godang Tua Jaya and PT NOEI. Both companies are conducting modern and conventional waste processing. Processed waste sources were taken from locations in the greater Jakarta area. Research activities in the field were carried out for 3 months from September 1 to 30 November 2011.

The method used is ex post facto, accordingly, ex post facto is used to examine whether there is influence of the independent variables on the dependent variables through measuring the occurrence of events already in progress that is seen in the context of the current time without manipulation of the variables studied. The research design ex post facto study by level 2 x 2 can be described as follows table 1:

Table 1: Desain *Ex Pos Facto by Level* 2 X 2

Managerial Skills (B)	**Waste Processing Method (A)**	
	Biogas Technology (A_1)	***Sanitary Landfill* (A_2)**
High Managerial Skills (B_1)	A_1B_1	A_2B_1
Low Managerial Skills (B_2)	A_1B_2	A_2B_2

The population in this research is the operational employees of waste PT Godang Tua Jaya and PT NOEI, respectively 56 people from each company were taken at random for the sample, making up the total number of 112 people. Of the respondents who have downloaded the measuring instrument, responsible managerial skills are compiled by ranking the samples from highest to the lowest. The sample is taken to meet the high managerial skills variable categories (ranking above) and managerial skill Pilan low (low raking), then set out with the proportion of 27%. With these proportions, the obtained number of samples data was analyzed for the top group or under group is 0.27 x 56 = 15.2 (set 15 samples). The results of this study were analyzed using a two-way analysis of variance (two-way ANAVA). ANAVA two lanes used for experimental research consists of two independent variables by level in table 2,3, and 4.

Table 2: Raw of Data for Result Testing, CO_2 Emission Decrease of Data each Group

Waste Treatment Methods (A) / **Managerial Skills (B)**	**Anaerob Digester Technology (A_1)**	***Sanitary Landfill* Technology (A_2)**
High Managerial Skills	38,40 37,80 38,10 38,30 38,70 45,50 45,00	31,10 31,10 31,80 31,60 29,60 30,10 31,20

(B_1)	40,00 43,30 43,90 43,20 40,00 43,45 44,41 44,20	33,30 34,29 34,40 35,00 35,30 36,60 35,50 36,00
Low Managerial Skills (A_1)	33,60 31,50 28,10 30,20 32,20 31,20 30,70 28,50 30,20 29,00 27,30 28,50 28,80 27,80 28,60	31,50 30,50 29,10 29,80 30,10 30,20 29,70 29,10 31,20 31,00 30,30 30,50 29,50 28,90 30,60

Table 3: Raw of Data for Result Testing, CO_2Emission Decrease of Data for A_1B_1 dan A_2B_1 Group

Waste Treatment Methods (A) / **Managerial Skills (B)**	**Anaerob Digester Technology (A_1B_1)**	***Sanitary Landfill Technology* (A_2 B_1)**
High Managerial Skills (B_1)	38,40 37,80 38,10 38,30 38,70 45,50 45,00 40,00 43,30	31,10 31,10 31,80 31,60 29,60 30,10 31,20 33,30 34,29

	43,90 43,20 40,00 43,45 44,41 44,20	34,40 35,00 35,30 36,60 35,50 36,00

Table 4: Raw of Data for Result Testing, CO_2 Emissions Decrease for A_2B_1 dan A_2B_2 Group

Waste Treatment Methods (A) / **Managerial Skills (B)**	**Anaerob Digester Technology (A_2B_1)**	***Sanitary Landfill* Technology (A_2 B_2)**
Low Managerial Skills (B_2)	33,60 31,50 28,10 30,20 32,20 31,20 30,70 28,50 30,20 29,00 27,30 28,50 28,80 27,80 28,60	31,50 30,50 29,10 29,80 30,10 30,20 29,70 29,10 31,20 31,00 30,30 30,50 29,50 28,90 30,60

Results and Discussion

Results

The results of the study on the first hypothesis testing is to obtain empirical evidence in answer to the first hypothesis, namely:

$H_0 : \mu_{A1} \leq \mu_{A2}$
$H_1 : \mu_{A1} > \mu_{A2}$

ANOVA calculation results for the first hypothesis test result can be summarized in the following table 5:

Table 5: Summary of Two-Way ANOVA Test Method Effect of Waste Management and Managerial Skills against CO2 Emissions Levels

Variance Source	**dk**	**JK**	**RJK**	**F_{hit}**	**F_{tabel}**	
					α=0,05	α=0,01
Model Corrected	3	1370,127	456,709			
Intercept	1	67976,370	67976,370			
Waste Processing Method (A)	1	245,511	245,511	55,839	4,20	7,72
Managerial Skills (B)	1	829,932	829,932	188,761		
Int. A x B	1	294,684	294,684	67,023	1,00	7,08
Fallacy	56	246,218	4,397			
Total	60	69592,715	-			

Information:

df = degrees of freedom.
JK = sum of squares
RJK = Average Number Squares.
Int. = Interaction.
**) = Very significant (α = 0.01) .

From Table 5, was the obtained price of F = 55.839 ** > F0,95 (1,56) = 1.00. This result means reject Ho at a significant level of 0.05. Thus, it is found that the first hypothesis test is the average level of CO_2 emissions in waste treatment technology using biogas is higher than using sanitary landfill technology tested with very significant results.

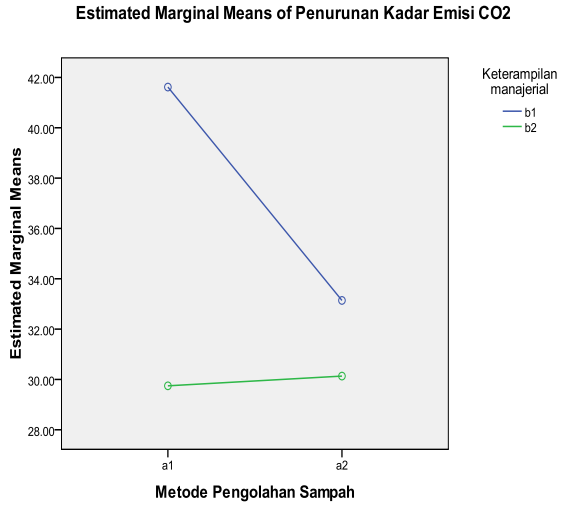
Results of research on the second hypothesis testing to obtain empirical evidence in response to the second hypothesis, namely:

H0: Int . A x B = 0
H1: Int . A X B ≠ 0

Table 5, the second hypothesis test results, the source column variance on line Int. A X B can be obtained F0,95 prices (1,56) = -1.00 < Fhit = 67.023 ** > F0,95 (1,56) = 1.00. This result

means reject Ho at significance level of 0.05. Thus, it is found that in the second hypothesis test there is an interaction between the effects of waste processing methods and managerial skills to the CO_2 emission levels tested with very significant results. The interaction between waste treatment methods and managerial skills against emissions decreased levels of CO_2 can be shown in graphical form as follows Figure 1:

Figure 1. Graph Effect of Interaction between Waste Management Methods and Managerial Skills on CO2 Emission Levels



Results of research on the third hypothesis testing to obtain empirical evidence in response to the third hypothesis, namely:

$H_0 : \mu_{A1B2} \leq \mu_{A2B1}$
$H_1 : \mu_{A1B2} > \mu_{A2B1}$

By using the Tukey test, the hypothesis testing results can be summarized the results in the following table 6:

Table 6: Summary of Tukey Test Results Effect of Waste Processing Method Based on Managerial Skills Levels CO_2 Emissions

Variance Source	**dk**	**JK**	**RJK**	**F_{hit}**	**F_{tabel}**	
					α=0,05	α=0,01
Model Corrected	1	539,074	539, 074			
Intercept	1	41914,194	41914,194			
Waste Processing	1	539,074	539,074	78,678**	4,20	7,84

Method ((A)						
Fallacy	28	191,847	6,852			
Total	30	42645,115				

Information:

df = degrees of freedom.
JK = sum of squares.
RJK = Average Number Squares.
Int . = Interaction .
**) = Very significant (α = 0.01) .

Table 6, the price obtained F_{Cal} = 78.678 ** > F 0,95 (1,28) = 4.20. This result means H_o was rejected with the significance level of 0.05. Thus, a third study that was is based on high managerial skill categories, that CO_2 emissions in waste treatment technology that uses biogas is higher than using sanitary landfill technology, tested with very significant results. Results of research on the fourth hypothesis testing to obtain empirical evidence, that is:

$H_0 : \mu_{A2B1} = \mu_{A2B2}$
$H_1 : \mu_{A2B1} < \mu_{A2B2}$

By using the Tukey test, the hypothesis testing results can be summarized the results in the following table:

Table 7: Summary of Tukey Test Method Effect of Waste Management (Managerial Skills based on CO2 Emission Levels empirical evidence)

Variance Source	**dk**	**JK**	**RJK**	**F_{hit}**	**F_{tabel}**	
					α=0,05	α=0,01
Model Corrected	1	1,121	1,121			
Intercept	1	26892,108	26892,108			
Waste Processing Method ((A)	1	1,121	1,121	0,577^{ns}	4,20	7,84
Fallacy	28	54,371	1,942			
Total	30	26947,600				

Information:

df = degrees of freedom.
JK = sum of squares.
RJK = Average Number Squares.

Int . = Interaction .
**) = Very significant (α = 0.01) .

Table 7, the price obtained F_{Call} = 0.577 < F 0,95 (1, 28) = 4.20. This result means a rejected H_o at a significance level of 0.05. Thus, the findings of the study can be obtained by a category that managerial skills are low, and levels of CO_2 emissions in waste treatment technology using biogas is lower than using sanitary landfill technology tested very significantly.

Discussion

The first finding, namely: the average CO_2 emission on the processing of waste Biogas Technology is higher than at the sanitary landfill technology. The first finding is not inconsistent with the principle that CO_2 emissions cannot be separated by material and energy processing. CO_2 emission can be achieved by the use of methods of waste management and sanitary landfill technology and continued with the use of biogas technology, and it can be manufactured in such a way at minimum cost so that high levels of CO_2 emissions be converted into biogas energy. With the technology, CO_2 emissions can be reduced by up to 30-45% (Gregg et al., 2008).

The use of biogas technology, where application of the manufacture of gas in the digester can reduce air emissions. The composition of most of the biogas containing methane (CH_4) and CO_2 and some minor compounds that include hydrogen sulphide (H_2S), ammonia (NH_3), Hydrogen (H_2) and nitrogen (N). The content of biogas consists of 60% CH (methane), 38% CO_2, 2% N_2 and hydrogen and other gases. The formation of biogas in waste as application digester gas technology tools effectively prevent the emission of CO_2 released into the environment. This condition is reinforced by the chemical composition of the biogas itself, which turned out there in bind CO_2 along with methane gas (CH), hydrogen sulphide (H_2S), ammonia (NH3), Hydrogen (H_2) and nitrogen (N). Thus, research findings state that the levels of CO_2 emissions on the processing of waste biogas technology is higher than with the use of sanitary landfill technology, enriching the knowledge about the effectiveness of biogas technology in terms of generating bio gas (Brennecke & Gurkan, 2010).

The findings of the second study, namely: there is an interaction effect between the method of waste treatment with managerial skills to the levels of CO_2 emissions on the processing of waste biogas technology that is higher than with the sanitary landfill technology. The influence of this interaction incompatible with the use of technology, system technology utilization showed a touch of several technologies that can cope with waste processing in order to make it environmentally friendly (Chang, Fu, & Luo, 2012).

Biogas technology with the Jenbacker engine is a large-scale technology that has been used by companies that deal with waste management in Bantar Gebang Bekasi. A set of equipment/materials or components that support a large-scale machine temperature that works in the Jenbacker machine is temperature. Digester requires managerial skills in the lawyer-operational. In the essence of the managerial capabilities using biogas technology, it is the ability to understand and apply the methods, processes, procedures and techniques for using biogas technology. The ability to use technology for the biogas process is carried out through a collaboration with another person or another individual as a member of a group of organizations (companies). Thus, the findings of the study as described above, it can be seen that the influence of biogas technology and technology sanitary landfill to CO_2 emission levels should also be seen from the factor of managerial skills (Martinot, Chaurey, Lew, Moreira, & Wamukonya, 2011).

The findings of the third study, namely: the average CO_2 emissions on the processing of waste biogas technology is higher than at the sanitary landfill technology. The findings from the third study provide a more specific finding that under the managerial skills of high levels of CO_2 emissions on the use of biogas technology is higher than the use of sanitary landfill technology. High levels of CO_2emissions are supported by research conducted by (Gerpen et al., 2004; Olah, 2013), on the conversion of biogas technology, indicating that the biological conversion process can be achieved by means of anaerobic digestion (biogas) or land landfill (landfill). Levels of landfill technology at an early stage aerobic process produces approximately CH_4 and CO_2 (30-45)% and in the process anaerobic clicking methane gas produced approximately 50-70% (Hunt & Derozier, 2004; Richter, 2013; Williamson, 1967).

These managerial factors described that a good manager has the technical skills and conceptual skills, and motivation to manage. In the management system, all managers must have the abilities or skills on the respective fields in order to work effectively (Gregg et al., 2008). Its capabilities include: 1) Expertise conceptual (conceptual skills) is the cognitive ability to see the organization as a whole and the interrelationship among its parts. This involves a conceptual thinking manager, information processing and planning capabilities. This means the ability to think strategically with a broad view and a focus onlong-term results; 2) Skilled humans (human skill) is the manager's ability to work with and through others, as well as being able to work effectively as a member of the group by getting in touch with others, including the ability to motivate, facilitate organizing, directing, communicating and resolving conflict, as well as allowing subordinates to express themselves and encourage participation; 3) Technical skills (technical skills) is understanding and fluency in performing certain tasks which include mastery of methods, techniques and equipment used in certain functions, such as engineering or manufacturing. Managers who had high managerial skills in the use of processing waste technology-oriented use of biogas technology in comparison with the sanitary landfill technology. Biogas technology has significant absorption and

economically use more effective and efficient if supported by a high managerial skills (Ripoll-Bosch, de Boer, Bernués, & Vellinga, 2013).

The fourth research findings, namely: the average CO_2 emissions in waste management with biogas technology is lower than at the sanitary landfill technology. This fact confirms that, the operation of modern technologies such as biogas technology will not necessarily be effective when not supported by the operator under the control of managers with high managerial skills. In some conditions the managerial system is not supported by a high managerial skill, the more appropriate sanitary landfill technology is used in the management of CO_2 emissions. Technologically, sanitary landfill is recognized also effectively used in sewage treatment. This is described by Noriko (1999: 125), that the processing of waste sanitary landfill method is considered the most effective, when seen from the three existing ideas, namely: the emergence buried, burned, and sanitary landfill. Culling waste sanitary landfill is to remove and piled garbage into something that is at a concave location, compacting the trash then closing it with soil. This method can eliminate air pollution and emission levels of about 20-30% CO_2. (Brennecke & Gurkan, 2010; Ho et al., 2011; MWE, 2007).

Conclusion

Based on the results of research and discussion can be concluded as follows:
The first is, the average reduction in CO_2 emissions in waste management with biogas technology is higher than only using sanitary landfill technology. Secondly, there is the effect of the interaction between waste treatment methods and managerial skills to the reduction of CO_2 emission levels. Minimization of CO_2 emissions by using biogas technology or technology sanitary landfill are determined by factors of managerial skills, both high or low managerial skills. Third, based on the factors of high managerial skills, reduction in CO_2 emissions in waste treatment technology using biogas is higher than using sanitary landfill technology. Minimization of CO_2 emissions by using biogas technology more relevant done on managerial Final Disposal (TPA) which is supported by a high managerial skill. Fourth, based on the factor of low managerial skills, decreased levels of CO_2 emissions in waste treatment technology using biogas is lower than using sanitary landfill technology. The minimization of CO_2 emissions by using technology more relevant sanitary landfill performed on a managerial landfill supported by low managerial skills.

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