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Management and Employees Perception Analysis on Sugar Industry Waste Management Based on Cleaner Production

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Abstract :
The analysis of management's and employees' perceptions is needed to create strategies and policies on sugar industry waste management based on cleaner production, to reach the concept of cleaner production by reusing, reducing, and recycling waste. The research's scope is analyzing management's and employees' perceptions toward cleaner production principles, that includes Good Housekeeping knowledge aspects, environmental aspect, social-institutional and economical aspects. The aim of the research is to get strategies and policies on sugar industry waste management based on cleaner production, based on management's and employees' perceptions toward the application of waste management based on cleaner production at sugar industry. The research was done in Sei Semayang Sugar Factory, Kwala Sugar Factory, and Tjoekir Sugar Factory. Primary data was tested by Alpha Cronbach and Lickert ordinal scale transformed into interval scale using Successive Interval method. To understand the connectivity between variables, multiple linear regression analysis was used, using SPSS 11.5, and then descriptively analyzed. Analyzing Sei Semayang Sugar Factory's management's and employees' perception toward cleaner production results in the knowledge that technical aspect is an influential aspect in factory's efficiency and waste management. Kwala Madu Sugar Factory management's and employees' perception is that environmental aspect, Good Housekeeping aspect, technical aspect, and knowledge aspect, are influential toward sugar industry waste management. While Tjoekir sugar factory management's and employees' perception is that social institutional and economical aspect is the influential aspect toward sugar industry waste management. Sugar industry waste management based on cleaner production strategy based on management's and employees' perception is an integration between technical aspect, environmental aspect, Good Housekeeping aspect, and social institutional and economical aspect.
Keywords :
sugar industry; waste; managements' and employees' perception; cleaner production

I. Introduction

Sugar industry gives large benefit and profit to community and economy. The economical benefit is because sugar is one of the strategic commodity in Indonesian economy. Sugar industry is also one of the main income source for 900 thousands farmers, with more than 1,3 million labors involved. Because sugar is a primary need, sugar price dynamics directly influence inflation rate in Indonesia (Sukria and Krisnan, 2009).

Besides giving positive effect, sugar industry can also give negative effects toward the environment. This is related to the sugar industry waste, ranging from liquid waste to the large amount of air emission. If not treated or recycled correctly, sugar industry will face challenges in the form of environmental pollution from the resulting waste. The amount and level of sugar industry's waste must be controlled carefully, starting from starting from the harvesting the sugar cane on the field to the processing of the sugar cane into sugar in the factory.

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When used as fertilizer, plant leftover and kettle ash that contains high level of organic material can increase production and reduce environmental pollution. Research reported that using the decomposition and accumulation of mud, vinasse, and plant leftovers give a very good result for the need of organic material to increase sugar cane production (Ou Yang et al, 2004; Lu, 2007, Zhu et al, 2007).

Researches of Tang, Qi Zhan et al (2008) reported that the using of mud, vinasse and leaves, roots and under-ground cane stalk increases bacteria, actynomicetes and fungi in earth. The nutrients from the organic fertilizer increases fertilizer efficiency by increasing microbe activity and earth carbon quantity.

Various researches show sugar factory's waste or byproducts have the potential to be minimized, including reducing water, energy and additives. Reducing waste production will reduce waste processing cost. Industrial environment management, including sugar industry, can be done using proactive approach, and curative approach, that use cleaner production principles (National Ministry of Environmental Affair, 2006).

From observation in the field, sugar industries in Indonesia have used cleaner production in some regards by reusing wastes, but it's still not optimal. The application of cleaner production will benefit industries, because it will reduce costs, and gives better environmental performance. The application of cleaner production in an industrial area can be used as an approach to actualize Environmentally Minded Industrial Area (Purwanto, 2005). Besides giving positive impact, sugar industry can also give negative impact to the environment. This is related to the resulting wastes, ranging from solid waste, liquid waste, to the big amount of air emission. These wastes if not treated or recycled correctly will challenge sugar industry, in the form of environmental pollution.

According to Indastri and Fauzi (2009), cleaner production is needed to harmonize environmental protection and development or economical growth, prevent environmental pollution, maintaining and strengthening economical growth in the long run, preventing or slowing environmental degradation process, utilizing natural resources by the application of waste recycling, and strengthening product competitiveness in the international market.

To obtain the strategy and policy of sugar industry waste management based on cleaner production, community and sugar factory managements' and employees' perception analysis is needed, as an effort to get the cleaner production concept. Waste management based on cleaner production by reusing, reducing, and recycling waste will become income source for the surrounding community and employees, and reduce environmental pollution.

The scope of the research on waste management based on cleaner production is to analyze managements' and employees' perceptions toward cleaner production concept. The perception analysis is based on cleaner production principles that includes knowledge aspect, Good Housekeeping (GHK) combined with sustainable development aspect, environmental aspect, socio-cultural aspect and economical aspect. The aim of the research is to obtain strategy and policy of sugar industry waste management based on cleaner production based on management's and employees' perception toward the application of industrial waste management based on cleaner production.

II. Research Method

The research was done in January-November 2012. Primary data collection of management and employees' perceptions was done using questionnaire. Research population was employees' of Sei Semayang Sugar Factory and Kwala Madu Sugar Factory, PT Perkebunan Nusantara II in North Sumatera, and Tjoekir Sugar Factory, PT Perkebunan Nusantara X in East Java, Indonesia. Research sample was management's and employees' of Sei Semayang Sugar Factory, Kwala Madu Sugar Factory and Tjoekir Sugar Factory that were grouped by their operational work type in the factory.

Sample amount was determined using Taro Yamane's formula (in Israel, 1992), as follows:

n = sample amount;
N = population amount;
e = confidence level – 10 %

Data tabulation and processing result from each correspondent' answers then got its validity tested using Cronbach's Alpha test (Lowry, 1999), then the Lickert ordinal scale transformed into interval scale using Successive Interval method (Maranell, 2007).

Cronbach Alpha test with the formula:
α = Alpha Cronbach Coefficient
N= Item amount
r = correlation mean

To further understand the dominant variables that have positive effect on sugar industry waste management based on cleaner production that synergizes with management and employees' perceptions, multiple linear regression analysis with SPSS 11.5 was used.

In this research, the variables used are independent variables and dependent variables. Independent variables are noted with the notation x, and dependent variables with the notation y. Variable identification for management's and employees' perception analysis as follow:

Y : Sugar Industry Waste Management Based On Cleaner Production.
X1: Knowledge Aspect
X2: Environmental Aspect
X3: Technical Aspect
X4: Social, Economical, and Institutional Aspect
X5: Good Housekeeping Aspect
X6: Commitment Aspect.

The analysis used in this research was multiple linear regression analysis with multiple regression formula to find out the effect of management's and employees' perception in sugar industry waste management based on cleaner production as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta k X_k + \varepsilon$$

Y = Dependent Variable (Sugar Industry Waste Management Based On Cleaner Production)
β0 = Regression Constant
β1, β2, β3....= Regression Coefficient for Independent Variable
X1, X2,X3... = Free Variables.

III. Result and Discussion

Someone's perception to an activity or change depends on how much benefit felt by the community compared to the drawback resulted from the activity. That's why the perception can be different depending on the benefit and drawback that's felt by the community. Even though community's overall perception is positive, the less influential negative perception must still be noted and managed carefully, because it can result in following impacts like restlessness and conflicts. Negative influences can be cumulative, and can be minimalized or eliminated by good policy or management from the company together with local government.

According to Rusmanti (2002) and Sudrajat (2010), perception is how a person views a message or a symbol that's shown to him. In this case, perception is someone's view toward the existence of sugar factory that resulted from his ability to organize his views (Sudrajat, 2010). Following is the descriptive and quantitative explanation of the result of the employees' and community's perception questionnaire about the existence of the field and the factory and the activity related to waste management.

Field and Factory employees' perception toward sugar industry waste management system based on cleaner production was known from respondent's answers, employees' of Sei Semayang Sugar Factory, Kwala Madu Sugar Factory, and Tjoekir Sugar Factory, that's spread proportionally based on the type of work in the field and the factory. The validity result of each question items are valid, with Corrective Item-Total Correlation > r table, as with reability test on 30 questions resulting in 0.862, 0.870, and 0.894 alpha. The validity and reability test results show that all questions can be used to understand management's and employees' perception toward sugar industry waste management based on cleaner production.

The overall percentage of the management's and employees' perception that shows that sugar industry waste management based on cleaner production has good rating in Sei Semayang Sugar Factory is 50,8%, Kwala Madu Sugar factory is 55,0%, and Tjoekir Sugar Factory is 46,7%, while very good rating in Sei Semayang Sugar Factory is 26,6%, Kwala Madu Sugar Factory is 26,8%, and Tjoekir Sugar Factory is 24,3%. Lickert scale points transformed into interval scale using Successive Interval method shows score between Good Enough and Good, that is between 2 and 3. This shows that management's and employees' perception says that sugar industry waste management based on cleaner production has been done well. Summaries of percentages and transformed scale scores can be found in Table 1, Table 2 and Table 3.

Table 1. Sei Semayang's Respondent Management's and Employees' Percentage and Perception Score on Sugar Industry Waste Management System Based on Clear Production

Perception Aspect	**Respondent's Rating Percentage**					**Score**
	VG*	**G2***	**GE3***	**NG4***	**VNG5***	
Knowledge Aspect	7,8	42,2	47,3	2,7	0	2,36
Environmental Aspect	30,7	40,9	19,8	5,8	2,9	2,92
Technical Aspect	29,6	53,1	9,8	5,6	2	2,87
Socio-economical-institutional Aspect	28	56	8,9	6,4	0,7	2,88
GHk Aspect	36,4	54,4	7,1	0,9	1,1	3,18
Commitment Aspect	27,1	58,4	9,8	3,6	1,1	2,84
Mean Score of Overall Aspects	**26,6**	**50,8**	**17,1**	**4,2**	**1,3**	**2,93**

*Very Good, 2*Good, 3*Good Enough, 4*Not Good, 5* Very Not Good

Table 2. Kwala Madu's Respondent Management's and Employees' Percentage and Perception Score on Sugar Industry Waste Management System Based on Clear Production

Perception Aspect	Respondent's Rating Percentage					Score
	VG*	G2*	GE3*	NG4*	VNG5*	
Knowledge Aspect	6,9	46,7	46,2	0,2	0	2,08
Environmental Aspect	27,8	51,6	14,2	6,4	0	2,61
Technical Aspect	28,2	59,8	7,6	2,9	1,6	3,12
Socio-economical-institutional Aspect	27,6	58,7	7,8	6	0	2,8
GHk Aspect	42,9	51,3	4,9	0,7	0,2	3,02
Commitment Aspect	27,3	61,8	8,7	1,8	0,4	2,99
Mean Score of Overall Aspects	**26,8**	**55,0**	**14,9**	**3,0**	**0,4**	**2,89**

*Very Good, 2*Good, 3*Good Enough, 4*Not Good, 5* Very Not Good

Table 3. Tjoekir's Respondent Management's and Employees' Percentage and Perception Score on Sugar Industry Waste Management System Based on Clear Production

Perception Aspect	Respondent's Rating Percentage					Score
	VG*	G2*	GE3*	NG4*	VNG5*	
Knowledge Aspect	11,8	44,7	39,5	3,6	0,4	2,60
Environmental Aspect	27,1	39,8	24,7	1,1	7,3	2,77
Technical Aspect	31,1	41,6	14,9	7,8	4,7	2,91
Socio-economical-institutional Aspect	22,0	50,9	20,9	5,3	0,9	3,22
GHk Aspect	30,4	50,0	15,3	1,6	2,7	3,04
Commitment Aspect	23,3	53,1	16,2	4,0	3,3	2,85
Mean Score of Overall Aspects	**24,3**	**46,7**	**21,9**	**3,9**	**3,2**	**2,94**

*Very Good, 2*Good, 3*Good Enough, 4*Not Good, 5* Very Not Good

The scores and percentages' descriptive analysis scores then significanized and dominized from perception aspects as independent variables of the dependent variables of sugar industry waste management based on cleaner production by multiple regression analysis using SPSS.

Double linear regression analysis result from management's and employees' perception variables toward sugar industry waste management based on cleaner production , using stepwise method with 5% probability, shows that the most dominant independent variables (X) toward the dependent variables (Y) are as follow:

Sei Semayang field and factory management's and employees' perception shows that technical aspect (X3) is the most significant and dominant aspect that influence sugar industry waste management based on cleaner production (Y). Kwala Madu field and factory management's and employees' perception shows that environmental aspect (X2), good housekeeping aspect (X5), technical aspect (X3), and knowledge aspect (X1), successively, are the most significant and dominant aspects that influence sugar industry waste management based on cleaner production (Y). The community around Tjoekir factory's perception shows that social-institutional and economical (X4) aspects are the most significant and dominant aspect.

Then, with F test and t test, significance points of each variable are obtained, each are lower than 0,05. For Sei Semayang Sugar Factory management and employees', X3's significance point is X3=0,047, for Kwala Madu Sugar Factory management and employees', X2's significance point is X2=0,004, X5= 0,0001, X3= 0,004, and X1=0,04. For Tjoekir Sugar Factory management and employees', X4 significance point is X4=0,016. This means simultaneously and partially, each independent variables influence variable Y. Multiple linear regression result

tabulation of management's and employees' perception can be seen in Table 4.

Table 4. Multiple Linear Regression Analysis Result about Management's and Employees' Perception toward Sugar Industry Waste Management Based on Cleaner Production

Place	Model	Coeficient		t Count	Sig.	R^2	R	F
		B	Std Error					
SS	(constant)	283,724	16,895	16,793	0,0001	0,033	0,210	4,056
	X3	-0,135	0,067	-2,014	0,047			
KM	(constant)	3,168	1,803	1,757	0,083			
	X2	0,209	0,07	3,003	0,004	0,331	0,582	44,986
	X5	0,312	0,081	3,833	0,0001	0,474	0,697	41,086
	X3	0,16	0,055	2,928	0,004	0,511	0,726	31,948
	X1	0,152	0,073	2,088	0,04	0,529	0,742	25,986
Tjoekir	(constant)	288,104	15,606	18,462	0,0001	0,054	0,254	6,068
	X4	-1,941	0,788	-2,463	0,016			

The analysis result of Sei Semayang Sugar Factory worker's perception toward waste management based on cleaner production is that technical aspect is the most influential aspect on factory efficiency and waste management. Kwala Madu Sugar Factory employees' perception is that environmental aspect, good housekeeping aspect, technical aspect, and knowledge aspect influence sugar industry waste management. And Tjoekir Sugar Factory employees' perception is that social institutional and economical aspect is the one that influences sugar industry waste management.

Corresponding to the expected aim, the perception analysis at sugar field and factory management's and employees' is to help improving and developing sugar industry waste management. The perception analysis result can help to understand how far the organization works, and the affectivity of the cleaner production. According to Mas'ud (2004), when a company's organization is developing, then the learning system is working in the company, because there are communication activities in the form of information exchanges, and participation in decision making and strategy formulation. Besides that, the survey result can be used for organizational change and development, so the research result can be used to make decisions in the future so the organization can function more optimally. Then, the survey result also can be used as a weighing matter for decision making for better policies, changes and improvement.

From organizational commitment aspect, the cleaner production program leads more to self regulation and self command and control. So the cleaner production program execution doesn't just rely on government regulations, but more on self awareness for attitude and behavioral changes (National Ministry of Environmental Affair, 2009).

According to Djajaningrat (2001) and Salim (2009) there are some alternative factors that influence waste management, that is (1) Good Housekeeping that covers procedural, administrative, and institutional actions that can be used to reduce waste and emission, (2) Changing input material that aims to reduce dangerous and poisonous materials that are used in production process, to reduce dangerous and poisonous wastes, (3) Technological changes that include process and equipment modification with the aim to reduce wastes and emissions, (4) Product changes that include product substitution, product conservation, and product composition change, and (5) On site reuse, that is the attempt to reuse materials in the waste,

both for reusing in starting process, or as input material in other processes.

Generally, concepts that support cleaner production in creating an integrated farming system between socio-cultural, environment, and economical aspect are by maximizing the utilization of organic material from plant waste, field waste, and food industry waste; reducing the use of an organic material as much as possible (National Ministry of Environmental Affair, 2006). Those concepts are related to company management by looking at employees' perception as the implementer of cleaner production program application to optimize sugar industry waste management. This is consistent to Misran's opinion (2005) that the development of integrated sugar industry will give it own meaning in an attempt for zero waste sugar industry.

IV. Conclusion

Research shows that workers have good perception about sugar industry waste management based on cleaner production. Sei Semayang field and factory management and employees' perception shows that technical aspect is the most significant and dominant aspect that influence waste management based on clean production. Kwala Madu field and factory management and employees' perception shows that environmental aspect, good housekeeping aspect, technical aspect, and knowledge aspect, successively, are the most significant and dominant aspects that influence sugar industry waste management based on cleaner production. The management and employees' perception at Tjoekir factory shows that social-institutional and economical aspects are the most significant and dominant aspect. Sugar industry waste management based on cleaner production strategy based on management and employees' perception is an integration between technical aspect, environmental aspect, Good Housekeeping aspect, and social institutional and economical aspect.

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