International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

Managing the Value Chain of Hazardous Waste: A Lesson from an Indonesia Company

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Abstract: ***The purposes of this study were to 1) map the value chain of hazardous waste management, 2) analyze value chain governance an Indonesiancompany. This research used the descriptive method that used value chain analysis, value chain governance analysis, gap analysis. Based on value chain analysis, there are nine actors in the whole hazardous waste management value chain in PT XYZ: operational raw material suppliers, 3rd party logistic supplier, recycle facility, transporter, collector, utilizator, processor, microcapsule facilitator and generator of hazardous waste. The relationship between PT XYZ and the operational raw material supplier is modular, between PT XYZ and 3rd party logistic supplier is captive, and between PT XYZ and the recycle facility is more likely modular. The results of gap analysisare some attributes that are still below the average likerecycle facility with the type of waste to be treated, landfill treatment which has competitive prices, the collector who has a competitive price and processor which has speed of processing time, the transporter that has the accuracy of the transport time, recycle facility processors, and the transporterhave competitive prices.***

Keywords: hazardous waste management, value chain, hazardous waste map, performance value chain, value chain governance

1.Introduction

Hazardous waste material is the waste of business or activities that usethe hazardous or poisonous material, which due to its characteristic and or concentration and or amount, directly or indirectly can contaminate and or harm the environment or ecosystem, health and the sustainability of human as well as other species (Riani 2012).Considering the risks caused by the hazardous material, the government is trying to manage the hazardous waste thoroughly, integrated and continuously.

The government of Indonesia on October 17, 2014 has issued Government Regulation No. 101 of 2014 about the Management of Hazardous Material Waste Management. Companies as the producer of hhazardous waste are responsible since the wastes are produced until getting processed (from cradle to grave). It can be done through correct internal management as well as ensuring the third party managing the waste meet the regulation and have the competency in managing hazardous material (KLHK 2015).

Companies number of proper participating are likely to increase in the period 2002 to 2016 can be seen in Figure 1.

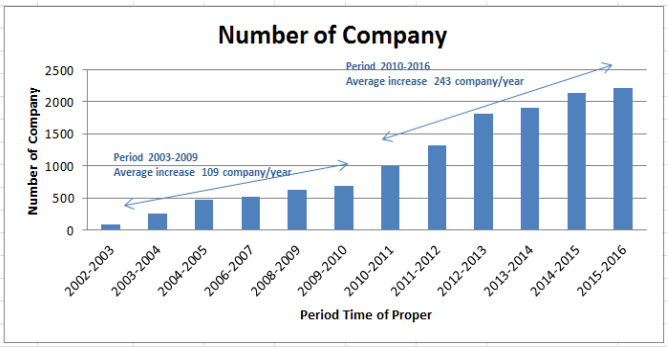

Figure 1 Companies number of Proper participate

Industrial of environmental management in this case waste management treatment is a future business in Indonesia, because in Indonesia is still very open investment opportunities to work on service management and handling of wastes household or industrial products which can certainly generate high profit value both financially and in the aspect of increasing the quality of the environment (KLHK, 2016).

The value of B3 waste managed in 2014estimated at 22.1trillion and predicted increased. Waste management permit application continues to increase in 2011 as many as 525 companies, in 2012 as many as 555 companies, in 2013 as many as 633 companies, and in 2014 as many as 821 company.

With the demand of liability hazardous waste management required by the government, in this term ministry of Environment and Forestry, especially proper management and the increasing amount of hazardous waste to be managed influence the demand of hazardous waste management service by companies, therefore PT XYZ must at all-time observe its company value chain performance so that the waste management service can be optimal.

PT XYZ has positive trend for hazardous waste management service business that increases each year but still facing various problems in value chain in its company, that is the need of value chain mapping from waste management service. Value chainactivityin PT XYZ needs to review the value chain management system. The following are the research problems formulation:

1. How does the value chain mapping implemented in the Hazardous waste management service of PT XYZ today?
2. How are the management and the performance of value chain in hazardous waste management service PT XYZ?

The purposes of this study were to analyze:

1. Mapping the value chain of hazardous waste management.
2. Analyze value chain governance in PT XYZ.

2.Data

The data used are primary and secondary data, both qualitative and quantitative data related to value chain management in PT XYZ. Primary data is collected through in-depth interview and direct observation. Secondary data is collected through literary study, documents from related institutions.

For management and experts, questionnaires given are semi-closed questionnaires, which is the type of questionnaires with questions as well as answer choices, but still enables the open answer. While questionnaires for customers are closed questionnaire. In these questions, the multiple choices are given, so that the respondents only need to answer by selecting one of the answers.

In detail, the data types that are going to be used in this research can be seen in table 1.

Table 1: Research Design

	Data Type	Data Source
Primary Data		
Value chain system of Hazardous Waste Management	Qualitative	Interview
Actor involved in Hazardous Waste Management	Qualitative	Interview, survey
Value chain management performance	Qualitative	Interview
Secondary Data		
The general condition of the actors in the value chain	Qualitative	PT XYZ
Balanced of B3 Waste	Quantitative	SLHI KLHK
B3 Waste management company	Qualitative	SLHI KLHK

3.Methodology

The data collected by purposive sampling technique, respondents are expert respondents and respondents as consumers who use the services of B3 waste management, the selection respondents based on the consideration of expertise, knowledge, and experience, determination of expert respondents in this study is done by non-probability sampling using purposive sampling technique (Reza Satria 2013).Respondents as consumers are 30 companies as the B3 waste management services selected by purposive sampling.

Hazardous waste management value chain in PT XYZ is mapped with a survey and interviews, interviews were conducted in each of the actors involved from operational raw material suppliers, 3PL transporter, collectors, recycling facility, processor, each of the actors studied their role in the value chain. From the results of the mapping will be obtained along the chain map B3 waste management value chain, and then analyzed descriptively with scale Gereffi to know the value chain management (Reza Satriya 2013), for waste management performance used gap analysis (M Aji 2011).

4.Empirical Results

Value Chain Mapping

Value chain mapping is a model used to know the pattern, role, and activities conducted by each business persons in the value chain, in this term is hazardous waste management. Thoroughly, the value chain in hazardous waste management industry is shown in Figure 1.

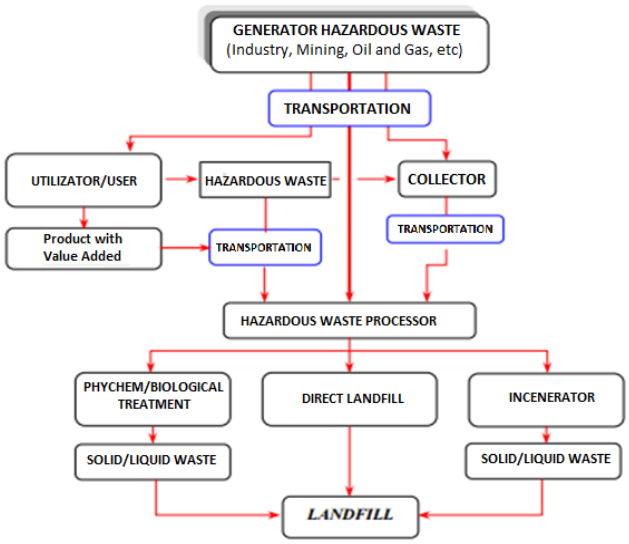

Figure 2 Value chain map waste management industry

Various activities in value chain is to create and increase the added value as well as competitive advantages for business or business persons in a value chain, besides, it is to find out the bargaining positions of each business person in the value chain so that a relation improvement can be made between the actors involved in that value chain if it is true that there are not mutual (Nur Sabrina 2015).

From the result of value chain mapping analysis for PT XYZ as waste management service company, as shown in Figure 2, that the actors involved in the value chain of PT XYZ are 9 actors, with the following detail: operational raw material suppliers, 3rd party logistic supplier, recycle facility, transporter, collector, utilizator, processor, microcapsule facilitator and generator of hazardous waste. The transportation requirement for hazardous waste are not entirely supplied by PT XYZ, because the amount, type and location of waste collection highly varied, therefore the waste transportation is still needed although PT XYZ uses their own vehicle to transport the waste, there are 15 vehicle supplier companies for transporting hazardous waste, each has various type and amount of vehicles from 9 types of hazardous waste transportations, there are 7 types of waste transport vehicles that still use rented vehicles, there are routine vehicle suppliers and ordered supplier when the waste transport order suddenly arise.

Each supplier of the waste transport vehicle has the type and amount of hazardous waste transport in particular area. The type of waste transport vehicles are tankcar and dump truck using PT STM, PT GPB, PT SPD, PT STL, PT BCS, PT SBN, while for TWB and dump truck vehicles using PT SPD, PT MPU, PT SBK, PT DSS, PT TIK, PT GMM, for ISO tank using PT MPC, PT AFI, for hi blow vehicle using PT TIK, for Flat Truck using PT EJ, PT STM, PT GPB, PT STL, PT BCS, PT SPD, PT MPU.

In the process, the vehicle supplier provides the waste transport vehicle with the vehicle types according to the order from PT XYZ and the particular location of the customer. Usually, the vehicle suppliers are already in the area near the hazardous waste collection location and driving to PT XYZ at night.

From the operational material supplier actors, the materialsundergo the processing step done by PT XYZ. In the process, PT XYZ performs operational material processing to process hazardous waste in the particular process to create the result of the processed waste to be forwarded to the next process. Until today, PT XYZ itself has several results of waste processing in the form of synthetic fuel and hazardous material type that is ready to be processed by backfilling or the return of the waste to the river and the processing result that is in the form of materials ready to be utilized.

The companies receiving the processed RF are the companies receiving the result of waste processing by PT XYZ that can perform utilization and further processing of the waste from PT XYZ, one the recipients of the PT XYZ processed waste is PT HIN as the recipient of the waste processing results in the form of synthetic fuel from PT XYZ using Fuel Blending Process. Other utilizing actors are PT NFU and GGA as the recipient of the result of waste processing from PT XYZ in the form of contaminated metal processing result that has been decontaminated. PT DWI and BLD are the utilizers that receive plastic waste processing result. Another recipient of the waste that cannot be processed by PT XYZ is PT IB overseas with the utilization process by separation of mercury compound with the contaminant.

The next actor is the other waste management companies, which are the companies that have the business in the field of hazardous waste transportation, collection, utilization, and processing. Collecting actors handed over the collection result from several customers that do not directly send the waste to PT XYZ.

The collector usually collecting several types of waste from several customers and gathered into one type of waste profile that will be sent to PT XYZ as the processor.

Utilizing actors are the waste management companies by utilizing the waste and the residue sent to PT XYZ because it still contains hazardous material.

Waste transportation actors are waste transport companies that are appointed by the customers/collectors to send the waste to PT XYZ this company can have the role in the process of waste transportation to the waste collection location or waste management location such as PT XYZ.

Customer actor has the role as the recipient of the result from waste management service from PT XYZ. This customer actor can select what services that will be used, by the direct process of one management or through several waste management companies. Regulators/government has the role as supervisor of the Hazardous waste management activities in the value chain of hazardous waste management.

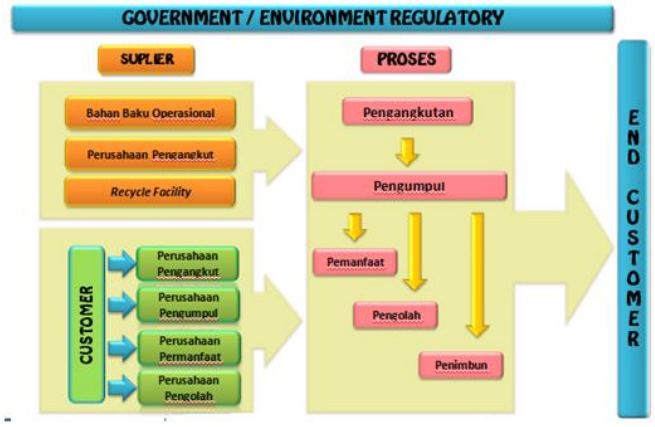

Figure 3: Value chain map PT XYZ

Customer actor has the role as the recipient of the result from waste management service from PT XYZ. This customer actor can select what services that will be used, by the direct process of one management or through several waste management companies.

Regulators/government has the role as supervisor of the Hazardous waste management activities in the value chain of hazardous waste management. Based on the value chain analysis, it can be understood that there are several weak points from the value chain of hazardous and poisonous waste management which are transportation vehicle supplier, processing and utilizing the process.

In the transport vehicle supplier value chain, it is known that the number of each type and area of the collection tends to be fluctuation that made the process of order of type and amount of the vehicles to the vehicle supplier causes the tight deadline from the customer and can cause the quality of the vehicles sent to the customer are not optimal. Several waste transport vehicle suppliers said that the order time are too close to the preparation time so that the amount of the vehicles that can be prepared, the vehicles technical requirements must be according to the requirements, but sometimes the amount and the capacity of the vehicles are not in compliance with the demand.

While the problem of the vehicle supplier are obstructed due to the time estimation of the waste arrival are ate or too soon from the estimated time. In processing step, they also face the obstacle especially in processing when the waste increases more than average volume of 5000 tons/day. Storing process and processing step is demanded to be more optimal.

In the process of waste utilization process, in which the license is owned by PT XYZ but the direct utilization process does not have utilization facility yet, and still depend on Recycle Facility (RF). When RF1 facing disturbance in the utilization process, the waste supply that will be sent from PT XYZ will also decrease, today the tolerance that can be accepted is 1000KL maximum/day for 4-day storage, after that PT XYZ must stop the processing step until the result of the previous processing step can be sent to RF1.

Value Chain Governance

Value chain management depicts the management of relation between various actors involved in one company's value chain (Prayugo 2010), in this term consists of operational material suppliers, transport vehicle supplier, Rf companies, collecting companies, utilizers, processor, transportation and customers. In its process, the determination of value chain management type need to consider several factors, including the complexity of information and knowledge transfer needed to keep the continuity of the transaction, in which information and knowledge can be arranged and authorized efficiently as well as the capability of the supliers both actual or potential in relation to the requirements in transaction.

From three factors that needed to be considered, several attributes are chosen that are considered to be able to represent as the determinant of the value chain such as transaction complexity (transaction intensity, amount of transaction, the use of media for transaction, information and knowledge transfer as well as management control), transaction codification capabilities (arranging new transaction, managing relation with clients, and widening the network), and capability factor of the suppliers (product offering, promotion frequency, promotion variation, and HR quality) (Gerrefi, 2005).

The result of type determination of value chain management for the relation between the operational material suppliers with PT XYZ is presented in table 2. From the table 2, it can be known that the management of value chain in the relation between operational material supplier and PT XYZ is modular value chain, in which the supplier provides more specific material according to what is desired by PT XYZ, it is known from the relatively high amount of three value chain management factors such as transaction complexity that has the value of 3.20, transaction modification that has the value of 3.07 and offering capability is 3.05.

Basically, this modular value chain means that operational material has full responsibility for all amount and type of material standards that covers all process of hazardous and poisonous waste management according to the demand of PT XYZ, so that PT XYZ only need to use the operational material supply according to the need with exact quality and according to the technology used or developing technology.

Table 2: Value chain management for the relation between the operational material suppliers with PT XYZ

		Value
Complexity of Transaction	The intensity of transactions	3.20
	The number of transactions	
	Media of transactions	
	Transfer of information and knowledge	
	Management control	
Ability Codification of Transaction	Planning a new transaction	3.07
	Managing relationships with clients	
	Expand the network of trx	
Offering capability	System of sales	3.05
	Frequency of sale	
	Variationsof sale	
	Quality of human resources	
	Value chain management type	Modular

Description: The <3 = low and Value> = 3 = High

The result of type determination of value chain management for the relation between 3rd party transporter with PT XYZ are presented in table 3.

From the table 3, it can be known that the management of value chain in the relation between 3rd party transporter and PT XYZ is captive value chain, is like the mutual dependence of the suppliers of raw materials operational mainly for B3 transportation vehicles certain type (dumptruck, flatdeck, hi blow tank) and in certain regions to continue to supply vehicles transportingB3 waste to the PT XYZ, especially with the growing waste management thereby making XYZ needs a supply of B3 waste transporter vehicle that is continuous every day to keep the level of productivity of XYZ.

In addition, with the cooperation contract held between XYZ and suppliers vehicles B3 waste, making the level of capability of offers from suppliers of transport vehicles B3 waste into low and creating constraints of both parties to cooperate with the other party, this is the case because the current state of any party suppliers B3 waste transportation vehicles are still not able to fully meet the demand of PT XYZ, so XYZ need to find vehicles other B3 waste as an alternative to meet the needs of the transport vehicle supply B3 waste every day.

Table 3: Value chain management for the relation between the 3rd party transporter with PT XYZ

		Value
Complexity of Transaction	The intensity of transactions	3.20
	The number of transactions	
	Media of transactions	
	Transfer of information and knowledge	
	Management control	
Ability Codification of Transaction	Planning a new transaction	3.00
	Managing relationships with clients	
	Expand the network of trx	
Offering capability	System of sales	2.95
	Frequency of sale	
	Variations of sale	
	Quality of human resources	
	Value chain management type	Captive

Description: The <3 = low and Value> = 3 = High

The results of the determination of the type of value chain management for the relationship between the company receiving RF processing results with XYZ shown in Table 4.

Table 4: Value chain management for the relation between recycle facility with PT XYZ

		Value
Complexity of Transaction	The intensity of transactions	3.36
	The number of transactions	
	Media of transactions	
	Transfer of information and knowledge	
	Management control	
Ability Codification of Transaction	Planning a new transaction	3.27
	Managing relationships with clients	
	Expand the network of trx	
Offering capability	System of sales	3.05
	Frequency of sale	
	Variationsof sale	
	Quality of human resources	
	Value chain management type	Modular

Description: The <3 = low and Value> = 3 = High

From Table 4, it is known that the type of value chain governance on the relationship between the company receiving the results of the processing of the RF with XYZ is modular value chain, where suppliers provide the type Recycle Facility more specific and with a technology tailored to what is required by PT XYZ , it is known from relatively high three determinants of value chain management types such as the complexity of the transaction valued at 3:36, 3:27 modification transaction valued and offers valuable capability factor 3:05. Basically modular value chain this means the company receiving the processing of RF have full responsibility for all of the standard amount and types of wastes produced by waste management that will be utilized to the needs of the XYZ, so that the XYZ stay using the recycle facility in accordance with the need to quality is ensured and according to the technology used or being developed.

The results of the analysis in Table 04 also shows the differences in terms of complexity of transactions when compared to the relationship between the company receiving the results of processing RF with XYZ which tend to be very high, unlike the case with the relationship between suppliers vehicles and raw material suppliers operational high value but but not dominant relations company receiving RF processing results with XYZ. It is because of differences of management controls and network expansion transactions made by the XYZ company results RF receiver.

When management controls are carried out between the company receiving the results of RF and XYZ is of considerable concern because it is associated with advanced process B3 waste management of PT XYZ to be utilized by the company receiving the results of RF, result of processing/ utilizing from RF conducted confirmed to be in accordance with the appropriate technology and with the standard of XYZ. The recipient company (RF) transaction results in recurrent and mutually addicted and has been formalized by using the contract and the B3 waste management license from the Ministry of Environment and Forestry.

Gap Analysis

Gap performance of expectation desired by customers (waste generators) of services waste management XYZ can be identified by the gap analysis, from this analysis, we can know the attributes the performance of products in accordance with customer expectations and attributes that is not in accordance with the customer expectation. From the attributes corresponding to customer expectation is the one could be a reference to the increase in the value chain.

The scale of measurement used in this descriptive analysis is the scale interval of four. Figures 1-4 respectively, disagree, somewhat agree, disagree and strongly disagree (Sabrina, 2015). Answer each question attribute calculated his average. From here it will be known which attributes are above average or below average.

The result of the calculation of gap analysis in this analysis are presented in Figure 4. Gap demonstrated high performance of its B3 waste management services. To attribute the approaching of the expectations of consumers are stockpiling in accordance with government regulations and the attributes most distant from the expectations of customers is the carrier that has competitive prices.

Table 5: Gap Analysis

	Atribute	Average		Gap (%)
		Expectation	Performace	
A	**Transporter**			
1.	In accordance with government regulations	3,97	3,50	88,16
2.	Appropriate to the type of waste to be transported	3,90	3,60	92,31
3.	Have carrying capacity and large capacity	3,50	3,00	85,71
4.	Have competitive prices	3,93	2,60	66,16
5.	Have carriage timeliness	3,83	2,87	74,93
6.	Have speed of transport time	3,70	3,20	86,49
B	**Processor**			
7	In accordance with government regulations	3,93	3,53	89,82
8	Appropriate to the type of waste to be processed	3,83	3,37	87,99
9	Have carrying capacity and large capacity	3,60	3,20	88,89
10	Have competitive prices	3,90	2,87	73,59
11	Have carriage timeliness	3,50	3,00	85,71
12	Have speed of transport time	3,67	2,77	75,48
C	**Utilizator**			
13	In accordance with government regulations	3,93	3,57	90,84

14	Appropriate to the type of waste to be processed	3,77	3,03	80,37
15	Have carrying capacity and large capacity	3,47	3,13	90,20
16	Have competitive prices	3,80	2,80	73,68
17	Have carriage timeliness	3,50	3,07	87,71
D	**Collector**			
18	In accordance with government regulations	3,90	3,53	90,51
19	Appropriate to the type of waste to be processed	3,50	3,23	92,29
20	Have carrying capacity and large capacity	3,80	3,50	92,11
21	Have competitive prices	3,93	2,77	77,59
22	Have carriage timeliness	3,57	3,17	88,80
E	**Landfill/ Microcapsule facility**			
23	In accordance with government regulations	3,90	3,83	98,21
24	Appropriate to the type of waste to be processed	3,70	3,50	94,59
25	Have carrying capacity and large capacity	3,27	3,00	91,74
26	Have competitive prices	3,37	2,63	78,04
27	Have carriage timeliness	3,37	2,87	85,16

From Tabel 5. and it can be seen that the average expectation was 3.71 and the average performance is 3.15 while the average gap between expectation and performance of the B3 waste management services is 85.45%. From the table it can be seen that the highest level of customer expectations are the transport of waste is in accordance with regulation carrier with a value of 3.97% and for the highest performance on landfilling in accordance with government regulation with a value of 3.83. While the lowest gap is a carrier that has a competitive price with a value of 66.16%.

From the table it can be seen that there are some attributes that are still below the average are beneficiaries in accordance with the type of waste to be treated (80.74%), landfilling which have competitive prices (78.04%), the collector who has a competitive price and processor which has speed of processing (75.48%), the carrier that has the accuracy of the transport (74.93%), beneficiaries have competitive prices (73.68%), processors which have competitive prices (73.59%) and the carrier have competitive prices (66.16%).

5.Conclusions

Based on the study that has been done, it can be concluded as follow:

1. There are nine actors who participated in the process B3 waste management in PT XYZ : operational raw material suppliers, 3rd party logistic supplier, recycle facility, transporter, collector, utilizator, processor, microcapsule fasilitator and generator of hazardous waste
2. The determination of the type of value chain management relation between operational material supplier and PT XYZ is modular value chain, of value chain in the relation between 3rd party transporter and PT XYZ is modular value chain, the type of value chain governance on the relationship between the company receiving the results of the processing of the RF with XYZ is modular value chain.
3. Some services which do not meet customer expectations are utilizator in accordance with the type of waste to be treated, landfilling which have competitive prices, the collector who has a competitive price and processor which has speed of processing, the transporter that has the accuracy of the transport, utilizator have competitive prices, processors which have competitive prices and the carrier have competitive prices.

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