

INDUSTRIAL SYMBIOSIS AT SUPPLY CHAIN

Yunita Ismail
President University, Jababeka Education Park, Bekasi
Email: yunitaismail@president.ac.id

T Yuri M Zagloel
Indonesia University, Industrial Engineering Study Program, Engineering Faculty – Depok
Email: yuri@ie.ui.ac.id

ABSTRACT

Industrial symbiosis has been planned to establish on a certain area like industrial estate, because industrial symbiosis requires synergy and collaboration early in its emerged. Synergy and collaboration is highly possible to occur between companies that are at the same location. However, the emerged of industrial symbiosis, can be used a planning models and self-organizing models. The second model is a model that stems from the participation of industrial symbiosis that have same purposes, which is reduced costs and increased productivity. The participans are work together to manage the flow of materials, energy, water and byproducts. So that the material, energy, water and by-products can be returned to the production process in the relevant industry or other industries. Establishment of industrial symbiosis with self-organizing model of the early stages requires synergy between the companies. Synergy will happen if there is a communication or there is a common interest between the companies. When viewed on a firm relationship of supply chain, companies have to communicate and work together to meet common needs. The synergy that occurs in the supply chain can be used as an initial synergy that will lead to the formation of industrial symbiosis. Synergies in the supply chain will evolve into a collaboration among companies, as inter- company have the same goal, which meet the exact order of quality, delivery and cost. Emerging industrial symbiosis need a long time like evolution process. Emerge industrial symbiosis in suply chain will need less time, because synergy and collaboration in supply chain already happen. Emerging industrial symbiosis can continue to next process, that is make industrial symbiosis among company.

Keywords: Industrial symbiosis, self-organizing, synergy, coloboration

INTRODUCTION

Industry as one of the sectors that contributed greatly to the economy of a country, industrial sector has contributed greatly to the GDP, and also provide great employment opportunities. However, it is undeniable that industrial development will have an impact on the environment. This becomes a very important issue to be addressed, as desired is sustainable industry, while maintaining the quality of the environment, so that future generations can still continue the industry.

One of the government's efforts to reduce the environmental impact due to industrial activities is to build the industry in certain places, which is commonly referred to as an industrial estate. In the early stages, the development of industrial estates in Indonesia held by SOEs (State Owned Enterprises), but since 1989 , the construction of industrial estates handed over to private parties.

With the entry of private sector in development to make development industrial estate, the industrial estate tremendous growth in the number. But another effect is the price of a place of business in the industry is high and not all industries are able to afford. As a result there are still industries that are built outside the industrial estate, or around the industrial estate. Or may be that industry existed before the policy to built the industrial estate. Industries are located around the industrial estate also contribute to environmental waste and pollution .

Waste generated from industries that are outside of industrial estate usually not processed, because if sewage treatment alone, would be hard for the industry especially in cost. Therefore, another approach used in reducing the environmental impact of the industry , namely by building industrial symbiosis between different supply chain industry with companies involved do not have to be on the industrial estate.

Another phenomenon, that the inter- company located in the industrial park does not have a business relationship establish a relationship of mutual dependence. This makes the companies in the industrial estate does not form a cooperative relationship. This sometimes creates difficulties in the formation of inter- firm cooperation in environmental management.

Another case in the relationship between companies is in a supply chain. In a supply chain, the company has linkages between raw materials, with a relationship of mutual dependence makes communication between companies become more intensive. The existence of inter- company communication is the glue start to build cooperative relationships that others, including the use of waste and environmental management. Utilization of waste from a company by another company, either as raw material or other support material is the forerunner of the industrial symbiosis.

Industrial symbiosis according to Chertow (2007) is part of the industrial ecology associated with inter- industry cooperation to improve the comparative advantage through a joint approach in the exchange of materials, energy, water and byproducts. The key word is collaboration and synergy among different industries that happens you indulge proximity location.

Establishment of industrial symbiosis is planned on an industrial estate. As is known formation of industrial symbiosis requires synergy and collaboration. Synergy and collaboration is highly possible to occur between companies that are at the same location.

Industrial symbiosis that occurs in Kalunborg an example of the symbiosis that occurs between industries that are at the same location. This has happened in Kalunborg optimizing the utilization of energy, heat, water and byproducts. So it becomes more efficient resource utilization and occur along the approach to achieve sustainability of the industry (Jacobsen , 2006).

In the course of implementation of industrial symbiosis was found that in practice the development of industrial symbiosis occurs. Keywords collaboration is the only thing that counts is not derived from the proximity of the location of industries. However, collaboration is more determined by the way the industry related to each other (Lombardi , 2012). In addition to the close proximity is more analogous to the impact of transportation and mental closeness between industries (Lombardi , 2012).

In this study wanted to see the potential for industrial symbiosis that occurs between some of the industry in supply chain . Potential industrial symbiosis that occurs not only seen from the flow of matter, energy, water and waste, but also see the flow of information that occurs.

PURSUING INDUSTRIAL SYMBIOSIS

Industrial Ecology is an important approach in the development of the industry. The goal of industrial ecology is to integrate and use the understanding of natural systems and apply it in designing man-made systems (Tibbs,1993, Djajadiningrat, 2004).

There is no one definition to describe industrial ecology (Garner, 1995). However, industrial ecology is always associated with: a system that integrates industry and nature, the study of the flow and transformation of matter and energy, a multidisciplinary approach oriented to the future, a change from a linear industrial system to cycle the system, any attempt to press the waste produced, always strive for harmonization of industrial activity, the sustainability of the industry and always strive industrial systems with natural systems.

In the natural system adopted cycle system, while the system is still known industrial linear system. This is a major discrepancy between industrial systems and natural systems. Therefore, efforts to make the industrial system into a system will make the system cycle industry becomes analogous to natural systems.

Graedel and Allenby (1995) in Ayres, 2002, Allenby (1995) in Djajadiningrat , 2004 conveying the typology of ecosystem consists of 3 types. as follows : 1. Type I systems: linear systems;In this system, material and energy into or processed in the system and then transformed into products and their by-product or waste/garbage. Because the waste/garbage and byproducts are not recycled or used again, the system becomes very large in a purely material - consuming energy and material, the result is not an efficient use of pure materials. 2. Type II system: In this system started recycling and reuse, although not yet fully reduce waste/garbage. In the economy, although the use of materials in these systems is still high, but the use of the material sought to be reduced. In this case, the material management system and other material planning has become a common thing done. 3. Type III system: This system represents a dynamic equilibrium in an ecological system, where the energy and the trash has been recycled and used again by other organizations and processed in a system. The third system is a system that has seen a high level of integration, as a closed system.

System thriving industry now directed to form a third type of system, which is a closed system. This closed system refers to what happens in natural systems, where there is no matter and energy out of the system. The materials that go into industrial systems used again in the relevant industry or in other industries. So that waste and byproducts of an industry can be entered for the other industries. In the end use of the material or resource becomes more leverage.

Maximize or improve the efficiency of material usage can occur through industrial symbiosis between industries. Industrial symbiosis in industrial ecology is an approach which saw the exchange of matter, energy, water, waste and byproducts. Material exchange can occur between companies that produce waste that can be utilized by other industries . So do not waste discharged into the environment as a valuable material, but used to produce other useful products. Excess energy of a production process can be heat. This heat can be streamed on the production processes that require high temperatures.

According Chertow, 2000, the definition of industrial symbiosis is: “Engaging traditionally separate industries in a collective approach to competitive advantage involving physical exchange of materials, energy, water and by products. The keys to industrial symbiosis are collaboration and the synergistic possibilities offered by geographic proximity”

According to the definition of Chertow, 2000, the industrial symbiosis occurs in the presence of a physical exchange, ie matter, energy, water and byproducts. The physical exchange becomes easier if occurs between adjacent companies. Geographic proximity makes the cost to deliver materials or energy or water or by products become cheaper. Keywords on industrial symbiosis are collaboration and synergies available with geographic proximity.

To develop industrial symbiosis, we need to find out the material, energy or water flow. These flow not easy to find among company. Because of among company does not have communication and can not make- relationship. Even in certain industrial park, among company could be not know each other. That's why, the flow of material, energy or water amongcompany hard be happen.

Collaboration between companies can occur in a variety of corporate networks. Collaboration is a concept that connects two or more members of the network concerned in building commitment and maintain relationships with strategic objectives process, using essentially the ability to handle the changes and challenges of the corresponding (Bowersox et al., 2003). According Simatupang and Sridharan 2005 variable indicators used by three main dimensions, namely information sharing, decision synchronization, and incentive alignment. Information sharing is the intensity and capacity of a company to share information on the achievement of business goals and strategies together (Simatupang & Sridharan, 2008) . Decision synchronization is defined as an attitude to facilitate coordination in the planning and execution of decisions inter -related network members (Simatupang et al., 2004). Incentive alignment is an activity to share costs, risks, and benefits among the members participating in the network business (Simatupang & Sridharan, 2008) .

Synergy is defined as something that is done together will provide better results than done individually. Ansoff, 1968 in Sulasmi, 2006, within the scope of business policy defines synergy as an effect that can produce a result that is obtained from a combination of organizational resources, whose value is greater than the sum of the values of each parts. The synergy between the company done to achieve efficiencies and synergies occur due to differences with the same purpose. In handling the environmental impact, the synergy between companies is needed, because this is the same environment. So the differences in each company's ability to manage the environment can charge each other to form a synergy.

Covey (1989) uses the term synergistic communication in a relationship that is formed from the integration between the high - class spirit of cooperation and mutual trust relationship that high level anyway. Understanding these synergies can be equated as a development built together creativity of mutual trust and a spirit of cooperation is very high, so both sides will be able to declare with open ideas and opinions of each, without feeling threatened and concerned themselves with the possibility of conflict happens . According to Covey, 1989, synergistic communication is built from a form of courage and firmness, with high consideration at the same time anyway. The more relevant and significant issues become the focus in the cooperation relationship, the synergies that result will be more meaningful as well for the benefit of the organization.

Hampden - Turner, 1990 in Sulasmi, 2006 stated that the synergistic activity is a process that involves a variety of activities, which run together so as to create something new. Synergy is the result of a relation between the various sources of knowledge dialogik different, and is a process of accumulating various kinds of knowledge.

Geography suggests close spatial proximity is obtained by an industry that is on the same site or adjacent, for example, a particular industrial area. Industrial area is the ' place ' the mutually beneficial relationship between industries. This geographic proximity allows for using facilities together and eliminate transportation costs for transporting goods. Examples of the most popular shows on a regional industrial symbiosis is happening in Kalundborg, Denmark. Kalundborg an exchange of water and heat that is a by-product of Asnaes to Statoil Refinery Power Plant (Jacobsen, 2006). The cost of construction of the pipeline installations and drain water heat becomes less expensive than the costs incurred from the use of energy and water from other sources .

It can be seen that the emergence of industrial symbiosis can occur by two approaches, namely the planning approach and the approach to self-organization (Chertow, 2007). Planning approach to identify companies from different industries, at the same location which seeks to use shared resources. In this approach required the other parties, such as the government or the party that can serve as the government, in order to an exchange or joint use of resources. The second approach is the approach to self-organization. In this approach arises from the desire of industrial symbiosis perpetrators are motivated to reduce costs and increase revenues. As it is known that the formation of industrial symbiosis always experiencing operational problems, financial and behavioral (Chertow, 2000).

INDUSTRIAL SYMBIOSIS AT SUPPLY CHAIN

Collaboration and synergy in industrial symbiosis between companies is due to the geographic proximity is often questionable. This was seen in Lombardi and Laybourn, 2012, redefining industrial symbiosis, as follows:

Industrial symbiosis engages diverse organisation in a network to foster ecoinnovation and long-term culture change. Creating and sharing knowledge through the network yields mutually profitable transactions for novel sourcing of required input, value added destinations for non-product outputs, and improved business and technical processes”.

From the definition of Lombardi and Layborn is seen that industrial symbiosis can occur not only in a single location, but can also be in a particular industry network. Spatial closeness in geography are not seen as the main thing. Industrial symbiosis can occur even if the location is not adjacent spatial industry, the proximity of the location no significant effect on the occurrence of industrial symbiosis (Lombardi and Laybourn, 2012).

In this study, the first definition in view of the physical flow, materials, energy, water and by-products, but use restrictions (place) occurrence in a network industry in the supply chain. Also in this study will be seen also physical exchanges that occur driven by the flow of information. Thus in this study, industrial symbiosis is defined as inter- industry cooperation in the supply chain through the exchange of materials, energy, water and by-products are driven by the exchange of information on good communication.

The flow of matter and energy that occurs in both places is the case with inter- company communication begins, so as to obtain the information of what the industry can be developed to also develop industrial symbiosis. Companies that participate in the industry have a symbiotic relationship or communication such as the flow of information, knowledge and expertise (Meehan and Muir , 2008) .

CONCLUSION

Establishment of industrial symbiosis takes a long time and great effort. The first step of industrial symbiosis is synergy. Synergies between companies only occur if the presence of inter-company communications. The synergy that occurs can be used for environmental management, so that there will be collaboration between companies in environmental management. Collaborative environmental management can be forwarded to the formation of industrial symbiosis. The synergy that has occurred in the supply chain can be used as a first step the formation of industrial symbiosis. Synergies in the supply chain is due to the dependence of raw materials and the presence of the same production goals.

REFERENCES

- Ayres, R and Leslie WA., (2002). *A Handbook of Industrial Ecology*. Edward Elgar Publishing Limited. Cheltenham, UK.
- Bowersox, DJ, Closs DJ, Stank TB. (2003) *How to Master cross Enterprise Collaboration*, *SCM Review*. 7 (4) : 18 – 27
- Chertow, Marian. (2000). *Industrial Symbiosis: Literatur and Taxonomy* Annual Review of Energy and the Environment 2000: 25 ProQuest pg. 313.
- Chertow, Marian. (2007). *“Uncovering” Industrial Symbiosis*. *Journal of Industrial Ecology* Vol 11 Number 1.
- Djajadiningrat, ST dan Melia F. (2004). *Kawasan Industri Berwawasan Lingkungan (Eco Industrial Park)*. Rekayasa Sains. Bandung.
- Covey, S.R. 1989. *The Seven Habits of Highly Effective People*. Simon and Schuster. New York.
- Garner, Andy. (1995). *Industrial Ecology: An Introduction*. Pollution Prevention and Industrial Ecology. University of Michigan.
- Jacobsen, NB. (2006). *Industrial Symbiosis in Kalundborg, Denmark. A Quantitative Assessment of Economic and Environmental Aspects*. *Journal of Industrial Ecology* vol 10, Number 1-2.
- Lombardi, R and Peter Laybourn. (2012)b. *Redefining Industrial Symbiosis. Crossing Academic – Practitioner Boundaries*. *Journal of Industrial Ecology* Vol 16 number 1.
- Mehan, Joanne and Lindsey Muir. (2008). *SCM in Merseyside SMEs: benefits and barriers*. *The TQM Journal*. Vol. 20 No.3.