

Managing Circular Economy Barriers in Recycling Companies

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Abstract: *Circular Economy (CE) has recently attracted the attention of academics, governments and business people due to the concept which believed to be a solution to the negative impacts caused by the traditional economic system. Previous research examining this topic has generally dominated CE principles as the focus of an investigation. Another study also conducted a mapping of CE barriers which consisted of cultural, regulatory, market and technological factors. However, the focus of such studies often makes it difficult to determine how companies are implementing CE. This article aims to fill the gap by analyzing how recycling companies manage CE based on their saving factor. This study uses a qualitative case study approach in three companies located in Pekanbaru. The first two cases are waste managers made from cans, paper, plastics and organic waste, while the last case involves a used oil refining company. Data collection was done through desk evaluations, direct interviews, and document studies, while the analysis was utilized by using within-case and cross-case. The results show that CE implementation was carried out through several approaches including adopting a sharing economy system (between companies and customers), cooperating production of similar companies, and encouraging employee skills improvement through continuous training.*

Keywords: *Circular economy, barriers, strategies, case studies, recycling companies*

Abstrak: *Ekonomi Melingkar (CE) belakangan banyak menyita perhatian akademisi, pemerintah maupun pebisnis dikarenakan konsep tersebut diyakini dapat menjadi solusi terhadap dampak negatif yang disebabkan oleh sistem ekonomi tradisional. Penelitian terdahulu yang mengkaji topik ini umumnya didominasi prinsip CE sebagai fokus penyelidikan. Studi lain juga melakukan pemetaan hambatan CE yang terdiri dari faktor budaya, regulasi, pasar, dan teknologi. Bagaimanapun, fokus studi tersebut sering membuat bagaimana perusahaan menerapkan CE sulit diketahui. Artikel ini bertujuan mengisi kekosongan tersebut dengan menganalisis bagaimana perusahaan daur ulang mengelola CE berdasarkan faktor penghambatannya. Studi ini menggunakan pendekatan kualitatif studi kasus di tiga perusahaan yang berlokasi di Pekanbaru. Dua kasus pertama adalah pengelola limbah berbahan dasar kaleng, kertas, plastik dan limbah organik, sedangkan kasus terakhir merupakan perusahaan penyulingan oli bekas. Pengumpulan data penelitian dilakukan melalui desk evaluation, wawancara langsung, dan studi dokumen, sedangkan analisis dilakukan dengan within-case and cross-case. Hasil menunjukkan implementasi CE dilakukan melalui beberapa pendekatan diantaranya mengadopsi sistem ekonomi berbagi (antara perusahaan dengan pelanggan), kerjasama produksi perusahaan sejenis, dan mendorong peningkatan skill pegawai melalui pelatihan berkelanjutan.*

Kata kunci: *Ekonomi melingkar, hambatan, strategi, studi kasus, perusahaan daur ulang*

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Introduction

Circular economy (CE) has been widely discussed in recent years due to an increasing concern of academicians, governments and private sectors towards environmentally friendly manufacturing practices (EC, 2008; EMF, 2015). In some developed countries such as Japan, Germany, and China, CE has been incorporated into national law by which promoting sustainable economic growth (Winans et al. 2017). The commitment to CE in Japan is formally constructed in the Promotion of Effective Utilization of Resources Act 1991 aiming at ensuring such recycled waste which eventually can be reused as a supply chain (Ministry of Economy Trade and Industry, 2010), and it is thus adopted in Germany by creating and proclaiming the Closed Substance Cycle Waste Management Act (German Law Archive, 2000) with the direction of recycling products and minimizing the waste. China, on the other hand, issued Circular Economy Promotion Law 2008, and proposed a strategic plan as a guide for government, and entrepreneurs in developing CE, encouraged resource efficiency, actualized environmental welfare, and sustainable economy ""(Circular Economy Promotion Law of the Peoples Republic of China, 2008).

CE transition is seen as the right decision to meet business, social and ecological needs (Lozano, 2012; –Tibbs, 2006). The traditional approach (linear economy), widely applied nowadays has failed to maintain economic prosperity (EMF, 2013), and environmental welfare (Goyal et al. 2016; Ghisellini et al. 2016). It is due to the principle of *take-make-dispose*, where companies only extract resources from nature, process, and disposed of in the form of waste (EMF, 2015).

It is unlikely that CE removes waste through reducing, reuse, recycling (Allwood, 2014), and responsible for the consumption (Gallaud and Laperche, 2016). In producing the products, used materials are utilized which contribute to the extended value of used products (Alamerew and Brissaud, 2018).

Instead of being economically profitable, material cost-saving and strengthening supply also bring to positive impacts on environmental safety since the capability of reducing emissions and reliance on natural raw material use (EMF, 2015). Given that, the CE is a prominent solution to anticipate natural resources scarcity and environmental problems, caused by traditional model (Esposito et al. 2018; Muranko et al. 2018; Urbinati et al. 2017).

As an economic approach, the idea of CE originated from Cradle to Cradle wherein the concept of the product design process in the company is carried out by promoting circularity to ensure that each product when it enters its end of life can still be returned to its original function with the same quality. This is what differentiates CE from recycling economy, wherein recycling the products produced do not necessarily have the same quality as the original, and some components can still be wasted into waste (Michellini et al., 2017). Likewise, a linear economy that only takes resources from nature, processes them into products, then disposes of them in the form of waste. Figure 1 illustrates the difference between traditional economic models, circular and recycling.

Although attention to CE has increased significantly, research discussing this concept generally focuses on inhibiting factors consisting of culture, market, regulation, technology (Galvão et al., 2018; Kirchherr et al. 2018; Jaca et al, 2012; de Jesus and Mendonça, 2018; "Geng and Doberstein, 2008). The cultural barriers referred to include the limited interest of companies and public in CE practices, and regulatory barriers related to the lack of government support in making the CE transition. From the market aspect, barriers arise from the tendency of negative assessments; society (consumers) as the results of recycled products, while the last obstacle is the lack of technical support and low technical capabilities of the company.

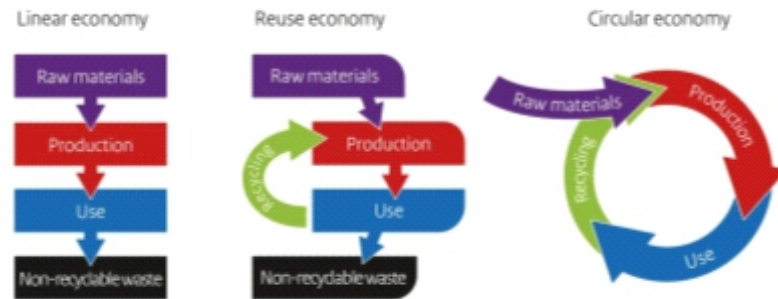


Figure 1.

Differences between linear, reuse and circular economy model
(Adopted from Michellini et al. (2017)).

The purpose of this study is to analyze how companies, recycling, apply CE based on their inhibiting factors. It is important to note that the output of this research is to implement business practice which based on CE, how companies are urged to be equipped with a clear strategic framework (Siregar et al., 2019) as their implementation is expected to run properly. Thus, the research question posed is *how do recycling companies manage CE based on the factors hinder it?*

The structure of the article is organized as follows. The following section discusses the research approach adopted in this article. The case study description is included in the third part, which is followed by a cross-case analysis to determine the similarities and differences in the findings of each case. The limitations and recommendations for further research are also described, followed by conclusions in the last section.

Research Methodology

This study is aimed to analyze how recycling firms manage the barriers of CE. The strategy used to answer the research questions was carried out by referring to the qualitative research framework based on case studies (Yin, 2009; Eisenhardt, 1989). This framework is considered to be the most appropriate since this allows researchers to provide iterative changes within the literature, the data collection, and the analysis. The case study is more suitable choice to answer research questions in the form of *how* and *why*, where researchers have little control to the phenomena being investigated (Yin, 2009; Voss et al. 2002).

In the case study research, the sampling technique is different from the survey in quantitative. The sample in a survey is the representativeness of the population in which the characteristics of such a sample should be identical to the population (Yin, 2009; Eisenhardt, 1989). This is different from the case study, where the sample selection was based on a theoretical sampling approach. Given that, this study uses three recycling companies, as shown in table 1. The selection of these is considered to be following the research topic. Initially, companies focus on producing recycled products from used materials. Thus, monitor the activities and identify the involvement of strong partnerships with external parties such as social communities, government, private sectors, and NGOs which is in line with the CE principles. Finally, all of the samples are considered to be successful in conducting and utilizing used materials within their business.

The process of collecting data was carried out through a literature review, company visits, interviews, and document studies. The first was carried out by finding information available in public, both via the internet and company reports. The second method was direct interviews with directors, managers, and operational employees to obtain information in relation to managing the CE based on factors inhibiting it. The selection of those informants is considered to be appropriate because they are directly involved in the daily routines of the company. The last data collection was used via document analysis, where it aims to enhance accuracy through triangulation (Yin, 2009; Eisenhardt, 1989).

Table 1.
Description of Case Study Research Samples

Case Study Information	Dalang Collection	Rumah Kompos Muara Fajar	Shali Riau Lestari
<i>Year of established</i>	2007	1984	2011
<i>Management</i>	Private	Local government, private	Private
<i>Total of employees</i>	27 people	32 people	30 people
<i>Raw material</i>	Plastic, can, used paper	Organic waste (leftover of vegetables, fruits, leaves) and inorganic (paper, can, used plastic)	Used lubricant/oil
<i>Types of products</i>	Bag, shoe rack, wallet	Compost fertilizer, tissue box, table-cover, flowerpot	Recycled oil
<i>Customers</i>	Individual & corporation	Industry & corporation	Industry

Analysis of qualitative research, especially case studies, is a process carried out to obtain an explanation, understanding or interpretation of the phenomena found in the field. Data analysis was carried out in two stages, within-case and cross-case analysis (Eisenhardt, 1989; Miles and Huberman, 1994). The first analysis was carried out by investigating and giving a general description of the CE strategy applied by the companies (Creswell, 2012), while the latter was organized by making the comparison between theories and findings from the field research (Miles et al. 2013; Voss et al. 2002). This also aims to identify the arguments underlying the emergence of patterns (Eisenhardt & Graebner, 2007) so that conclusions can be made.

Results and Discussion

This study aims to investigate how a company manages the CE based on factors hindering it. It is essential to discuss the issue since the study supports rare answers, which made the adoption of CE challenging to figure out. This section will present the study finding within the case separately, before comparing their similarities through cross-case analyses.

Dalang Collection Case Results

The first case was conducted in Dalang Collection (DC), a waste recycling company, located in Pekanbaru, Indonesia. Established in 2007, the company has focused on producing handicraft products from used plastic, paper, and cans with a capacity of 2 tons each month (a variety of products such as bags, shoes, shoe racks, wallets, book folders, and baskets). To support its operation, DC helped by 27 employees with different expertise. Categorizing as social-based companies, DC aimed to help the communities in creating home-based businesses, especially for housewives, and the selection of the employees aims to encourage them for the use of household waste as a raw material in creating innovative products which have economic value.

To ensure the availability of raw material which is relatively high, 2 tons each month, DC made garbage banks in several collection points so that every waste such as plastic, paper, and cans originating from households could be collected. The operationalization of waste banks was carried out through collaboration with housewife communities, schools, hospitals and several private companies.

To ensure that the waste bank functions properly, DC provides incentives in the form of saving cards which can be disbursed by the manager at the end of each month. For the company, this helps them to obtain raw material, while for communities, it is easier to manage household waste and obtain economic value. The production process in DC was started by collecting raw materials in the waste bank. The waste collected was thus cleaned in the washing tub, and then the material was handed over to the production section for pattern making, carried out according to the type of material, some of which were made as book covers, and others can be made into products which were a little more complicated and needed a more prolonged process such as bags and baskets. All the stages were done manually without technology support, making similar products sometimes had a different appearance.

Aside from being an environmental activist, the director of the company is also a civil servant at the Province Environmental Agency. This makes it easier for DC to invite communities to join as partners, in managing waste banks and making handicraft products. These partners then will be facilitated with training so that they can have skills in producing products from the waste, which eventually can be sold to costumers, government agencies, NGOs and private sectors. Such firms have a concern for home industries and environmental problems due to the issue of household waste.

Rumah Kompos Muara Fajar Case Results

The second case is in Rumah Kompos Muara Fajar (RKMF), a state-owned enterprise located in Pekanbaru, Indonesia. Established in 1982, this company is engaged in processing organic and inorganic waste by using a controlled landfill system with drainage channels, leachate collection, reservoirs, and methane gas control facilities.

The establishment of RKMF was aimed at encouraging the community to be more active and responsible for the waste resulted from households. For those involved is provided with unique guidance from local government through the Ministry of Cooperatives and SMEs. RKMF produces two groups of products determined based on the type of material used. The first is an organic product made from organic waste such as food scraps, vegetables, animal bones, and fruits obtained

from traditional markets around Pekanbaru, while the second is products made from inorganic materials such as plastic, cans, and paper. The production of organic waste is carried out by the company and for inorganic is carried out through collaboration with waste management centres (P2ST) Medan State University, located in North Sumatra province. The lack of production facilities such as chopper machines makes RKMF impossible to handle these materials independently, even though the operational costs incurred can be higher. Each month, RKMF is able to produce compost up to 2.4 tons, distributed to schools, and government offices to be used as garden fertilizers. Other products such as bags, shoes, baskets are sold to individual and industrial customers.

Shali Riau Lestari Case Results

Shali Riau Lestari (SRL) is the last case study, using oil and diesel processing company situated on Jalan Siak II, Riau, Indonesia. Since 2011, the company has gained a license from the Ministry of Environment, the Republic of Indonesia in managing Hazardous and Toxic Waste to be used as an industrial material. The establishment of SRL is not solely for business purposes, but it concerns the issues of environment caused by motorcycle workshop activities which tend to ignore the adverse effects of using oil disposal. The owner of the company is aware that environmental issues have become a global concern due to environmental health factors, contributed to the spread of cross-infectious diseases.

As an oil refinery company, the production process at SRL is divided into chemical, physical, and incineration. Chemical processes include the redox process, electrolysis, neutralization, control, stabilization, adsorption, ion exchange, and pyrolysis. The physical stage includes gas cleaning, liquid separation and removal of specific components by crystallization, dialysis and reverses osmosis.

The stabilization or solidification further aims to reduce the potential of toxins' waste by limiting the solubility, dispersion, and toxicity before being discharged to the final stockpiling site. While the incineration process is done by burning waste material using an incinerator with combustion efficiency reaching 99.99 so that the remaining ash of material does not exceed 10 grams and is certainly not harmful to the environment.

The production capacity in the company is possible to reach a ton monthly and increase at a particular time. Processing raw materials exceeding the capacity is normally left to other similar companies, Wiraswasta Gemilang Indonesia (WGI). The production starts from the collection of used oil from the suppliers, motorcycle workshops. This material is placed in a room measuring around 6x9 square meters. Afterwards, used oil and diesel are put into a special room for sterilization, followed by putting into a tank with a capacity of 25,000 litres and distributed as industrial materials for costumers, mostly manufacturing companies.

Summarizing the Results through Cross-Case Analysis

This section compares the findings of each case using a cross-case analysis approach that grouping is carried out based on four categories of CE inhibitors, namely cultural, market, regulatory, and technological factors. Table 2 summarizes the main themes that emerged and are further explained in more detail.

Table 2.
Summary of the CE Strategy within The Case Companies

<i>Barriers</i>	<i>Strategie s</i>	<i>Dalang Collection</i>	<i>Rum ah Kompos Muara Fajar</i>	<i>Sbali Riau Le stari</i>
<i>Culture and Market</i>	Sharing economy	Waste bank management involving community groups		Collaboration with motorbike / car workshop owners
<i>Technology</i>	Outsource manufacturing	Submitting excess material to a third party (Environmental and Hygiene Agency)	Processing of waste made from cans and plastics to P2ST	Material distribution exceeding capacity to WGI
	Business process innovations	Periodic training and workshops	Development through extension services for cooperatives and SMEs	-
<i>Regulation</i>	External collaboration	Becoming a supplier of various seminar packages in seminars held by government / private agencies		-

As a system to encourage the operation of environmentally friendly businesses, the CE approaches in DC and RKMF are similar. These two companies are engaged in managing household waste into handicraft products, carried out by executing the sharing economy model, to ensure the sustainability of their business (Ritter & Schanz, 2019). In a sharing economy system, people (customers) have two roles, as suppliers and consumers (Geissinger et al, 2018). This practice in DC and RKMF arises from community involvement in the management of waste banks, located at specific points, generally in residential areas, as they become permanent suppliers for the company. SRL, on the other hand, implements this by placing used oil collection containers in several car/motorcycle workshops around the city.

The second CE strategy confirmed by the study is third party manufacturing. At certain times, the number of raw materials coming from the waste bank can exceed the capacity of the company, thereby the entire production process is not possible. In this condition, the company outsource to a third party, such as DC with the Environmental and Hygiene Agency, thereby their excess capacity can be taken as well as at RKMF submitted the materials originating from can and plastic to be produced by P2ST. SRL delegates used oil processing exceeding its capacity to WGI.

The findings of this study are reflected aside from technological usage. It is inevitable by manufacturing that the product is possible to be executed well during the assistance. Otherwise, it could harm the quality. As categorized SMEs, technological assistance in DC is restricted, even nonexistent, as the production process relies on upon manually. The condition caused the appearance of similar products to vary, and standards of the product can be met. To cover the situation, the director strongly encourages the employee to be more creative to create products and process innovations based on personal creativity.

Remanufacturing/recycling is a part of a labour-intensive industrial group demanding high innovation power. Innovation indeed cannot be separated from the human resource capacity of the company due to the driving force of all activities internally, and this is a common problem for SMEs.

For DC companies, the drive for innovation received extra attention, and directors always includes employees in participating in various training activities provided by the government and private companies. This effort aims to ensure that the model of handicraft products produced can be developed with new variants according to market needs. In addition, this cooperation also allows companies to more easily enter a broader market because the activities that are participated in general involve government agencies such as the Office of Industry and Trade, Bank Indonesia, the Ministry of Small and Medium Enterprises, the Ministry of Environment. RKMF, on the other hand, relies more on government extension activities through the Office of Cooperatives and Small and Medium Enterprises. When these agents hold seminars/workshops, both DC and RKMF become providers of packages such as book covers, notebooks, bags, so that they can be regular customers.

Proposition for CE Implementation

From the results of the analysis and comparison of the case study findings conducted in the previous section, the researchers develop two important propositions in carrying out CE based on the company's perspective.

Preposition 1: Shared ownership is a critical approach to be applied in anticipating the reluctance of the public (customers) to participate in CE.

Overall, it shows that the implementation of CE requires participation from various parties and generally comes from the external environment of the company. To ensure their presence, companies are required to implement policies in the form of shared

ownership due to the possibility of external participation, especially the community in CE development. This would be possibly better, precisely since this approach is considered to be the most effective alternative applied in social enterprises which generally focus more on collaboration rather than competition'.

Preposition 2: The quality of external cooperation to the successful implementation of CE.

The results of the exploratory analysis carried out by this study also show that the smooth operation of the production cycle in CE consisting of the creation of value, preservation, exploitation and restoration of the used product is highly dependent on the cooperation built and developed by the company. In other words, the quality of multi-stakeholder cooperation is the most important requirement in CE '(Mishra et al., 2019) because this is the process of exchanging information related to technical problems faced by companies and external parties, the community will be easier to manage (Vangen, 2017).

This study investigates how companies anticipate inhibiting factors for CE. Two of the sample case studies used are household waste recycling companies and refining used oil. The three samples are still classified as one industrial sector (recycling) as the next study is expected to include companies from various industrial sectors due to the CE approach which is not always similar to the characteristics of the industry that the company enters. Besides, further investigations are also expected to be carried out using different methods such as quantitative or mix-methods by which the researchers are capable of showing the components of the most productive and dominant strategy to be applied.

Conclusions

CE is an economic model which aims to minimize waste by extending the life cycle of a product entering its end of life. The transition

to this model is believed to be able to encourage a reduction in environmental impact due to the dominance of traditional economic practices. This study at least offers some contribution in understanding how companies apply CE principles in their business.

Reluctance to participate in the community is a form of obstacle to CE that is most frequently mentioned in the literature, and this study found that this condition is possible to anticipate by implementing a sharing economy between companies and the community. As the second obstacle to CE, limited technology support allows it to be managed through third-party collaboration and encourages employee innovation through continuous training. This is done to ensure that the production process can run according to the plan and that employee creativity is increasingly developing according to company needs. Finally, the interaction and cooperation between companies and the government is also an important point to pay attention to because these two parties have to join hands in transitioning the traditional business to a more environmentally friendly based on the CE principles.

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