Value Creating Activity from Aluminium Recycling on Metal Scrap Collector Site: Malaysia Case Study

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Abstract. This research is on the value creating activities from aluminium recycling on the metal scrap collector site. Less is known on how value is created from recycling. Value creation is important in order to generate profit. Metal scrap collector is one of the main component in the recycling chain which creates value for recycling. Understanding the value creation part of metal scrap collector will help to understand the value creation from recycling as metal scrap collector is one of the actors in the recycling industry. A case study was conducted in order to gather the data for this research. An indepth interview session was done with Managing Director of the metal scrap collector firm. A few value creating activities were identified consisting of two categories which is primary and supporting activities. Eventhough the separation between primary and supporting activities is in line with the value chain analysis by Porter. But the activities in the primary and supporting section differs slightly in a few section. This indicates that the value creation activities in the metal scrap collector differs from the original value chain analysis by Porter. Further research on other actors in the recycling value chain is needed in order to test the homogenosity throughout the recycling value chain.

1. INTRODUCTION
Aluminium is the second most processed metal in the world after iron 1. One of the primary aluminium production process is the Bayer process based on the extraction of bauxite. Aluminium is then obtained from alumina through electrolysis, a highly energy intensive process 2. Nevertheless, unique from other materials, aluminium presents the advantage to be recycled indefinitely without any loss of its physical
properties. For this reason, it is estimated that 75% of the total aluminium ever produced is still in use today and that the recycling of aluminium reduces emissions by over 90% compared to primary production. This advantage makes aluminium recycling more cost friendly than the production of aluminium from bauxite.

According to the report by, aluminium stock in the developed country is in rise from daily and industrial usage and in need to be recycled. With the high demand and cumulating amount of aluminium around the world, aluminium is important and valuable in the recycling industry. Some nations with high developing rate quickly adopt recycling as a business. China is the country with highest aluminium recycling rate being followed by Europe and Japan. The high recycling rate of aluminium in many nations indicated aluminium is a promising business venture and being competitive is the way to remain on top of the game. This means for a developing country, it needs to prepare a good recycling approach to recycle aluminium.

The issue of recycling had become a major issue in many developing countries in the world. It is facing greater challenges in order to keep all of the waste in proper management. Aluminium recycling is one of the major components of recycling. It is not clear whether first recycling existed as a mean to save the environment or as a business. But after years of the recycling campaign, a chain of recycle has developed that serves as recycling and business opportunity at the same time.

Most of the recycling campaign mainly deals with the environmental benefits of recycling regardless of the materials. As an example, handles the issue of recycling by manufacturer by putting emphasis on environmental effects. Environment is the main emphasise in recycling. But usually the value part of recycling in term of creation and monetary still lag. The creation of value and monetary perspective of recycling is important as we want to strive to the future and preserving the nature, often quoted as sustainability.

Aluminium recycling has become one of the green technologies which help to increase economy while at the same time save the environment. Aluminium recycling has never been standing as a single entity. It composed of many parties such as collectors, dismantler, metal merchants, shredders and many more. These components of aluminium recycling created a chain. This chain creates value for the final product which is the recycled aluminium. It has to be evaluated in order to understand the value that can be created from the recycling chain.

In the case of aluminium, the main source of the aluminium recycling is transportation, building, engineering, packaging and others. The industry which contributes towards the highest number of the aluminium waste consistently from 2007 until 2013 is transportation industry, followed by building industry and subsequently packaging, engineering and others industry.

According to, the main source of aluminium waste is the transportation industry not only in Europe but for the rest of the world. However this figure might differ from country to country based on the level and type of industry’s activities. As an example even though Malaysia has its own transportation industry, the utilisation of aluminium in vehicle is not as extensive as in Europe. For the countries without an automobile industry or does not utilise it in their transportation manufacturing, the construction industry is probably the largest markets of aluminium, consuming some two and nine million tonnes of aluminium products per year in Europe and the world respectively. Research by has confirmed construction as a source of aluminium for recycling in Malaysia.

Once again, the level of aluminium waste may vary considerably from country to country due to the level and type of industry activities, which implies that the scrap generated at the end of life of the building will also be different. The total stored aluminium in the industry of building is the largest since the beginning of the industrial use of aluminium, amounting to nearly 170 Metric tons worldwide. The main use of aluminium in this industry is to provide materials for roofing and cladding, and window and door frames, as well as small applications such as shutters, door handles, ceiling partitions.

Before the value part is investigated, the actors and activity which they performed should be identified and understood. Hence this research focuses on the waste or scrap of aluminium on the metal scrap collector site as metal scrap collector is one of the actors in the aluminium recycling industry. The main objective of this research is to trace what are the value creating activities on the metal scrap collector site.
2. LITERATURE REVIEW

Aluminium recycling is the process by which aluminium waste or scrap can be reused in products after its initial production. The process partly involves re-melting the metal, which is far less expensive and energy intensive than creating new aluminium through the electrolysis of alumina, which must first be mined from bauxite ore and then refined. Aluminium recycling has a number of key environmental and economic benefits. Compared to other high volume materials, aluminium production has one of the largest energy differences between primary and secondary production: 186 MJ/kg for primary compared to 10-20 MJ/kg for secondary. The International Aluminium Institute has come out with their ideal of well-developed aluminium recycling structure as shown in Fig. 1 as follows:

![Fig. 1: Structure of a Well Developed Aluminium Recycling Industry](image)

Fig. 1 shows the required processes and parties in the aluminium recycling industry. As in Fig. 1, after the last process of recycling, how finally the recycled aluminium reaches the manufacturer again to be processed as a product is still unknown. Initially also, the aluminium product does not simply thrown away as a waste then someone collect it. The collecting phase might involves a few party especially if the aluminium is not a waste instead is a scrap in a manufacturing company such as a car factory or a construction site which uses aluminium as part of its input. All of these is important as a way to understand the value being created through the aluminium recycling process. Due to many benefits of recycling, it is a worthy area to be explored and understood. The value of the aluminium recycling industry should never be underestimated. The next section will be on the methodology on how this research is conducted.

3. METHODOLOGY

This study employs a case study method to identify the value creating activity of aluminium recycling on a metal scrap collector site. An in depth interview session was conducted with possible respondent in charge on site. The respondent was selected based on the use of aluminium and recycling activity in their facilities. This method is chosen due to the explorative nature of this study since the activity might differ depending on country and main aluminium contributing industry in any particular country. The research begins by identifying metal scrap collector site that utilises aluminium as one of material being recycled. After that, it is validated whether they perform any aluminium recycling activity on site. This is done through observation and the interview itself. Person in charge and the value creating activity from the aluminium recycling activity being performed is the main concern in the interview. The next section is on the results of this research.
4. RESULTS
This case study was conducted with a metal scrap collector company. It is a metal recycling company operating in Johor. This company covers materials for recycling around Malaysia and oversea such as Singapore. The interview session was conducted with the founder of the company. Respondent holds two positions in the company which are the Chief Executive Officer (CEO) and the Managing Director. Aluminium, copper and magnesium are among the metals being recycled in this firm. Respondent has 20 years of experience in metal scrap business.

As the CEO of the company, the respondent founded the company and manages most of the recycling activities of the metal scraps. Roles of the respondent are to ensure the firm is appropriately organised and staffed and to have the authority to hire and terminate staff as necessary. The respondent also ensures expenditures of the firm are within the authorised annual budget. The respondent assesses the principal risks of the firm and to ensure that these risks are being monitored and managed. The respondent also has to ensure the firm has appropriate systems to enable it to conduct its activities both lawfully and ethically. The respondent also finds the supplier and buyer for the aluminium which the company has processed.

In this case study, the respondent has confirmed one of the material being purchased is aluminium. Based on the documents of the materials being purchased and processed; and researcher observation, aluminium is among the main materials in the compound of the firm. This firm processes aluminium to be further recycled into high purity aluminium. Supplier of the aluminium scrap are from construction site, manufacturing firm and petroleum processing company. This conformed this case study as an actor in the aluminium recycling industry. Table 1 is the description of the case study. This is an excerpt of the interview with the respondent.

"Before this aluminium scrap mostly came from the manufacturing firm and petroleum processing company. As we are going more green, even building use aluminium. So we have new source of aluminium scrap from the construction site" (Respondent).

| Type of firm          | Metal scrap collector |
|----------------------|-----------------------|
| Location             | Johor, Malaysia       |
| Position of respondent| Chief Executive Officer (CEO) and the Managing Director |
| Other identified actors | Construction site Manufacturing firm |
| Materials            | Magnesium, copper and aluminium |
| Working experience   | 20 year experience in metal scrap business |
| Roles and Responsibilities | a. Founder, b. Manager, c. Budgeting, d. Human resource management, e. Finds supplier and f. Buyer for the aluminium scrap |

Value creation can be understood by exploring the activities that impact the value of the intended material. It usually consists more than one activity to create value for a product. In the case of aluminium scrap, the activities that impact the value creation is still unclear. The aim of this part is to investigate and explore activities that impact value of the aluminium scrap being sold. This case study recycles
aluminium scrap among other material such magnesium and copper. The aim of this part is to explore the activities that affect the value of the recycled aluminium.

There are a few factors that affect the value of the aluminium scrap being sold. The first factor is warehousing. Warehousing is the activity to store the scrap aluminium after it arrives, waiting for processing and after processing. Warehouse is where the unprocessed and compressed aluminium scrap being stored. Two workers were assigned to take care of the warehouse. Compressed aluminium will not be sold directly if the price of the aluminium is down. When the price is down, then compressed aluminium scrap is kept in the warehouse. Once the price is high, then it will be sold. Respondent mentioned that once there was 6 months waiting for the right price to sell the compressed aluminium scrap. Sometimes when the warehouse is full, the respondent will have to rent another place to store the compressed aluminium scrap. When selling the processed aluminium scrap, the cost and selling price will be considered by the respondent.

The next value creating activity is worker. The number of worker affect the cost needed to transport and process the aluminium scrap. The company focuses on optimising the number of worker. Optimise means hiring and maintaining productive and skilful worker. For example, worker that can handle weighing process and then help with the compression process is regarded as productive and skilful. Emphasising on more than one skill and more than one work. During the interview time, respondent does not increase number of workers to process the aluminium scrap. This situation remain the same even if the amount of the aluminium scrap increases. If the amount of aluminium scrap increases, respondent will just increase the processing time. High number of worker is helpful when the amount of aluminium scrap is high. But when the number of aluminium scrap drops, there is no work to do, yet the payment is still on. Thus number of worker is helpful if it is accompanied with skill. Worker without skill and don’t know how to do the work is ineffective. That is why the respondent try to maintain the existing worker to maintain production even if the time to process the aluminium scrap is prolonged.

In term of the recycling process, other than compressing machine, the respondent uses shredder machine. Compression machine is used to compress the aluminium scrap after it has been segregated by the worker. Magnet is used to segregate the aluminium scrap more easily. Sometimes the metal scrap is mixed with other metal. By having certain level of magnetism, it can help to attract different metal. Shredder machine functions especially for the colour coated aluminium. It will help to eliminate the colour on any coloured aluminium scrap such as aluminium can. Then the machine will shred and compress the can. After that, it can go directly into the furnace if there is. In this case study, the respondent does not have any furnace.

Transportation is the next factor that affect value. Transportation was used in three ways. The first one is to collect the aluminium scrap from the supplier and take it to the firm. The second one is to carry the processed aluminium scrap within the firm after compression. The last one is to send processed aluminium scrap to the customer after it has been purchased. Lorry and forklift are two types of transportation being used. Lorry is used to carry aluminium scrap into and out of the firm. While forklift is used to carry the aluminium scrap within the firm. Use of transportation requires driver and fuel. Both driver and fuel requires cost. This will ultimately affect the value of the aluminium scrap.

When the respondent has bought aluminium scrap from supplier, he will send workers to collect it. Worker also will be dispatched from the firm to send processed aluminium scrap whenever the customer paid for the item. This will be done upon request from the customer. Service affect the aluminium scrap value in two ways. First, if the supplier calls, then this company will send the lorry to collect the aluminium scrap. Second, sometimes the customer will call back and complain about the sold aluminium scrap. This happens when the item has problem. Then the respondent will send workers to confirm the situation. For example, if the sold aluminium scrap is not as specified, then it will be taken back to the firm. Magnesium physically looks like aluminium in term of the greyish colour. This situation sometimes causes aluminium scrap to be mixed with magnesium scrap in the form of compressed or contaminant in the compressed aluminium scrap. If the customer check the compressed aluminium scrap thoroughly, and magnesium is detected. The whole batch will be double checked. This requires worker to be sent to the customer’s facility to do the checking. If the contaminant is found, then it will be brought back to the firm. This process will take time and cost.
The present of contaminant is an important issue when buying or selling the aluminium scrap. For example, if the bought aluminium scrap has a lot of oil. Then the weight will be reduced after certain discussion and consideration. The customer will estimate the weight of the oil and will be subtracted from the total weight. The same process also will be done for other contaminant. The aluminium scrap is the purchased item, not the contaminant. Observation is important in the buying process. Oil, waste, rust, soil, and other contaminant are among the factors to be considered during the buying process.

The cost for production is considered minor in determining the value of the aluminium scrap value. It is more on the volume and cost of purchase of the aluminium scrap. The respondent prefers supplier and customer that want high volume of aluminium scrap since it affects the cost of transportation. If the volume is too low, for example it does not even fill one lorry, it is not favourable. As the cost for the transportation and worker remains the same even if the volume is low. The net profit will be 5% to 10% from the total cost. Basically the issue of quantity and cost is the main consideration in determining the value of the aluminium scrap.

In term of selling, the respondent send the aluminium scrap that they sell to the buyer. Price of the bought aluminium scrap is taken into consideration before it is sold and transported to the customer. Sometimes when fast cash is needed, the respondent will sell the aluminium scrap to the trader which can give instant cash compared to the aluminium smelter. But usually the respondent calls all of the possible buyers to get the best price. Then the respondent sells to the buyer which offers the highest price.

The respondent mentioned on the trouble of making sure that the aluminium scrap that they buy is not a stolen item. This is important since it will cause a delay in processing the items since the interference by the authority like police is unavoidable when this thing occur. The respondent do not allow any entrance without permission. It is risky. The respondent might lessen the production of recycled aluminium due to lack of trusted workers. The price on the market will definitely affect the value but the challenge of keeping the recycled items when the price is high from being stolen is another challenge.

Another challenge is buying wrong materials. For an example, magnesium looks like aluminium. But aluminium is more valuable. If magnesium is mistaken for aluminium, then a loss will happen. The respondent is paying high for cheap item.

In term of improvement, there should be stricter regulation using manufacturing raw materials regardless whether it of primary or secondary source. This is important to control the rate of pollution. Even when recycling is exercised, pollution still take place. For an example, aluminium recycling can produce dross which cannot be further processed and need to be disposed. The government control the purchase and use of raw material from recycled source such as aluminium. The control can be in the form of a quota to control the amount of aluminium or materials used in the manufacturing process as this will cause pollution.

All of the aforementioned factors are considered value creating for the respondent. Some of it is internal factor while some of it is external factor. Table 2 is the summary of the factors that affect the value of the aluminium scrap in this case study together with the annotation from the respondent.

| Value creating activities | Annotation |
|---------------------------|------------|
| a) Warehouse              | “When the warehouse is full then we sell it. Sometimes the place is not enough then we rent a place to store the items. The price for renting the place the store also will be considered when we want to sell the items”. |
| b) Worker                 | “Two workers will help to compress the aluminium scrap. One will help to put the scrap from the forklift. The other controls the compression machine”. |
| c) Sale                   | “I will consider a lot of buyer with high prices of course. When we need fast cash, I opt for trader”. |
d) Transportation
“We use lorry to pick the aluminium scrap from the supplier. When we want to send the processed and sold aluminium scrap we also deliver it by lorry”.

e) Service
“Sometimes the customer will complain that our scrap has magnesium. We have to double check this claim by sending worker to check the claim”.

f) Purchase
“We send the worker to take the purchased aluminium scrap from Penang”.

g) Volume
“I really consider big volume of purchase. When you buy small volume, there will be empty space in the lorry. Very wasteful. Yet we still have to pay for the trip”.

h) Contaminant
“We don’t want contaminants like oil to be in the product that we buy or sell. It reduces the selling price”.

i) Government
“We hope government could increase the use of recycled materials so that we can increase our production. Fortify the policy to recycle and make use of recycled items compulsory”.

5. DISCUSSION
Table 2 is the value creating activities on the metal scrap collector site from the aluminium recycling. There are 9 activities taken place. Some of these activities creates value directly while some other affect value by affecting other activities. For example, warehousing affect value creation because the respondent needs to pay for the rent of the warehouse. Same goes with worker, sale, transportation, service and purchase. While other activity such as the present of contaminant, government policy and volume each proceed the activities mentioned above. This is because, if the aluminium is too contaminated, the aluminium scrap will not be purchased since it cannot be recycled any further. Same goes with the government policy and volume. Government policy to recycle will make people recycle and as a result sell the recyclable such as aluminium scrap to be recycled. While volume is also important in affecting value creation since if the volume is too small no this company will be reluctant to purchase the aluminium scrap. In combination, these will hamper the value creation process.

6. CONCLUSION
It can be concluded the combination of the nine activities affect value directly or indirectly. The dynamic of how they work together need more work to be understood fully. Just by collecting the aluminium waste, economic, social and environmental benefit can be achieved. It is not only save the environment but also economically profitable. Our economy can be sustained by recycling aluminium by maintaining our source of aluminium for future generation. Socially, by recycling it can avoid any safety and legal issue such as illegal dumping which is dangerous and can cause havoc to the society. Among many benefits of recycling is less pollution, saves energy and sustaining environment. This action also can ensure a sustainable future on the construction site. Rather than throwing away the aluminium scrap mindlessly and illegally which can be costly if get caught by the authority, we can get some of the money back by selling the scrap of aluminium.

7. FURTHER WORK
Since this research is only on exploring the activities that create value. The dynamic of how actually they work together as value creating factor is still in haze. But, the first step to identify the activities is rather important as it shows how many factors or activities will impact in just one actor from the whole aluminium recycling value chain. More activities from other actors should also be explored to investigate the whole aluminium recycling industry value creation.
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