

# **Stakeholder Analysis of The Circular Business of Electric Motorcycle Swappable Batteries in Indonesia**

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## **Abstract**

Swappable batteries which are no longer used in electric motorcycles are hazardous waste. So, there is a need to make some efforts to extend battery life and process battery waste. The efforts to extend battery life by repairing, refurbishing, remanufacturing, and reusing as well as process batteries by recycling are circular businesses. The development of a circular battery swap business cannot only be carried out by one company but involves various companies and various stakeholders. This study seeks to identify the stakeholders involved in the development of a swappable battery circular business, identify the roles of stakeholders and conduct stakeholder mapping. Data collection was carried out through literature studies, observations, and in-depth interviews as well as distributing questionnaires. Data is processed using Mende low matrix and interactive analysis. The results of the study show that to develop a circular business of electric motorcycle swappable batteries, 30 stakeholders need to be involved. Stakeholders are mapped into four groups, namely key players, keep informed, keep satisfied, and low priority. Stakeholders who are included in the key player category are stakeholders who are the main priority because these stakeholders are important stakeholders and have a major influence in the development of circular business. There are 25 stakeholders included in the key player. The large number of key players shows that circular business development cannot only be carried out by one company, it needs to involve various stakeholders. Each stakeholder has a role in developing a circular business. Stakeholder roles include policy creator, coordinator, implementer, facilitator, and accelerator. Policies regarding battery waste already exist, but these policies need to be evaluated for their effectiveness. Coordination and communication are one of the keys to successful circular business development, therefore coordination and communication are always carried out and it is necessary to involve all existing stakeholders.

## **Keywords**

stakeholder, swappable battery, business, circular

## **1. Introduction**

The Indonesian government is very aggressive in accelerating the development of electric vehicles, one of which is an electric motorbike with a battery. Battery charging can be done by charging the battery directly to a power source or by exchanging the battery (battery swappable). A swappable battery is a battery that, if the electric power runs out,

is exchanged with a battery that is full of electricity (Ahmad et al. 2018). Swappable battery technology has several advantages, namely faster refueling of electric vehicles (Sun et al. 2019) and hassle-free (Ahmad et al. 2018). The battery swap process only takes 3 - 5 minutes (Liang and Zhang 2018; Shao, Guo, and Qiu 2017; Wang, Li, and Wang 2014).

Swappable batteries have a lifespan. If the battery is not used, then the battery should not be disposed of carelessly, because the battery is a hazardous waste. Battery waste contains heavy metals which can be harmful to health and pollute the environment if discharged directly into the environment (Jumari et al. 2022; Y. Zheng et al. 2016). Heavy metals contained in batteries include Li, Ni, Co and Al. Ni metal is very dangerous to health because it can cause chronic bronchitis, decreased lung function, and cancer of the lungs and nasal sinuses (Miaratiska and Azizah 2015). Cobalt metal is a carcinogen, a compound that can cause or induce cancer (Kovoichich et al. 2021; Paustenbach et al. 2013). Systemic toxicity of Cobalt manifests as a clinical syndrome with a variable presentation of neurological, cardiovascular and endocrine symptoms (Leyssens et al. 2017) and Lithium metal can result in cognitive and neurological disorders (Waring 2006).

Disposal of battery waste by landfilling can slowly contaminate groundwater through a leaching process (Sattar et al. 2020). If battery waste is disposed of by landfill, it may cause infiltration of toxic heavy metals into underground water bodies resulting in serious environmental pollution. Likewise, if used battery waste is incinerated as a general type of solid waste, it will produce large amounts of toxic gases, such as hydrogen fluoride (HF) gas, thereby polluting the atmosphere (X. Zheng et al. 2018).

Regarding battery waste, it is very detrimental because it can interfere with the health and can pollute the environment, it is necessary to make efforts to conduct a circular business for batteries in the form of extending battery life and processing batteries (recycle). Extending the battery can be done by repair/refurbish/remanufacture/reuse. The development of a circular battery swap business cannot only be carried out by one company but involves various companies and various stakeholders. The success of a circular business is largely determined by the commitment of all stakeholders (Hankammer et al. 2019). For circular business development to be more effective and on target, it is necessary to know who the stakeholders of the swappable battery circular business are. The purpose of this study is to identify the stakeholders involved in the development of a swappable battery circular business, what are the roles of these stakeholders, and map the stakeholders.

## 2. Literature Review

### 2.1. Circular business and circular business benefits

A circular business is a business that carries out its activities using circular economic principles (Pietrulla and Frankenberger 2022). The circular economy principle is how to extend product life through repair, refurbishment, remanufacturing, and reuse as well as processing product waste into useful raw materials (recycle). In other words, a circular business is a business that carries out its activities by extending life through repair, refurbishment, remanufacturing, and reuse as well as processing waste through recycling. The definition of circular economy principles can be seen in table 1.

Tabel 1. circular economy principles

<b>Principle</b>	<b>Definition</b>
Repair	Fixing a specified fault in used equipment that is a waste or a product and/or replacing defective components of equipment to make the equipment a fully functional product to be used for its originally intended purpose
Refurbishment	The process of returning a used product to a satisfactory working condition may be inferior to the original specification. Generally, the resultant product has a warranty that is less than that of the newly manufactured equivalent. The warranty applies to all major wearing parts
Remanufacture	Modification of used equipment to increase or restore its performance and/or functionality or to meet applicable technical standards or regulatory requirements, with the result of making it a fully functional product to be used for a purpose that is at least the one for which it was originally intended, including through such activities as cleaning and data sanitization.
Reuse	The using again of fully functional equipment that is not waste for the different purpose (another application) for which it was conceived, possibly after repair or refurbishment.
Recycle	Any recovery operation by which waste materials are reprocessed into products, materials, or substances whether for the original or other purposes. It includes the reprocessing of organic material & the reprocessing into materials that are to be used as fuels or for backfilling operations

In conventional business, products that are not used are thrown away. Disposal of products that are not used will cause soil, water and air pollution. In connection with conventional business having an adverse impact on the environment, the circular business concept emerged. This circular business provides many benefits both for the economic, environmental and social sides (Khan et al. 2020). Product waste is a new business opportunity. A company can repair the product or process the waste and then resell it. Waste rectification and treatment means that the company reduces the waste generated, which means reducing the negative impact on the environment.

Some of the raw materials for making a product come from non-renewable natural resources such as petroleum, coal and metals. There is a constant concern that taking resources from nature will run out one day, so there needs to be an effort to reduce the mining of these natural resources. The reduction in natural resource mining can be reduced by using alternative materials from renewable resources or taking materials from recycled products.

Conventionally, companies tend to use cheap raw materials and ignore environmental factors. Circular business encourages a company to use competitive raw materials and reduce environmental pollution to produce products that are environmentally friendly. Consumers will feel happy with products that are environmentally friendly.

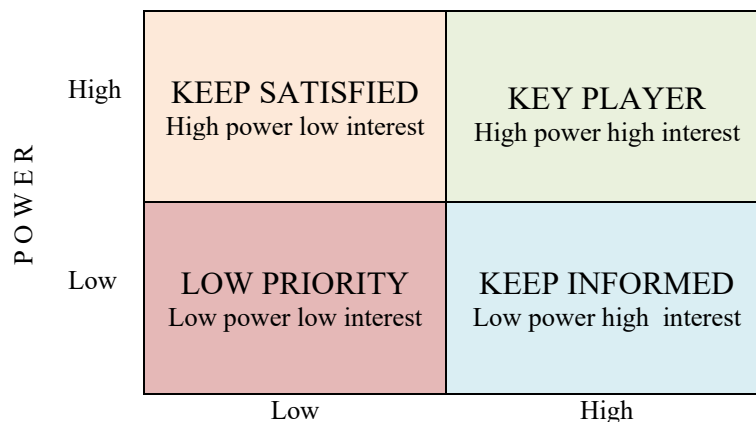
## 2.2. Stakeholders dan stakeholder's roles

Stakeholder is a group or individual who can affect or be affected by the achievement of organizational goals (Freeman 1984). While Gonsalves et al. describes stakeholders as those who impact and/or are affected by the impact of a program, policy, and/or development (Gonsalves et al. 2010). They can be individuals, communities, social groups, or an institution that exists at every level of society. The roles of stakeholders vary and can be classified into several groups, some classify into eleven groups (Fedotkina et al. 2019), some classify into seven groups (Mohamadian et al. 2022) and some classify into five groups (Nugroho et al. 2014). The five stakeholder role groups are as follows:

- a. Policy creator, this stakeholder has a role as a policy maker for a program.
- b. Coordinator, this stakeholder has a role as a coordinator to oversee the policy of a program and coordinate other stakeholders involved.
- c. Implementer, this stakeholder acts as program executor.
- d. Facilitator, this stakeholder plays the role of facilitating and fulfilling whatever is needed for the success of a program.
- e. Accelerator, this stakeholder plays a role in accelerating and contributing so that a program can run according to the expected plan.

## 2.3. The Mendelow Matrix

The Mendelow Matrix is a model for mapping stakeholders by looking at power and interest. This matrix was originally introduced by Mendelow (Mendelow 1981) and is still used today. The Mendelow matrix is in Figure 1. Several studies have used Mendelow, namely credit card stakeholder mapping (Gianotti and Damião da Silva 2021), stakeholder analysis in the management of Covid-19 (Mohamadian et al. 2022) and stakeholder classification in sustainable energy development in Iceland (Guðlaugsson et al. 2020). This matrix uses two parameters, namely the power parameter and the interest parameter. The power parameter can be interpreted as the ability of stakeholders to fight for circular business development programs or stakeholder contributions in allocating resources for circular business development. The interest parameter can be interpreted as stakeholder involvement in circular business development or the authority or responsibility of stakeholders in supporting circular business development. The Mendelow Matrix can be seen in Figure 1.



I N T E R E S T

Figure 1. The Mendelow Matrix

Stakeholders may have strong power but little interest in a business or have strong power and have a high interest in the business or have weak power but have a high interest. This matrix has four quadrants with different characters. Quadrant A is called low priority, namely the quadrant with low importance and power. Quadrant B, called keep informed, is a quadrant with high importance but low power. Quadrant C is called the keep satisfied quadrant, which is a quadrant with low importance but high power. Quadrant D is a key player, which is a quadrant with high importance and high power.

**Method**

This study was conducted with several stages adopted from Purwani's research (Purwani et al. 2022). The stages of the research are problem identification, data collection, analysis, and conclusions. The data sought are stakeholder data and their roles, stakeholder role categories, and data regarding the level of interest and level of power of stakeholders. The data collection process was carried out in several stages. The initial stage is in the form of collecting stakeholder data, stakeholder roles, and stakeholder role categories. The next stage is distributing questionnaires regarding the level of power and interest level of stakeholders. The questionnaire was prepared using a Likert scale from 1 very low to 4 very high. Data analysis used in this study is stakeholder mapping analysis, namely mapping stakeholders based on their level of power and level of interest, analyzing circular business processes, and analyzing the role of stakeholders.

**Data Collection**

Dari From the results of data collection, data regarding stakeholders and their roles were obtained, data regarding stakeholders and their role categories, and data regarding the level of interest and level of power of stakeholders. These data are described below.

**Stakeholders dan their roles**

Identification of stakeholders and their roles is carried out by observation, interviews, and literature studies. From the identification results, it was found that there were 30 stakeholders. Stakeholders and stakeholder roles can be seen in Table 2.

Table 2. Stakeholder and their roles

Code	Stakeholder	The role of stakeholder	Reference
S1	Electric motorcycle manufacturers	<ul style="list-style-type: none"> <li>- Producing electric motorcycles and assembling swap batteries into electric motorcycles</li> <li>- Selling electric motorcycles and swap battery electric motorcycles</li> <li>- Providing after-sales services in the form of circular repair, refurbish, remanufacture, reuse, recycle activities</li> </ul>	Observation and interviews
S2	Battery swap manufacturers	<ul style="list-style-type: none"> <li>- manufactures swappable batteries for electric motorcycles.</li> <li>- Selling electric motorcycle swap batteries</li> <li>- Providing after-sales services in the form of circular repair, refurbish, remanufacture, reuse, and recycle activities</li> </ul>	Observation and interviews
S3	Electric motorcycle dealers	<ul style="list-style-type: none"> <li>- Selling electric motorcycles and electric motorbikes swap batteries.</li> <li>- Providing after-sales services in the form of circular repair,</li> </ul>	Observation and interviews

<b>Code</b>	<b>Stakeholder</b>	<b>The role of stakeholder</b>	<b>Reference</b>
		refurbish, remanufacture, reuse, recycle battery swap activities.	
S4	Electric motorcycle authorized repair shops	- Providing after-sales services in the form of circular repair, refurbish, remanufacture, reuse, recycle battery swap activities.	Observation and interviews
S5	Electric motorcycle conversion repair shops	- Converting conventional motorcycles into electric motorcycles - Provide services in the form of circular repair, refurbish, remanufacture, reuse, recycle battery swap activities.	Observation and interviews
S6	Non-formal electric motorcycle repair shops	- Provide services in the form of circular repair, refurbish, remanufacture, reuse, recycle battery swap activities.	Observation and interviews
S7	Battery swap stations	- Serving swap battery exchange - Carry out repair, refurbish, remanufacture, reuse, recycle battery swap activities.	Observation and interviews
S8	Battery recycling companies	- Recycle the swap battery.	Observation and interviews
S9	Consumers of electric motorcycle	- Using services: repair refurbish and remanufacture battery swap.	Observation and interviews
S10	Consumers of reused products	- Buy products from reused batteries	Observation and interviews
S11	Consumers of recycled material products	- Buying recycled raw materials	Observation and interviews
S12	Suppliers of new cell battery	- Provide a supply of new cell batteries	Observation and interviews
S13	Suppliers of used cell batteries	- Provide a supply of used cell batteries	Observation and interviews
S14	Suppliers of battery management systems	- Provide BMS supplies for the manufacture of swap batteries	Observation and interviews
S15	Suppliers of supporting materials	- Provide supporting materials for making swap batteries such as holders, casings, etc.	Observation and interviews
S16	Universities and Research institutes	- Socializing the benefits and ways of circular business - Provide education and training to do circular business. - Doing research on circular business	Observation and interviews
S17	Mass media	- Socializing the benefits and ways of circular business	Observation and interviews
S18	The President	- Establish policies on handling battery waste and extending battery life. - Encouraging the relevant ministries to give appreciation to companies that process waste	Presidential regulation number 55 of 2019 chapter VI
S19	The coordinating ministry for maritime affairs	- Coordinate policies on handling battery waste - Making policies regarding market development, technology, circular business incentives	Presidential regulation number 55 of 2019 chapter VII
S20	The ministry for environment and forestry	- Make policies and regulations regarding the handling of hazardous waste. - Rewarding companies that manage battery waste	presidential regulation number 55 of 2019, regulation of the ministry of industry number 27 of 2022
S21	BSN	- Making policies regarding market and technology development - Promote electric vehicles and circular business	Observation and interviews
S22	The ministry for research and technology/National Agency for Research and Innovation	- Making policies regarding technology development - Conduct circular business research	presidential regulations number 55 of 2019 chapter VII
S23	The ministry of industry	- Making policies regarding market development, technology, circular business incentives - Promote electric vehicles and waste handling	regulation of the ministry of industry number 27 of 2022
S24	The ministry of energy and mineral resources	- Make policies regarding the provision of facilities and infrastructure for electric vehicles. - Promote electric vehicles and waste handling	regulation of the ministry of industry number 27 of 2022
S25	The ministry of BUMN	- Make policies regarding the provision of facilities and	regulation of the

Code	Stakeholder	The role of stakeholder	Reference
		infrastructure for electric vehicles and their components - Encouraging BUMN to implement circular business	ministry of industry number 27 of 2022
S26	The ministry of transportation	- Make policies regarding conversion motor repair shops - Encouraging conversion workshops to do electric vehicle battery swap circular business - Promote electric vehicles and waste handling	regulation of the ministry of industry number 27 of 2022
S27	The ministry of finance	- Making policies regarding circular business incentives	regulation of the ministry of industry number 27 of 2022
S28	The coordinating ministry for economics	- Coordinate policies on handling battery waste. Socialize electric vehicles and circular business - Encouraging companies to implement circular business	presidential regulation number 55 of 2019 chapter VII
S29	The ministry of trade	- Establish policies regarding battery imports	regulation of the ministry of trade number 100 of 2020
S30	BUMN (PLN, Pertamina, IBC)	- Provide facilities and infrastructure for electric vehicles and their components. - Implement circular business	regulation of the ministry of industry number 27 of 2022

### Stakeholder role category, level of power, and level of interest

Stakeholder roles are grouped into five groups, namely policy creators, implementers, coordinators, facilitators, and accelerators. Stakeholder role grouping is done by observation and interviews. The level of power and the level of importance were obtained by distributing questionnaires to experts. The results of distributing the power level and interest level questionnaires were then averaged and grouped into two categories, namely low and high. Low if the mean is in the range  $0 < x < 2.5$  and high if the mean is in the range  $x \geq 2.5$ . Complete results of role categories, level of power levels and levels of interest can be seen in Table 3.

Table 3. Role categories, level of power, dan level of interest

Kode	Role categories					Level of power	Level of interest
	Policy creator	Coordinator	Implementer	Facilitator	Accelerator		
S1			V			High	Low
S2			V			High	High
S3			V			Low	Low
S4			V			High	High
S5			V			High	High
S6			V			High	High
S7			V			High	High
S8			V			High	High
S9					V	High	High
S10					V	High	High
S11					V	High	High
S12					V	High	Low
S13					V	High	High
S14					V	Low	Low
S15					V	Low	Low
S16				V		High	High
S17				V		High	High
S18	V					High	High
S19	V	V				High	High
S20	V	V				High	High
S21				V		High	High
S22	V			V		High	High
S23	V	V		V		High	High
S24	V	V		V		High	High
S25	V	V		V		High	High
S26	V	V		V		High	High

Kode	Role categories					Level of power	Level of interest
	Policy creator	Coordinator	Implementer	Facilitator	Accelerator		
S27	V					High	High
S28	V	V				High	High
S29	V			V		High	High
S30			V	V		High	High

### 3. Results and Discussion

#### Power-interest matrix

From the data regarding the level of importance and level of power, a mapping of stakeholders is then made. Stakeholders can be grouped into four groups, namely key players, keep satisfied, keep informed, and low priority. This stakeholder group can be seen in Figure 2. Stakeholders included in the key players are the President, the coordinating ministry for maritime affairs, the coordinating ministry for economics, the ministry for environment and forestry, the ministry for research and technology/National Agency for Research and Innovation, the ministry of industry, the ministry of Energy and Mineral Resources, the ministry of BUMN, BUMN (PLN, Pertamina, IBC), battery swap manufacturers, electric motorcycle authorized repair shops, electric motorcycle conversion repair shops, non-formal electric motorcycle repair shops, battery swap exchange stations, battery recycling companies, electric motorcycle consumers, consumers of reused products, consumers of recycled material products, universities and Research institutes, Ministry of Finance, suppliers of used cell batteries, BSN, Ministry of Transportation, and Ministry of Trade. The large number of key players shows that circular business development cannot only be carried out by one company, it needs to involve various stakeholders (Wrålsen et al. 2021).

Stakeholders who fall into the keep satisfied category are electric motorcycle manufacturers and new cell battery suppliers. Stakeholders in this category need to maintain relationships to always assist in the development of a circular business. Stakeholders included in the low priority category are electric motorcycle dealers, suppliers of battery management systems, and suppliers of supporting materials. All stakeholders are important to note. Stakeholders with low levels of interest and low power are stakeholders with low priority. Stakeholders can be grouped into four groups, namely key players, keep satisfied, keep informed, and low priority. This stakeholder group can be seen in Figure 2

	<b>KEEP SATISFIED</b>	<b>KEY PLAYER</b>
High	Electric motorcycle manufacturers Suppliers of new cell battery	The President The coordinating ministry for maritime affairs The coordinating ministry for economics The ministry for environment and forestry The ministry for research and technology/National Agency for Research and Innovation The ministry of industry The ministry of energy and mineral resources The ministry of BUMN The ministry of transportation The ministry of trade The ministry of finance BUMN (PLN, Pertamina, IBC) BSN Battery swap manufacturers Electric motorcycle authorized repair shops Electric motorcycle conversion repair shops Non-formal electric motorcycle repair shops Battery swap stations Battery recycling companies Consumers of electric motorcycle Consumers of reused products Consumers of recycled material products Universities and Research institutes Suppliers of used cell batteries
Low	<b>LOW PRIORITY</b>	<b>KEEP INFORMED</b>
	Electric motorcycle dealers Suppliers of battery management systems	

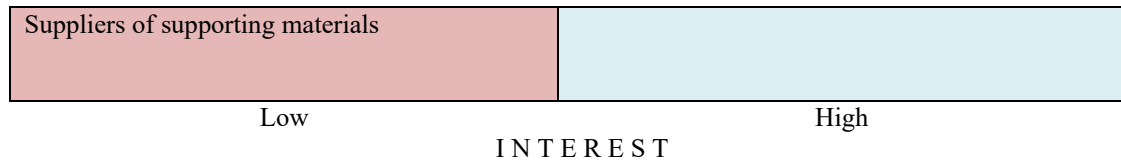


Figure 2. The Mende low matrix of circular business of electric motorcycle swappable batteries

Stakeholders included in the key players are the President, the coordinating ministry for maritime affairs, the coordinating ministry for economics, the ministry for environment and forestry, the ministry for research and technology/national agency for research and innovation, the ministry of industry, the ministry of energy and mineral resources, the ministry of BUMN, the ministry of transportation, the ministry of trade, the ministry of finance, BUMN (PLN, Pertamina, IBC), BSN, battery swap manufacturers, electric motorcycle authorized repair shops, electric motorcycle conversion repair shops, non-formal electric motorcycle repair shops, battery swap exchange stations, battery recycling companies, consumers of electric motorcycle, consumers of reused products, consumers of recycled material products, universities and research institutes, and suppliers of used cell batteries. The large number of key players shows that circular business development cannot only be carried out by one company, it needs to involve various stakeholders (Wrålsen et al. 2021).

Stakeholders who fall into the keep satisfied category are electric motorcycle manufacturers and new cell battery suppliers. Stakeholders in this category need to maintain relationships to always assist in the development of a circular business. Stakeholders included in the low priority category are electric motorcycle dealers, suppliers of battery management systems, and suppliers of supporting materials. All stakeholders are important to note. Stakeholders with low levels of interest and low power are stakeholders with low priority.

### 5.1 Battery swappable circular business processes

The circular battery swappable electric motorcycle (EMS) business process involves various stakeholders, both directly and indirectly. The circular battery swappable business process starts with suppliers who supply pack batteries and manufacture electric motorcycles as shown in Figure 3. After that, some batteries are rented out through swap stations, and some are bought and sold through dealers. The user uses the battery for the life of the battery. Batteries that have ended life are collected at the collector, the batteries are then checked for their condition and grouped into several groups. Batteries with minor damage are repaired. Batteries with damage are being refurbished. Batteries with major damage but can still be repaired are remanufactured, batteries with low power are reused for other uses. Batteries that have been badly damaged and cannot be repaired are going into recycling. Battery swappable circular business process can be seen in Figure 3.

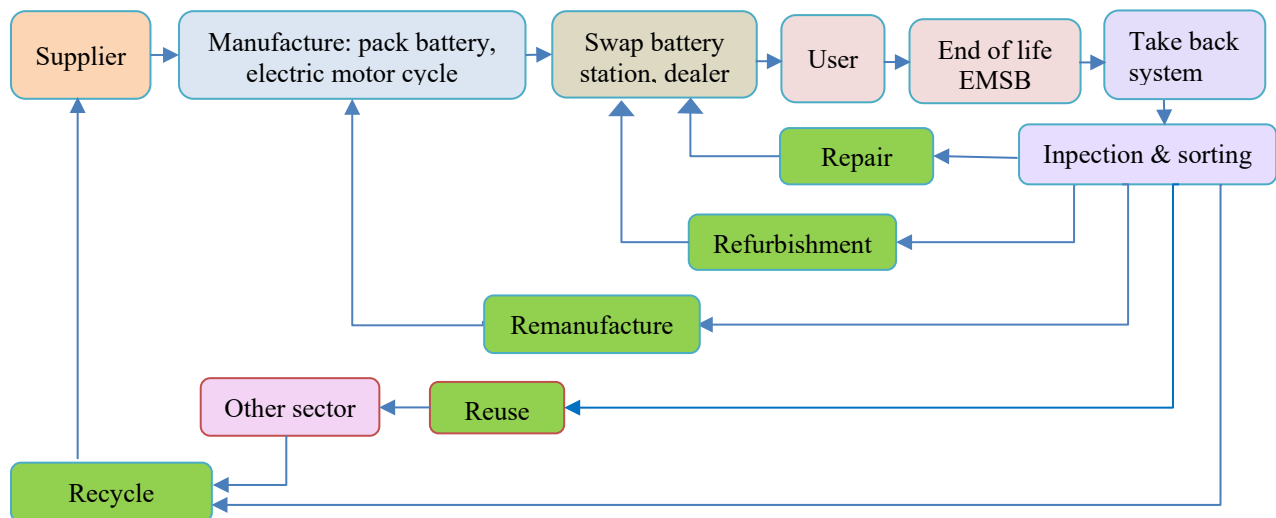


Figure 3. Battery swappable circular business processes

Consumers who use electric motorcycles with battery energy, there is a possibility that the battery will be damaged before it reaches its useful life. The damage can be of various kinds, in the form of loose connections, damaged battery



cells, or damaged BMS. Consumers will look for places that can repair batteries, or you could say places that do circular business. This circular business is a new business opportunity in accelerating electric vehicles. This business can be a business of its own so that it creates new jobs or a combination of other businesses so that it can become additional income for other businesses.

This circular business will provide many benefits both for the economic, environmental and social sides (Khan et al. 2020). Batteries that can no longer be used in electric motorcycles, then these batteries can still be used for use in other products or what is often referred to as reuse. There is a business opportunity to collect used batteries and utilize used batteries for other uses. Used batteries can be used for electric bicycles, street lighting, energy storage, etc.(Michellini et al. 2023).

Batteries that are no longer usable should not be disposed of or burned carelessly, because they will pollute the environment (X. Zheng et al. 2018). The battery needs to be recycled to reduce environmental pollution. Battery raw materials are materials derived from natural resources. Processing battery waste into battery raw materials is an effort to reduce the use of increasingly limited natural resources. Batteries contain important metals which are limited and non-renewable natural resources and have great economic value. These metals can be recovered even some of them with a higher level of purity than metals in natural mining ores through the recycling process (X. Zheng et al. 2018). Institutions that carry out circular business indicate that the institution cares about the environment and cares about the health problems of stakeholders. Stakeholders will feel satisfied if an institution pays attention to environmental issues and cares about the health of stakeholders.

## **5.2 Analysis of the role of stakeholders**

Stakeholder roles are grouped into 5 namely policy creator, coordinator, implementer, facilitator, and accelerator. Stakeholders who act as policy creators regarding the circular battery swap business are the President, the ministry of maritime affairs, the ministry of economics, the ministry of environment and forestry, BSN, the ministry of research and technology/National Agency for Research and Innovation, the ministry of industry, the ministry of ESDM, the ministry of BUMN, the ministry of transportation, the ministry of finance, and the ministry of trade. There is a policy regarding battery waste. Several policies regarding waste include Presidential regulations and Ministerial regulations. The President has issued policies on protecting the environment, handling battery waste, and giving appreciation to industries that handle battery waste. through presidential regulation number 55 of 2019 chapter VI (Presiden Republik Indonesia 2019). As a follow-up to the presidential regulation, the Minister of the Environment issued a regulation regarding quality standards for lithium battery recycling emissions (Menteri Lingkungan Hidup Dan Kehutanan 2021). Policies regarding the handling of battery waste already exist, but this policy needs to be evaluated for its effectiveness.

To make waste handling more effective, policy makers can adopt good practices from other countries (Adi 2022). The Swiss government requires battery users to return used batteries to sellers or collection points. The battery seller is required to accept and distribute the used battery to the collection point. There is an institution appointed by the Swiss government to handle the transportation, collection, and processing of battery waste. Funds for transportation, collection and processing are collected from battery excise when consumers buy batteries. Providing incentives to circular business operators will increase sustainability (Steinhiper and Nagel 2017). Policy makers can encourage circular business implementation to be faster through the provision of incentives (Sopha et al. 2022).

Stakeholders who act as coordinators are the coordinating ministry for maritime affairs, the coordinating ministry for the economy, the ministry of LHK, the ministry of industry, the ministry of Energy and Mineral Resources, the ministry of BUMN, and the ministry of transportation. Coordination regarding waste management has been carried out many times. Some of the coordination includes coordinating waste handling at the Center for Industrial Pollution Prevention Technology (BBTPPI) on 25-28 October 2020. In order for the handling of battery waste to be more comprehensive, coordination needs to involve existing stakeholders, especially the main stakeholders, in this case those involved in key player. Coordination and communication need to be constantly carried out, because good communication is one of the keys to improving circular business performance (Kazancoglu et al. 2021).

Stakeholders who act as implementers are electric motorcycle manufacturers, battery swap manufacturers, electric motorcycle dealers, official electric motorcycle repair shops, electric motorcycle conversion workshops, battery swap exchange stations, battery recycling companies, and BUMN. Lots of research shows that batteries can be repaired/refurbish/remanufacture/reuse/recycle, such as research on the electric vehicle battery circular business model (Albertsen et al. 2021), the transition to the electric vehicle circular business (Bonsu 2020), and business models circular to extend battery life (Olsson et al. 2018). However, not all stakeholders have fully implemented the circular business. There are several obstacles in implementing circular business, especially the problem of limited ability and knowledge to carry out circular business (Geissdoerfer et al. 2023; Pereira and Vence 2021). This limitation can be

minimized through training or education about batteries and battery repair. However, there are still very few institutions that provide education regarding batteries and battery repair.

Stakeholders who act as facilitators are universities and research institutes, mass media, BSN, the ministry of research and technology/National Agency for Research and Innovation, the ministry of industry, the ministry of ESDM, the ministry of BUMN, and the ministry of transportation. Stakeholders here function to provide facilities in the form of equipment, places, ideas, training, and education as well as outreach to support the circular battery swap business. Universities have a role in training human resources who are experts in the field of batteries and battery repair.

Stakeholders who act as accelerators are electric motorcycle consumers, consumers of reused products, consumers of recycled material products, suppliers of new cell batteries, suppliers of used cell batteries, BMS suppliers, and supporting suppliers. These stakeholders play a role in accelerating the implementation of circular business. Consumers have an important role in circular business (Maitre-Ekern and Dalhammar 2019). Consumers are parties who use circular business services, the more consumers use circular business services, the more circular business will develop. Consumer awareness to use circular business varies. This consumer awareness needs to be continuously increased so that consumers are more concerned about the environment and circular business.

#### **4. Conclusion**

Stakeholders are parties involved in the development of a business. To develop a circular swappable battery business, stakeholder involvement is required. There are 30 stakeholders involved in the development of the battery swap circular business. To facilitate how to manage and serve stakeholders, these stakeholders are mapped into 4 categories, namely key players, keep satisfied, keep informed, and low priority. Stakeholders who are key players are stakeholders who are the top priority in the development of the swappable battery circular business, this is because stakeholders in this position have a high level of interest and a high level of power. Stakeholders included in the key player are the President, the coordinating ministry for maritime affairs, the coordinating ministry for the economy, the ministry of LHK, the ministry of research and technology/National Agency for Research and Innovation, the ministry of industry, the ministry of Energy and Mineral Resources, the ministry of BUMN, BUMN (PLN, Pertamina, IBC), electric motorcycle manufacturers, swap battery manufacturers, dealers electric motorcycles, electric motorcycle authorized repair shops, electric motorcycle conversion repair shops, non-formal electric motorcycle repair shops, battery swap exchange stations, battery recycling companies, electric motorcycle consumers, consumers of reused products, consumers of recycled material products. Each stakeholder has their own role. Stakeholder roles can be grouped into five, namely policy creator, coordinator, implementer, facilitator, and accelerator. Policies regarding battery waste already exist, but the effectiveness of these policies needs to be evaluated. Policy makers can imitate policies from countries that are already good at handling battery waste.

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