

Conceptual Design of Business Model Canvas Mobile Battery Swap Charging Station

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Abstract. *The users of electric motorcycle in Indonesia are currently still limited. This is due to three main things, namely the limited amount of energy charging infrastructure, the lack of socialization regarding the knowledge of technical aspects of electric motorcycle and the financing aspects of electric motorcycle ownership. This research develops a conceptual design business model canvas of Mobile Battery Swap Charging Stations (MBSCS) for electric motorcycles which aim to find solutions to the three problems above. The development of the MBSCS model is an alternative to increase the number of electric charging infrastructure quickly, because the advantages of MBSCS include having a higher level of flexibility and simpler installation than Fixed Charging Stations. This research combines the need of increasing infrastructure and improving socialization to the community regarding the advantages of using electric motorcycle through marketing communication media. Increasing the understanding of technical aspects of electric motorcycle is expected to increase people's motivation to adopt electric motorcycle. This research uses secondary data to explore MBSCS business canvas model (BMC), MBSCS ecosystem, and MBSCS prototype design. The analysis illustrates the MBSCS ecosystem that align with the motorcycle users in Indonesia. The existence of MBSCS is expected to significantly increase the buying interest, adoption, and diffusion of electric motors more broadly.*

Keywords: *Business Model Canvas, Mobile Battery Swap Charging Station, electric motorcycle*

I. INTRODUCTION

To reduce carbon emissions to zero emissions by 2060, the Government of Indonesia continues to endeavour in reducing the use of oil-fueled vehicles with electric-powered vehicles. Literature studies show that one of the causes of low motivation in adopting electric vehicles is the limited availability of charging station infrastructure (Utami et al., 2020). The government has made efforts to procure charging station in which up until year 2020 it has reached around 7000 Charging stations (Dharmawan et al., 2021). These amounts are relatively small and still cannot increase the number of electric vehicle users in Indonesia significantly. A study shows

that people have a high interest in adopting electric vehicles, but the level of urgency to own electric vehicles is still considered low. Most respondents stated that the urgency to use electric vehicles both as a mode of private transportation and public transportation is still seems not too urgent. Eventhough people consider that there are many advantages will be obtained if using electric vehicles, such as electric vehicles are more environmentally friendly, energy costs are cheaper and relatively do not require intensive maintenance. However, it is realized that the disadvantages of using electric vehicles are short mileage, the battery charging stations is still limited, and it requires more time to recharge the battery (Krisdamarjati, 2022). To overcome with the problems, many efforts have been made such as to defeat with the mileage problems, each electric motorcycle is equipped with two battery packs, where each battery pack can cover a distance approximately 60 km. So, each electric motorcycle can cover approximately 120 km before finding the next battery charging station. Another breakthrough that has been made is to overcome the high price of the batteries. There is a scheme in which customer do not need to buy electric motorcycle, but the users are allowed to use electric

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Submitted: 03-01-2023

Revised: 18-05-2023

Accepted: 08-06-2023

motorcycle with a leasing system. With this scheme, the user can pay daily with a free of charge of exchanging the battery pack in a Battery Swap Charging Station. Customer can change the low energy battery with the full energy battery only within minutes.

Innovation in the easiness of changing battery at an affordable price is expected to increase the attractiveness of the community who wants to use electric vehicles especially motorcycle.

This research was conducted to develop Mobile Battery Swap Charging Station (MBCS) for electric motors. The existence of MBCS is not only for accelerating the amount of infrastructure of charging swab battery station, but also is used to increase awareness to the community, in which the MBCS is used as a tool for marketing campaign and socialisation.

The manufacturing process of MBCS is considered simple, flexible, and required low-cost investment. The existence of MBCS is not intended to replace fixed Battery Charging Station (FBCS) but can be considered as an alternative to accelerating the fulfilment of infrastructure that complements the exstance of FBSCS (Zhang et al., 2020). In the areas where electric charging infrastructure is still not available, the existence of MBSCS can temporarily meet the demand for electric charging stations, until the FBSCS network is available in the area (Afshar et al., 2021).

The existence of MBCS also can be used as tools for marketing communication campaign, education, and socialization for the community to know more about the advantages of electric motors. Moreover, these activities are expected to increase the willingness of the community to use electric motorcycles. This research develops the MBSCS design that combines three main purposes, first, to increase energy charging infrastructure for electric motorcycles. Second, to increase the socialization and to educate the community about the advantages, know-how, technical aspects, and other marketing communications that will increase the motivation for electric motor ownership in the community. Third, to design the business model of MBSCS. This research will answer some of basic questions

such as: (1) What is the MBSCS ecosystem design that suitable for electric motorcycles in Indonesia? (2) What is the prototype design of MBSCS? (3) What is the Business Canvass Model of MBSCS?

The Business Model Canvas (BMC) is a model developed by Osterwalder and Pigneur (Osterwalder, 2010). BMC has a comprehensive structure and details. The BMC framework proposes a model consisting of nine elements which describe different aspects of a particular business segment. The nine elements of the BMC model can be grouped into four perspectives: (1) customer perspective (2) business perspective (3) financial perspective and (4) value perspective of goods or service provided. The latter perspective plays the most important role in this business model, as it combines three other aspects that are the company's internal customer perspective includes key partnership (KP), key activities (KA) and key resources (KR). Business external perspective includes customer relations (CR), customer segments (SC) and channel (CH). Figure 1 shows the BMC chart developed by Osterwalder.

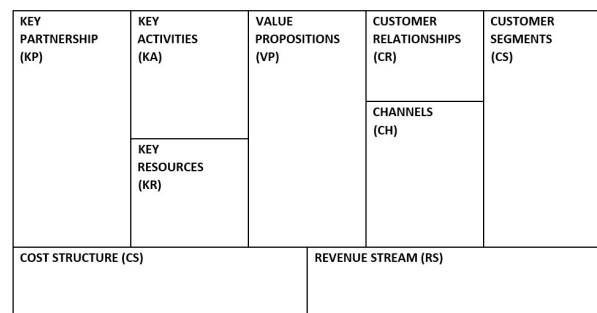


Figure 1. Business Model Canvas

Battery Swap Charging Station Infrastructure. According to Chutima et al, the infrastructure of battery swap charging station at least consists of four factors, namely software and applications, charging stations, operators, and aftersales services as well as the design of charging equipment and connectors (Chutima & Tiewmapobsuk, 2021). Figure 2 below, shows the four factors required in the battery swap charging station infrastructure.

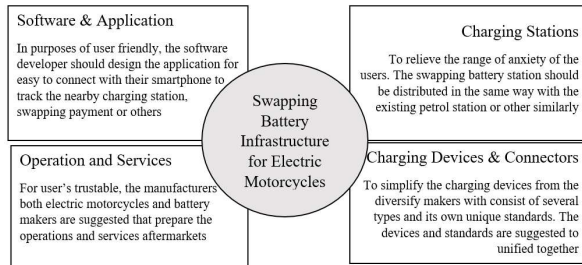


Figure 2. Battery swap charging station infrastructure (Chutima & Tiewmapobsuk, 2021)

Software and applications are used to inform the battery condition, the location of battery exchange as well as the payment method. The applications should be made as simple as possible and easy to use without any additional costs. In designing the applications, developers must work together both internally and externally to prevent obstacles when using the applications. The developers should work closely with providers Internet, battery industry, Electric motorcycle industry and operators.

Operator and aftersales services will serve customer to make them feel safe, especially when they have problems with their electric motorcycles for example when customer have problem with battery damaged. Other matters related to customers can be handled by the operators who can collaborate with the motorcycle industry, battery industry, software developers that allow the operator to work optimally for electric motorcycle customers.

Charging station

Currently, there are many different standards especially in charging devices, battery and connectors that is used in the electric motorcycle. It causes the battery charging stations can serve only for a specific brand. The competition among manufacturers will give negative impact especially in national standardisation. The standard of charging devices and connectors should be centralised, which make the service of charging stations can be wider, not only limited to a specific brand.

Charging devices and connectors

The charging equipment, battery specifications and more standards regarding

battery dimensions, capacity, connector protocols for each manufacturer are still not uniform, depending on the policies of each manufacturer. Battery innovation is strictly confidential for each manufacturer, some develop 48V, 60V and 72V. Therefore, we need to have national standard for swab battery charging station so the infrastructure of battery swab charging station can serve all users.

Mobile Charging Station (MCS) is defined as charging station or electrical energy provider that is mobile, movable, and able to travel for a certain distance. The mobile charging is mainly designed for specific purposes to help with vehicles that run out of fuel in locations where there are no electrical energy charging station facilities available (Atmaja & Mirdanies, 2015). The MCS using technology Lithium-iron phosphate (LiFeO₄) and electric double-layer capacitor (EDLC) as ultracapacitor Kesiapan teknologi MCS menggunakan baterai Lithium-iron phosphate (LiFeO₄) dan electric double-later capacitor (EDLC) sebagai ultracapacitor can provide adequate facilities for ultrafast charging of batteries (Dwi Atmaja, n.d.). Studies combining the implementation of grid networks and photovoltaic (PV) renewable energy sources have also been carried out, which are supported by information and communication technologies using cloud architecture (Maghfuri et al., 2021). Due to its flexibility and simplicity, MCS can be used as an alternative to accelerate the availability of electric charging infrastructure.

The current mobile battery charging for electric vehicle (especially for 4-wheels vehicle) include: portable charging station (see Fig. 3), truck mobile (see Fig. 4) and VtoV (vehicle to vehicle – see Fig. 5). Portable charging is a backup energy storage system that can be carried out together with electric vehicles. The energy storage system can also be in the form of mobile wheeled truck container. Fig. 3 and Fig. 4 are the example portable charging station and wheeled mobile charger that can move by being connected with another vehicle.

The design of truck mobile charging station can be standing alone or uniting with truck vehicles as shown at Figure 4. The V to V (Vehicle

to Vehicle) is commonly known as the transfer of energy between two electric vehicles, as shown in Figure 5.



Figure 3. Portable charger model and small mobile charging station (source: google search)



Figure 4. Truck model of Mobile Charging Station (Source: gGoogle Search)



Figure 5. V to V Charging Station (Source: Google Search)

In this process, one vehicle serves as an energy source and another vehicle act as an energy receiver. The technology of charging energy with VtoV is mainly used for emergency case. The availability of VtoV is very limited. Usually, each manufacturer has a special vehicle that are equipped with mobile charger equipment for servicing customer in an urgent case.

A model of mobile marketing communication campaign

Businesses use digital media to communicate with their customers. Communication between businesses and customers may include sharing experiences, evaluating products, handling complaints, introducing new product development or other purposes. The interaction between business and customer is getting better with the support of digital media. Digital media is an electronic device that contains a computer chip and control unit that can process digital signals through code in a format that can read by a computer, so that this digital signal can be created, modified, and stored in digital devices and can facilitate the communication process (Shankar et al., 2021). Marketing communication is necessary to influence customer decisions to use or purchase the products offered. A purchasing decision is the stage where a customer commits to spending a certain amount of money to get the goods or services he needs. The mobile marketing communication model usually uses vehicles, both two-wheeled and four wheeled that present product information introduced to customers. Figure 6 is a picture of the mobile marketing communication model which is digital or static.



Figure 6. Mobile marketing communication model (source: google search)

Table 1. Research in business models in energy and renewable energy

Reserachers	Titles	Topic
Goncearuc, A. (Goncearuc et al., 2022)	An integrative approach for business modelling: Application to the EV charging market	Business Model Canvas Charging Station for 4-wheels electric vehicle
Ziegler, D (Ziegler & Abdelkafi, 2022)	Business models for electric vehicles: Literature review and key insights	Business Model Canvas Electric Vehicle (4-wheels)
Reis I,F.G (Reis et al., 2021)	Business models for energy communities: A review of key issues and trends	Business Model Canvas clean energy community
Hoefst, F. (Hoefst, 2021)	Internal combustion engine to electric vehicle retrofitting: Potential customer's needs, public perception and business model implications	Electric vehicle based on customer perceptions (4-wheels EV)
Gerard McGovern (McGovern, 2021)	Capturing community value in civic energy business model design	Business Model distribution energy in urban area
Kumar. (Kumar & Shrimali, 2021)	Role of policy in the development of business models for battery storage deployment: California case study	Business Model battery storage
Karami, M.,(Karami & Madlener, 2022)	Business models for peer-to-peer energy trading in Germany based on households' beliefs and preferences	Business Model energy trading

This study aims to develop an MBSCS design that is suitable for the requirements of Indonesian people. MBSCS can also be function as digital marketing communication devices. The design is expected can serve as an alternative to accelerating the infrastructure of charging station as well as to be used as a digital marketing campaign devises to increase the motivation of the community to use electric motorcycle.

State of The Art

Research in business models in energy and renewable energy has widely carried out as shown in the Table 1.

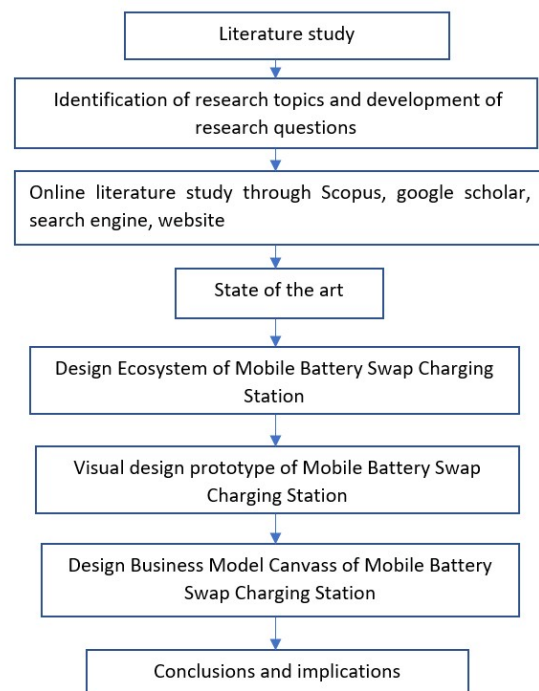
Research on Business Model Canvass for Mobile Battery Swap Charging Stations has never been found. This research fills the gap and attempt to design the business model canvass for battery swap charging station models of electric motorcycles.

II. RESEARCH METHOD

This research is a descriptive study using secondary data and information that is obtained trough literature studies. The secondary data is obtained from various sources such as published journals, newspaper, Google scholars and websites. The data is mostly obtained online. The keywords are used as references in this study are

as follows: Business Model, Business Model Canvass, Charging Station, Electric Vehicle.

Secondary data is used to complete the information required in designing the concept of MBSCS Business Model Canvass. This research process is shown in the flowchart shown in Figure 7.

**Figure 7.** Flow-chart of the research

III. RESULT AND DISCUSSION

Ecosystem of MBSCS

The design of MBSCS ecosystem consist of seven closely interrelated units which are coordinated by an operator of MBSCS (Operational Management). The seven MBSCS units are as follows: (1) Infrastructure facilities (2) MBSCS Operational Management (operator of MBSCS) (3) MBSCS business owner (4) Developer and e-mobility service provider (5) The owner of electric-motorcycle (6) Digital Marketing Agency (7) Financial Institution. The ecosystem of MBSCS is shown in Fig. 8.

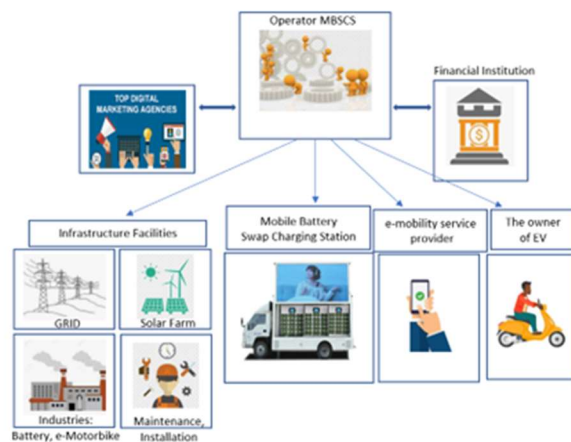


Figure 8. The Ecosystem of MBSCS

Infrastructure facilities. Infrastructure facilities of battery swap charging station consist of:

- Energy Supplier is a producer of grid electricity (grid-PLN) or energy sources from solar panels will be directly involved as energy chargers at MBSCS.
- Industries are manufacturer of battery, electric motorcycles and other supporting equipment is the main key partner for MBSCS.

Maintenance and Installation are contractors for maintenance, repair, and installation as well as regular inspections. Maintenance can also be assumed as some parties that performs after sales service maintenance of electric motorcycle.

MBSCS Operational Management (operator) and after-sales service unit is the company that operates the ecosystem of MBSCS. This company will run the day-to-day operations that is responsible of the smooth of running applications

and other transactions. This company gives services to customers and is responsible to manage customers database which is important to other stakeholders. This company coordinate other stakeholders in the ecosystems of MBSCS as described above.

MBSCS Business Owner. MBSCS units can be owned by investors, such as public companies, private companies, cooperatives, small and medium enterprises and even individuals. The day-to-day operations should also under coordination of MBSCS operational management.

Developer dan e-mobility service providers. The apps developers need to create simple apps that easy to use yet have completed features. Application providers play a significant role in the smooth management of the network providers and roaming. The apps created are related to electric motorcycles, battery system and Customer Related Management Applications.

Electric motorcycle users/owner. Electric motorcycle owner can take advantage of public or private battery swab charging station, and they will feel comfortable using their electric motorcycle.

Digital Marketing Agency. The operator of MBSCS or the operational Management coordinate with digital marketing agency to take advantage of the videotron facilities in each of the MBSCS unit. The MBSCS business owner can earn income from advertiser of the companies that required marketing product communication to the public. Ads will be served via videotron and can be monitored. The cost of ads fee is calculated based on where it is served, the length of views (per second, per minute) and the amount of period

Financial Institution. MBSCS operators coordinate with financial institutions to provide financial assistance for electric motorcycle ownership of the communities. Financial institution will connect directly to the customer through the apps developed by e-mobility developer (no.4). The apps may include financial loan feature, in which the financial institution can monitor about timely payment obligations and loan positions. The roles of digital marketing

agency (no.6) also can increase the number of financial institution customers significantly.

Visual design of MBSCS prototype.

The design of Mobile Battery Swap Charging Station is currently still not available. In this study, the prototype design of the MBSCS is combined with videotron as a marketing communication device. Two types of MBSCS prototype have been proposed. (1) MBSCS with self-contained container trucks (caravan shape) and trucks models, which can be three or four wheelers. Inside the caravan and the trucks are equipped with battery swap charging. While the videotron is installed on the rear door or also can be placed on the door that can be opened and closed. The size of videotron can be adjusted depend on the requirement, whether small, medium, or large sizes. The design of the MBSCS prototype caravan model requires additional vehicles that can move the Caravan unit as desired. This unit is suitable for the needs of a specific event in a particular location for a predetermined period. The design of the MBSCS caravan model can be seen in Figure 9.



Figure 9. Visual Design of MBSCS container model
(Source: Google Search)

(2) The design of truck model is more flexible because it can move without the requirement of towing vehicle. The design prototype of MBSCS truck model is shown in Figure 10.

Figure 11 shows the prototype design of MBSCS with videotron installment at the back of the three-wheelers truck.

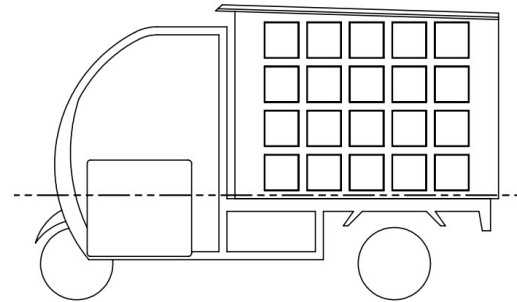


Figure 10. Visual design of MBSCS with 3 wheels Electric Vehicle



Figure 11. Visual design of MBSCS with videotron as marketing communication devices.

Business Model Canvass of MBSCS

The business model canvass is created especially for both the operator of MBSCS (the operational management) and the MBSCS business unit owner. The operator of MBSCS is the key operator because it coordinates the ecosystem of MBSCS. The business owner of MBSCS is also important, as they operate directly the MBSCS unit. There are nine elements in business model canvass that will be explained in the following sections.

CS - Customer Segment. The customer segment for MBSCS operational management is divided into three parts, namely BtoC customer (Business to customer), BtoB customer (Business to Business) and MBSCS owners. BtoC customer are individuals who come from middle class society who have the following demographic characteristics:

- a. Geographic: customers are in the territory of Indonesia especially in Java and Bali, both in urban and rural area

- b. Demographic: customers who use electric motorcycle are from various background and they are not limited by education, profession, income, gender, ethnicity, or race even though there are age restrictions due to regulations regarding driving permits, that are the age above 16 years old.
- c. Psychographic: customers who require a short-distance mobility, with high intensity, for example transport to workplace, to school, to go shopping, to distribute materials, and for taxi services.
- d. Behaviour: the behaviour of customers is those who need transportation which are economical, fast, flexible, and credible vehicle (high quality motorcycle).

BtoB customers may include companies that have a motorcycle fleet in their daily work, such as distribution companies, freight forwarding service companies, sales motorist team, mobile technician teams and other purposes.

The MBSCS business owners are the partner of operator MBSCS who provide and operate MBSCS unit. They may be individuals, MSMEs or business entities from public or private sectors.

The customer segment of MBSCS business owner is the individuals who own electric motorcycle.

CH - Channels. The channels in MBSCS ecosystem describe how the operational management and the business unit owner get customer. For MBSCS operational management, the customers, especially MBSCS business owners, are recruited through direct contact to public company, private company, cooperative, and government who are interested to be involved in the MBSCS environment.

While for MBSCS business owner, customers who own electric motorcycle, can be gathered through two channels. Firstly, direct selling to customer. The owner of MBSCS unit can also act as reseller of electric motorcycle. Giving more explanation to a new prospect customer can attract them to buy electric motorcycle unit. Secondly, the MBSCS business owner can connect to the new customer through social media, website, email, and Whatsapp.

CR - Customer Relationships. Automatically the relationship with existing customers is made through applications made by the electric motor industry and CRM (Customer Relation Management) applications provided by operators. Personal relationships can be performed for special circumstances, for example, there are cases that are very personal in nature such as accidents, damage, and loss of the electric motorcycle unit.

Customer relationship for MBSCS business owner mainly personal relation through direct contact and social media, especially for individual customer of electric motorcycle.

VP - Value Proposition of operator MBSCS. Firstly, as an operator in the MBSCS ecosystem, the role as a liaison and coordinator for all stakeholders is an important value. Being an industry liaison (both the electric motor industry and the battery industry), infrastructure providers (in this case PLN, battery replacement station providers and MBSCS stations), Marketing Agency as a party that is actively looking for companies that need marketing communication activities for their new product launching for example, to approach customers. Financial institutions are the partners that provide financing facilities ownership of electric motors for customers, and relationships with customers through available applications.

Secondly, as a mobile apps operator, they are responsible for the smoothness use of mobile applications by the customers. The Mobile apps allow operators to process data from customer database, location data of the presence of the battery replacement station, the location of MBSCS, and the location of the electric motor, customer payment system data, and customer support. Thirdly, Operator perform CRM (Customer Relation Management) services on an ongoing basis both for customers and in dealing with key partners, such as industry, marketing agencies, financial institutions and MBSCS operators for technical services and maintenance services.

While the value proposition of business owner's unit MBSCS are become a good liaison of

businesses and customer and providing an infrastructure of battery swab charging station.

RS - Revenue Stream. The revenue stream of the operational management, the revenue may come from the Agency fee which is charged from any activities in MBSCS environment, such as from manufacturer electric motorcycle, battery manufacturer, Apps developers, marketing agency. While the revenue stream for MBSCS business owner comes from battery sales, reseller fees from the sale of electric motorcycles and spareparts, and fee from videotron advertisement.

KA - Key Activities. MBSCS operational management is a provider of battery swab station infrastructure for electric motorcycle. MBSCS operators are also actively collaborate with marketing agency to obtain advertising order for MBSCS videotron. As one of the activities of MBSCS business owner is to do marketing campaign, therefore MBSCS operators should find a strategic location to conduct marketing communication with the community through videotrons installed in MBSCS units.

The key activities of MBSCS business owner are selling Battery Swab, promoting and socialization electric motorcycle to customer, become a reseller of electric motorcycle and doing marketing communication

KR - Key Resources. The significant resources of MBSCS operator are (1) a good relationship with apps developers (2) team experts who develop battery technology (3) network with videotron advertiser company that willing to advertise their products and doing marketing communication through MBSCS units. (5) skilled workers in manufacturing electric motorcycles (6) Experts in IT who develops applications platform for electric motorcycles.

The key resources for MBSCS Business owner are battery manufacturer and supplier, maintenance team and customers of electric motorcycle.

KP - Key Partnership. The key partners who involve in the MBSCS ecosystem consist of manufacturer electric motorcycle, Apps developer, Battery Manufacturer, Business Owner of MBSCS, MBSCS Installer, Maintenance Team, PLN (State Electricity Company), Financial

Institution, Marketing Agencies, Regulator, or government.

The key partnership for MBSCS business owner is Operator of MBSCS (Operational Management).

CS - Cost Structure. The cost structure consists of overhead cost of Operator MBSCS such as office rent, office supplies, human resources, research & development, maintenance, and tax. While the cost structure for MBSCS business owner may come from the cost of electricity for charging, labor cost and daily allowance, and space rent (if any), maintenance cost, tax.

The BMC chart of operational Management and MBSCS business owner are provided in the appendixes.

IV. CONCLUSION

MBSCS is an alternative to the acceleration of providing battery swab charging station infrastructure. The existence of MBSCS can help businesses increase the activity of marketing communication and socialization to the community, which allows for a significant ncrease in the adoption and diffusion of electric motorcycle in the community. MBSCS units can be owned by individuals as well as business entities, which will increase the role of MSMEs in the community's economy. This research is still a conceptual design and further research activities re still required such as technologi readiness analysis, commercialization readiness analysis and analysis of techno-economic aspects in the development of MBSCS. The prototype of MBSCS is follow-up research that need to be carried out and to be tested immediately in the community, to obtin more accurate empirical data.

ACKNOWLEDGMENTS

This research was funded by RKAT PTNBH Universitas Sebelas Maret for fiscal year 2022 through Penelitian Fundamental (PF-UNS) with Research Agreement Number: 254/UN27.22/PT.01.03/2022

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