Study the use of shared power supply in mobile telecommunication station in Indonesia

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Abstract. Increasing need of telecommunications and fierce business competition makes telecommunication tower providers try to continue the improvement of their competitive advantage. Improving telecommunications services by providing telecommunications towers or base transceiver stations, is something that must be improved in order to meet the communication needs in Indonesia. Hence, improving network infrastructure is something that must be done to meet the changing times. Of course, in the context of improving network infrastructure, investment costs are one of few significant factors. Each telecommunications company must continue to innovate, so that network infrastructure can be improved with lower investment costs. In this study, we propose infrastructure sharing model of its power supply in order to reduce capital expenditure for Mobile Network initial investment. It is expected that the proposed model can be useful as a new business scheme for tower providers and operators for business development in the field of telecommunications infrastructure, particularly in accelerating the growth of BTS devices in Indonesia. In addition, the purpose of this research is to meet the increasing needs of telecommunications network users in Indonesia and to improve the business competitiveness of each network infrastructure provider and to improve the quality of Indonesian people in communication.

1. Introduction

Telecommunications is one of the most important aspects in civilizations. With the increasing number of internet users in Indonesia, the increasing need for telecommunications infrastructure in Indonesia is something that must be considered. To make sure that the service of traffic increase, and to work on the underlying business opportunity, this traffic growth has to be considered without increasing the network infrastructure costs in terms of both capital expenditure (CAPEX) and operational expenditure (OPEX) [1]. Amid this challenge, markets are in fierce competition and increasingly saturated, so that operators have to be conscientious of costs in order to keep their profitability margins [1]. Investing and improving telecommunication infrastructure must also pay attention to the costs that will be charged to consumers [2]. Costs for improving telecommunications services, especially for telecommunications infrastructure, will be charged to these consumers. This is a dilemma for telecommunications service providers, or Mobile Network Operators (MNO), to improve telecommunications infrastructure. Operators certainly do not want investment costs to improve telecommunications services which will then become a burden for consumers. In addition, Operators strive to increase competitive advantage with competitors, by providing the best service at the lowest price. This is certainly one of the factors that can hamper the growth rate of telecommunications services.
infrastructure amid an urgent need for improvement in telecommunications infrastructure. Therefore, this study seeks to reduce capital expenditure incurred by operators so that the need for telecommunications infrastructure can develop without having to be borne by consumers.

In Indonesia, sharing infrastructure is used to be able to save costs related to the procurement of BTS equipment. On the other hand, tower providers provide towers and connections for electrical connections. Infrastructure sharing lies in the use of towers simultaneously.

In order to fulfill the demand of the telecommunication infrastructure, operators need to accelerate the growth of its infrastructure. For the operator side, one of the ways that can be done to accelerate the growth of infrastructure is by sharing infrastructure. Infrastructure sharing is considered both in growth or new roll-out (e.g. new technology or additional coverage) and in consolidation (e.g. phase out of old technology, re-location) scenarios [3]. In previous studies, research on the utilization of power supply devices, a rectifier, has never been studied before. In several previous studies, the use of shared power supplies only reached electricity sources, the generators. In this study, the model of using a shared power supply by operators is expected to be a solution to reduce costs incurred by telecommunications operators to add services to telecommunications infrastructure. Hence, this model is expected to be used easily for all operators. The use of shared power supplies on BTS towers is designed by charging fees to tower providers. This research will then conduct an analysis using the cost benefit analysis method. This method will be used to determine the benefits for tower providers and operators.

2. Research description
2.1. Shared power supply concept
In a power supply scheme for BTS devices, several components are needed, including an electric power source (AC) as the current power supply system at the BTS backed by an online UPS which ensures uninterrupted operation, and rectifier as a converter AC current into DC [4]. This model of infrastructure sharing includes in passive infrastructure sharing. This sharing is limited to non-electronic infrastructure at the cell site. Passive sharing is also known as site sharing, and in this form of sharing, all tenants or operators agree to share available infrastructure such as buildings and easements, site space, towers and masts, power supply and transmission equipment [5]. Therefore, the scheme in this study can be included in passive sharing infrastructure.

Shared power supply scheme is an effort that can be done in order to do infrastructure sharing, or commonly called co-location. Different from the existing power supply scheme where the rectifiers and batteries are procured by each operator, rectifier and batteries in shared power supply scheme will be provided by Tower Provider, there will be additional rectifier modules to anticipate the amount of power needed for the operator. The scheme of shared power supply can be seen in Figure 1.

![Figure 1. Scheme of shared power supply for BTS tower.](image)

In this scheme, operator only issue capital expenditure on network devices (BTS and antennas). Thus, it is expected that operator’s initial investment will be reduced by using shared power supply scheme. On the other hand, Tower Providers will increase the tower rental fees to compensate the purchase of rectifier. The important thing to be considered in preparing the rectifier is the capacity of
the rectifier. Rectifier capacity must be able to accommodate the load of BTS devices from each operator.

2.2. Research methodology
Some methodologies used in this study are feasibility study, linear regression method, and budget estimation.

2.2.1. Feasibility Study
Feasibility Study of Shared Power Supply is conduct to assessing the investment that will be carried out by Tower Provider on a shared power supply scheme. Profitability assessment is done by calculating cost benefit analysis, NPV, PP and IRR. From these calculations it can be determined whether the shared power supply scheme is feasible to be carried out by Tower Provider [5]. Decision making is done by comparing the results of the profitability assessment between the existing scheme with the shared power supply scheme.

2.2.2. Linear regression method
Simple linear regression is a linear regression model with a single explanatory variable. Simple regression is based on a functional or causal relationship independent variable with one dependent variable. Simple linear regression analysis also can be used to test the nature of the relationship cause-and-effect between the independent variable (X) and the dependent variable (Y) [6]. In this study, regression method is used to predict the value of an unknown variable based on past observations of that variable and others variable. In this study, a simple linear regression equation is used to calculate the number of BTS devices for year-n.

2.2.3. Capital Budgeting
When the firms can continuously invests funds in assets and it will produce income and cash flow, these assets can represent the firm’s capital [7]. These the capital budgeting can be used to analyse the budget allocation owned by Tower Provider to procure BTS devices each year. Capital budgeting is a normative approach to give rational selection of capital expenditure proposals. This process involves a determination of the size its budget and its financing, collect data and information on the viable alternatives investigating and identifying the prospective investment opportunities, classifying them according to some scheme, defining and estimating the cash flows, followed by economic analysis [9],[8]. The initial step taken is to calculate the budget for BTS equipment procurement using the equation:

\[
\text{Procurement budget for BTS} = \text{total BTS equipment} \times (\text{CAPEX} + \text{OPEX})
\] (1)

After knowing the budget that is owned based on the existing scheme, from the budget owned by telecommunications operators each year, then the amount of BTS equipment procurement will be calculated if using the power supply scheme together with the equation:

\[
\text{total BTS equipment} = \frac{\text{Operator’s annual budget}}{\text{CAPEX+OPEX shared power supply scheme}}
\] (2)

3. Finding and discussion
The research was conducted in 3 steps in order to find competitive advantages in using shared power supply which is the aim of this study, several findings were obtained:

3.1. CAPEX/OPEX analysis of shared power supply scheme
CAPEX used as an initial investment for both Tower Provider and Telecommunication Operator. For Tower Provider’s side, there is difference in value of CAPEX if using existing power supply scheme and shared power supply scheme, as seen below:
Table 1. Tower Provider CAPEX comparison between existing scheme and shared power supply scheme.

| Scheme                        | Cost (IDR)       |
|-------------------------------|------------------|
| CAPEX existing scheme         | 1,158,763,900    |
| CAPEX shared power supply     | 1,418,163,900    |

The difference occurs because of shared power supply scheme carried out additional costs for shared power supply devices, a rectifier. And for Tower Provider annual OPEX:

Table 2. Tower Provider OPEX comparison between existing scheme and shared power supply scheme.

| Scheme                        | Cost (IDR)       |
|-------------------------------|------------------|
| OPEX existing scheme          | 9,500,000        |
| OPEX shared power supply      | 105,300,968      |

The difference occurs because of Shared power supply scheme calculating electricity cost, which in the existing scheme is charged to telecommunication operator. Although the CAPEX and OPEX of shared power supply scheme is greater than existing scheme, Tower Provider can increase the rent fee to the Telecommunication Operator, which results a better investment feasibility assessment that obtained in this study. As for telecommunication operator side, existing scheme included rectifier in CAPEX. Whereas in the shared power supply scheme, rectifier as an infrastructure sharing devices is provided by Tower Provider.

Table 3. Operator CAPEX comparison between existing scheme and shared power supply scheme

| Scheme                        | Cost (IDR)       |
|-------------------------------|------------------|
| CAPEX existing scheme         | 821,608,100      |
| CAPEX shared power supply     | 652,308,100      |

Table 4. Operator OPEX comparison between existing scheme and shared power supply scheme.

| Scheme                        | Cost (IDR)       |
|-------------------------------|------------------|
| OPEX existing scheme          | 172,600,000      |
| OPEX shared power supply      | 196,600,000      |

Cost saving is the most important aspect when we need to take the decision for infrastructure sharing [3]. The difference, between the Operators OPEX compared to the existing scheme and the research scheme, is due to the rent cost. The electricity cost for existing scheme is charged to the operator, whereas in the research scheme, the electricity cost has already been borne by the tower provider as an integral part of the sharing power supply scheme. In this case, the operator does not need to think about electricity costs as an annual operational cost. However, the increase in OPEX occurred because the rental fees charged to operators increased, from IDR 10,000,000.00 per month to IDR 15,000,000.00

3.2. Feasibility Study of Shared Power Supply Investment for Tower Provider

Feasibility Study of Shared Power Supply conducted to provide an overview for Tower Provider about the proposed scheme investment. The calculation is done by using cash flow from existing scheme and shared power supply scheme. Cash flow components that calculated are CAPEX, OPEX, and revenue
obtained from tower leases. From each of these cash flow, profitability is calculated using NPV, IRR, Payback Period, and B/C. The results will be used as a reference for the Tower Provider’s stakeholder to carry out the investment or not.

Results for profitability assessment existing scheme and shared power supply scheme are:

| Scheme               | NPV (IDR)      | IRR  | Payback Period | B/C  |
|----------------------|----------------|------|----------------|------|
| Existing             | 2,182,896,486.95 | 17.54% | 7.95          | 2.6235 |
| Shared Power Supply  | 3,502,082,504.71  | 20.62% | 7.06          | 2.8899 |

From these results, can be seen that the profitability value for shared supply scheme is higher than existing scheme, as well as the payback period for this investment is shorter. So, the investment is feasible to be carried out by Tower Provider.

3.3. Utilization of Shared Power Supply for Telecommunication Operator

For operators, the utilization of shared power supply scheme can be seen from the perspective of their influence on the growth of the number of BTS equipment owned by telecommunications operators each year. Based on the growth data of BTS devices in 2011-2018, linear regression modelling is carried out for the next 20 years. The equation used is:

\[ y=23,158.25+42,136.83x \] \hspace{1cm} (3)

By using the simple regression equation that has been obtained, forecasting the number of towers is done until 2030. Then the writer calculates the number of towers that can be obtained using a joint power supply scheme based on the annual budget allocated by operators in BTS procurement.

This calculation is based on the assumption that the Telecommunications Operator has an annual budget for BTS equipment procurement.

| Total amount of BTS equipment using existing scheme | Total amount of BTS equipment using shared power supply scheme |
|----------------------------------------------------|---------------------------------------------------------------|
| 402,390                                           | 471,263.49                                                   |
| 444,527                                           | 520,612.71                                                   |
| 486,663                                           | 569,960.75                                                   |
| 528,800                                           | 619,309.96                                                   |
| 570,937                                           | 668,659.18                                                   |
| 613,074                                           | 718,008.39                                                   |
| 655,211                                           | 767,357.60                                                   |
| 697,348                                           | 816,706.81                                                   |
| 739,484                                           | 866,054.86                                                   |
| 781,621                                           | 915,404.07                                                   |
| 823,758                                           | 964,753.28                                                   |
| 865,895                                           | 1,014,102.50                                                  |

This, if the procurement of BTS equipment is carried out using a shared power supply scheme, there is an increasing number of annual BTS equipment by 17.12% compared to if the operator uses the existing scheme. Thus, the use of research schemes will affect the growth of the number of BTS operators.
4. Conclusion and Suggestions

4.1. Contribution

- For Tower Providers, from the results of a feasibility study on investment, the shared power supply scheme can be applied by Tower Provider with rent fees about IDR 15,000,000.00 because it produces greater profitability value than the existing scheme currently in use.
- For Telecommunication Operators, if the procurement of BTS equipment is carried out using a shared power supply scheme, there is an increasing number of annual BTS equipment by 17.12% compared to if the operator uses the existing scheme.

4.2. Suggestions

- The need for a business strategy review for telecommunications tower providers to maximize the number of operators renting telecommunications towers using a sharing power supply scheme
- Need for sensitivity analysis on the implementation of sharing power supply schemes for future telecommunications technology
- The need for further study related to the impact of the implementation of the sharing power supply scheme at the level of business competition of telecommunications operators.

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