CHAPTER 1
INTRODUCTION

1.1 Background

Telkomsel provider launched the first 5G launch in Indonesia on 27 May 2021. 5G development will continue to grow and evolve in Indonesia over time. The increasing growth of mobile data traffic poses several challenges to the coverage of existing macro cells. Small cells are a part of 5G technology that is a solution for macro cells. Small cell implements a low-power, short-range wireless transmission system. It covers geographically small, contiguous indoor or outdoor areas. In its implementation, small cells can help increase the capacity of macro cells and provide better and faster user connectivity speeds [1]. The coverage range of the 5G network is different from that of the 4G network in general. 5G networks that operate on higher radio frequencies will have a shorter network coverage range. Therefore, micro operators can overcome the problem of unreachable coverage areas with the 5G network indoors. The micro operator model is helpful in factories, educational institutions, hospitals, or shopping centers. The location placement of the micro operator model can function as the operator of the 5G network itself so that it fits the specific needs of each user. 5G has a system that produces broadband, ultra-robust, low latency, and massive connectivity for human and internet needs [2]. The 5G network business is more suitable for the industrial segment.

Based on [3], [4], the concept of micro operators is proposed to carry out local 5G network operations independently by different stakeholders. The micro operator can help serve the diverse needs of each stakeholder by achieving high capacity, more specific services, and supporting the offerings of MNOs (Mobile Network Operators) or telecommunication operators. Micro operator tenants can adjust their service needs because micro operators provide flexibility, privacy, and network customization in their services. In [5], high-frequency bands on the 5G network will result in a narrower coverage area. Therefore, it is necessary to implement local network solutions and indoor networks. The 4G frequency will become increasingly congested over time, while the telecommunication cell towers are outdoors, so the 5G network signal only covers a small area [6]. The 28 GHz

frequency band has been chosen in research [2] for an industrial area case study. The selection of these frequencies is a recommendation for selecting frequency bands in Indonesia [7].

The operation of telecommunications is divided into 3, namely the telecommunications networks operations, telecommunications services, and special telecommunications operations based on Law Number 36 of 1999 concerning Telecommunications [8]. Government Regulation 46 of 2021 concerning Post, Telecommunications, and Broadcasting regulates Regulations on spectrum sharing and radio station permit to be used in this research. The focus of setting regulations on 5G access allows for access to network infrastructure for operators who do not have their infrastructure so that in the future new competition in terms of price and frequency will arise between new players and old players. The new players here are new stakeholders who have local 5G frequencies. Meanwhile, the old players here are MNO. The government's goal in regulating the allocation and assignment of the spectrum is to maximize the use of the spectrum, not just to maximize revenue [3]. The frequency auction process previously carried out will still apply to implementing the 5G network. Spectrum allocation for 5G, in particular, needs to be complemented by a new local licensing model that will enable network slicing innovation to emerge in the vertical business sector.

In this study, the authors examine the use of the 5G mmWave frequency spectrum on micro operators in industrial areas. The use of mmWave spectrum for the implementation of micro operators is then analyzed to make a policy brief regarding the performance of micro operators in Indonesia to accelerate the deployment of 5G networks and boost the country's economy. The policy brief is obtained after going through three types of analysis: technical, techno-economic, and regulatory.

1.2 Research Problem

Several countries have already discussed plans for implementing micro operators. In Indonesia, frequencies above 6 GHz are still empty, so it is necessary to plan the allocation of frequency use to be more effective and efficient. However, its implementation in the frequency range above 6 GHz itself still raises pros and

cons in the future in Indonesia. The pro side shows that implementing micro operators has benefits regarding efficiency and effectiveness of 5G network smoothing. Meanwhile, on the contra side, micro operators are considered to be increasing the number of operators in Indonesia, where Indonesia is seeking a simpler and more consolidated number of operators. Therefore, it is necessary to conduct a feasibility study regarding implementing micro operators at frequencies above 6 GHz, to be precise, at the mmWave 28 GHz frequency in Indonesia.

Several analyses are needed, starting from technical, techno-economic, and regulatory studies, so each related party can contribute more fairly and maximally. Each analysis is reviewed on its performance and influence in the final comment regarding implementing micro operators at Indonesia's mmWave 28 GHz frequency.

1.3 Research Objective

This research aims to produce an output in the form of a policy brief regarding the implementation of micro operators in the mmWave 28 GHz frequency band in Indonesia. The method used is a technical calculation by considering several parameters. Techno-economic measures are also needed to assess the implementation of micro operators in the mmWave 28 GHz frequency band from an economic point of view by reviewing the CAPEX and OPEX used. Consideration of regulatory aspects is one of the essential points in this research to produce a policy brief. In addition, in this study, it can be seen how the impact of implementing micro operators at the mmWave 28 GHz frequency on the acceleration of 5G network implementation in Indonesia.

1.4 Scope of Problem

This research has scope of problem as follows:

1. This study uses the 28 GHz mmWave 5G network.
2. Using micro operators as telecommunications network operators
3. Analyze three scenarios (scenarios 1,2, and 3) have been introduced in the study of the Ministry of Communication and Information regarding the implementation of micro operators.

4. The frequency used by the micro operator has a local frequency from the government and shared spectrum with MNO.
5. The basis of regulation refers to Law Number 36 of 1999 concerning Telecommunications, Law Number 11 of 2020 concerning Job Creation, Regulation of the Minister of Communication and Information Number 5 of 2021 concerning Telecommunications Operations, Government Regulation Number 52 of 2000 concerning Telecommunications Operations, Government Regulations Number 46 of 2021 concerning Post, Telecommunications, and Broadcasting.
6. The industrial area used is Jababeka West Java.

1.5 Research Methodology

The research methodology used in this study includes:

1. Reference Documents

   This stage is carried out by using references from books, scientific reports, journals, papers, and various reading sources related to micro operators, for example, previous research on 5G implementation, telecommunications regulations, research reports, and discussions on micro operators in various countries.
2. Data Collection

   Collect data from BPS (Central Statistics Agency), such as geographic data of planning areas in the micro operator planning area.
3. System Design

   Perform system design using software for the calculation and design of micro operators. By taking into account the 5G network implementation variables and several variables used in calculating techno-economics in the micro operator implementation.
4. Analysis

   Industrial estates become a reference for analyzing the implementation of micro operators. The final analysis can be work after knowing each study's results. These are technical, techno-economic, and regulatory studies on implementing micro operators in Indonesia. The final analysis resulted in a policy brief for public consumption and the general discussion material.

5. Drawing Conclusion

   After conducting the analysis, conclusions are drawn. The decision is based on the results of research data and study in the form of policy brief recommendations and formulations for implementing micro operators in industrial areas based on the calculation of techno-economic values.

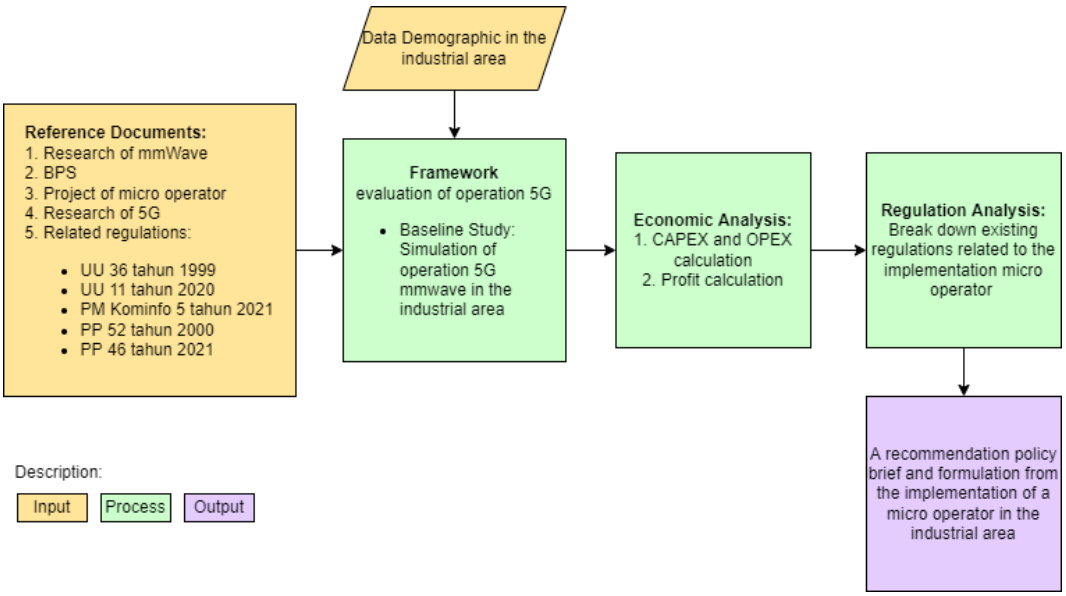

Figure 1. 1 Research methodology.

1.6 Research Method

The research method is a method of continuing research conducted. In this study, the author has several analyzes used. The results generated from the analysis are in the form of an assessment of the impact of implementing micro operators on the acceleration of 5G deployment in Indonesia. The following analysis is:

1. Technical analysis: technical analysis by calculating the implementation area. Simulations are carried out using the software.
2. Techno-economic analysis: techno-economic analysis can determine the CAPEX and OPEX of micro-operator operations in Indonesia and analyze the economic value of micro-operator implementation in Indonesia.
3. Regulatory analysis: analysis of existing regulations is carried out on implementing micro operators in Indonesia.