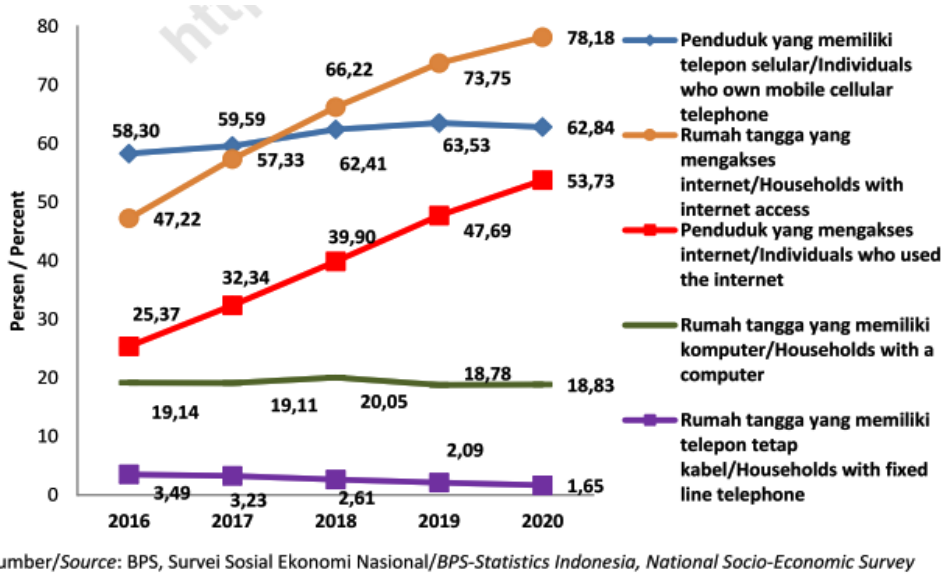
CHAPTER I
INTRODUCTION

1.1 Background

The use of Information and Communication Technology (ICT) by households in Indonesia in the last five years has shown rapid development, recorded in 2020 the growth of the population using cellular phones reached 62.84 percent and internet use in households also increased to 78.18 percent [1]. In the face of the rapid development of cellular technology, Indonesia and countries around the world are faced with the problem of limited resources and infrastructure [2]. These limited resources are frequency spectrum, a basic need for cellular wireless communication, and its supporting infrastructure [3]. 5G (fifth generation) is the fifth generation of cellular telecommunications technology which is expected to accelerate the national digital transformation through empowering the community and business actors in Indonesia. The Government through the Ministry of Communication and Information has conducted a frequency auction in the 2.3 GHz band to complete 4G needs and an initial showcase for 5G [4]. Through a press release from the Ministry of Communications and Information Technology, KOMINFO, “The government is reviewing the experience of implementing 4G which took about six to seven years and has continued to develop in Indonesia until now. So, of course, we hope that 5G will be faster than that, the time since it will be implemented in 2021. We hope that from 2024 to 2025 it will be able to expand and be evenly distributed, as is the case with 4G as it is now, " [5]. This condition is evidence that cellular operators in Indonesia cannot provide services with adequate data rates and coverage for users [6].

President Joko Widodo's instructions to the Ministry of Communication and Information to realize the acceleration of digital transformation, by utilizing a 5G technology-based telecommunications network, which consists of four main priorities, one of which is assisting the construction of the New Capital City in North Penajam Paser Regency (PPU), East Kalimantan Province [7]. The International Telecommunications Union – Radiocommunication Sector (ITU-R) has established 3

main categories of 5G use cases, namely: Enhanced Mobile Broadband (eMBB), Massive Machine-Type Communications (mMTC), Ultra-Reliable and Low Latency Communications (URLLC) [8]. The existence of the 5G use case model encourages the emergence of business models or collaborations that can be carried out by telecommunication providers [9]. The current form of cooperation with 4G service providers is Business to Business (B2B) and Business to Customer (B2C), but in 5G services, there is another form of Cooperation, namely B2B2X, of which the first "B" is a telecommunications provider that provides 5G technology services. and acts as a business incubator, as well as providing services to the second “B” which acts as a marketing platformer or a company that provides services based on 5G technology, while “X” is a company (Business or B), Government (Government or G) or direct user (Customer or C). The increasing penetration of smart devices such as tablets and smartphones has shifted the trend of telecommunication services, where the volume of data communication services exceeds voice and SMS services [10] Although data services are experiencing rapid growth, this growth does not necessarily increase the income of service providers, because consumers tend to want to use these data communication services at affordable rates, but on the other hand, investment costs (CAPEX and OPEX) of telecommunications networks remain. [11].



Sumber/*Source*: BPS, Survei Sosial Ekonomi Nasional/*BPS-Statistics Indonesia, National Socio-Economic Survey*

Figure 1. 1 The development of ICT indicators in Indonesia 2016-2020 [1]

Telecommunication service providers need to consider several solutions aimed at saving telecommunication network investment costs for the company's business sustainability and providing quality data communication services at affordable prices for consumers. One solution that should be considered to overcome these problems is a cooperation between telecommunication providers. There are two network sharing methods that can be used by several telecommunication operators or MNOs (Mobile Network Operators) namely passive sharing which includes passive infrastructure such as sharing the use of towers or sites and also sharing active infrastructure (active sharing), both on the radio access network side. or MORAN (Multi Operator Radio Access Network) as well as the core network or MOCN (Multi Operator Core Network). This is reinforced by research using the 3GPP standard showing that the more optimal method used is active sharing up to the frequency spectrum and not only limited to radio access, site, or mast, the economic impact can minimize the costs incurred by CAPEX and OPEX in operating the network [3] [6][11][12]. However, in these studies, the suitability of each method of network sharing has not been discussed with conditions in urban, suburban, or rural areas, especially in Indonesia. In addition, from an economic point of view, the consideration of market potential in an area has not been explained in depth, only looking at cost efficiency.

In this study, the authors propose recommendations for the application of network sharing by Mobile Network Operators (MNO) in the Prospective Capital City of the Republic of Indonesia, in this case, North Penajam Paser Regency as the location and utilization of spatial planning in IKN in [13]. As for this study, using the techno-economic approach method as site and/or network planning is needed for the implementation of 5G in the area that will be built to become the New Capital City of the Republic of Indonesia so that the implementation of spatial planning strategies is more aesthetic. Thus, a cost-benefit analysis is carried out further to produce recommendations and be considered for making a policy that is useful for regulators, vendors, and operators in providing cellular telecommunications services in Indonesia.

1.2 Problem Identification

The problem that is the focus of this research is the construction of the new capital city of the Republic of Indonesia which is currently underway and the spatial design and environmental utilization in the Capital City of the Republic of Indonesia have been determined. This results in the development and/or deployment of telecommunications networks that cannot be planned by telecommunications operators themselves and other problems that occur are the high costs of deploying new infrastructure (CAPEX and OPEX) as well as limited land, these high costs are not accompanied by the income earned by operators. The identification of the problems in this research are:

1. How to plan a 5G network to implement Network Sharing in an area that will become The New Capital City of the Republic of Indonesia
2. Coverage and Capacity analysis is carried out by considering throughput data quality parameters, calculation, and analysis of economic aspects using cost-benefit analysis (CBA) to obtain a feasibility value between implementation and economic calculation.
3. The cost-benefit analysis (CBA) method is used in this thesis with the following considerations: this model is quite comprehensive because it already provides the basic parameters for calculating NPV and has met the requirements for the types of parameters used in the techno-economic analysis because it includes economic and technical elements.

1.3 Research Objective

The objectives of this thesis research to be conducted are:

1. Conduct network planning simulations to provide an overview of the implementation of network sharing from the technical aspect
2. Make calculations and analyze the implementation of network deployment techniques and perform economic calculations to obtain a feasibility value using cost-benefit analysis (CBA) to produce NPV, IRR, and Payback period output functions

3. Conducting a techno-economic hypothesis that can be used as a strategy for implementing the network sharing method in the area that will be the capital of the archipelago.
4. Can encourage equitable distribution of mobile broadband networks in Indonesia as mandated in PER PRES No. 96 of 2014 concerning the Indonesian Broadband Plan (RPI) and implement spatial planning and spatial use in the Nusantara Capital Region as stipulated in PER PRES No. 63 of 2022 Regarding the Details of the Master Plan for the Capital of the Archipelago.

1.4 Assumption And Problem Limitation

Assumptions and limitations of the problem to avoid the widespread discussion of the topic of this thesis which causes it to not focus on the discussion, several things limit this research, as follows:

1. Technical parameters analyzed include, among others: coverage, capacity, and Throughput.
2. The frequency to be observed is 2300 MHz
3. The observation area of North Penajam Paser Regency is the Capital of the Archipelago.
4. Economic analysis is carried out by using the calculation of NPV (Net Present Value), IRR (Internal Rate of Return), and Payback period to perform Cost-Benefit Analysis (CBA).

1.5 Hypotheses

The growth of users of Information and Communication Technology (ICT) devices and the development of mobile broadband networks with market penetration that occurred in Indonesia must be immediately responded to properly and adaptively by cellular operators in Indonesia [1][2]. The Government's plan to move the capital city of the Republic of Indonesia to Penajam Paser Utara Regency has caused problems

with the availability of telecommunications networks to serve users who will move to IKN [4]. This problem can be minimized by using a network-sharing approach to have an impact on the development of mobile broadband in Indonesia [11][12].

In various studies, network sharing is considered effective in providing impetus for the development of mobile broadband. Network sharing by utilizing passive infrastructure can increase the coverage of the cellular network and by utilizing active infrastructure it can increase capacity for users. If the two network-sharing approaches are carried out (spectrum and infrastructure), the network will experience an increase in capacity and coverage. Increasing these technical parameters can have an impact on reducing the number of components needed for the implementation of cellular networks such as BTS/gNB [11][12]. Thus, the required capital costs (CAPEX) and operational costs (OPEX) can be more efficient and significantly reduced if this network sharing is implemented [3].

1.6 Research Methodology

The research methodology used in this study is as follows:

1. Problem Identification
2. Literature Study

   A literature study was conducted by looking for data in the form of papers, journals, textbooks, benchmarks, and various other studies that support this research.
3. Collecting Data

   Data collection includes data on infrastructure, frequency spectrum, market share, signal coverage area, and several other things owned by telecommunications operators.
4. Data Calculation and Technical Analysis

   Perform calculations and planning for the 5G network (5G Planning) concerning coverage, capacity, and throughput, as well as matters relating to the Network Planning method.
5. Economic Analysis and Benchmark

   Performing economic calculations and analysis after obtaining the results of

the technical analysis by referring to the NPV, IRR, and Payback period methods to become a cost-benefit analysis. The benchmarking process is carried out using a desktop study to see the flow of policies in various countries and the determination of policies carried out in these countries

6. Conclusion

   The results of the analysis can be concluded to answer the formulation of the problem so that it will provide recommendations or suggestions for regulators or telecommunications operators in carrying out network development.

1.7 Methodology

This research was conducted by calculating the planning of the 5G network which will be implemented using the Multi Operator Radio Access Network (MORAN) method, by calculating the capacity and coverage planning of the area that can represent the needs of the cellular network in the North Penajam Paser Regency as the Capital City of the Republic of Indonesia. . Then a network planning simulation will be carried out and analyze the costs and benefits for cellular operators from an economic aspect using the CBA (Cost-Benefit Analysis) method.

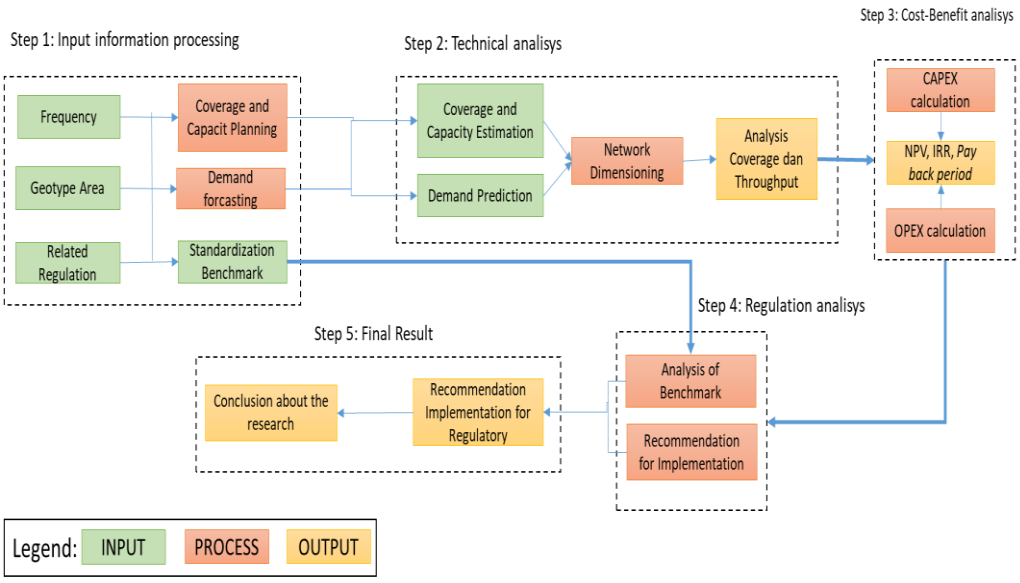


Figure 1. 2 Methodology Scheme