OPEN ACCESS
J. OF ICT, VOL. 5, NO. 1, PP. 101-108, JUNE 2023

ISSN : 2686-1089 (ONLINE)
DOI: 10.52661

Journal of Informatics and Communications Technology (JICT)

Studies on the Use of Spectrum Sharing for Mobile Network Operator in Indonesia

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Abstract

Since telecom businesses have already reached their peak level of revenue, their future is expected to get worse. To save as much money as possible, greater than sixty percent of mobile network operators (MNO) in the worldwide implemented Radio Access Network-Sharing or RAN-Sharing. Earnings before interest, taxes, depreciation, and amortization (EBITDA) pressure and the limited availability of the frequency spectrum are two factors that propel. Spectrum sharing can be one solution to reduce Capital Expenditure and Operational Expenditure operator costs, address spectrum shortages and promote development across the region in Indonesia. With different coverage of underserved areas, the number of assets in the form of BTS and license of frequency spectrum usage are owned by each operator. Research on business impacts for operators needs to be assessed to be able to determine business strategy.

Keywords: Business Impact, Capital Expenditure, RAN-Sharing, Telecom Companies, Operational Expenditure.

I. INTRODUCTION

According to the Telecom Application Developer Summit, which was conducted in 2015, since they have reached the peak of their revenue, the future of telecom firms is predicted to go worse. Starting to improve the game by coming up with a new strategy is one approach that must be implemented, especially considering the upcoming Internet of Things or also known as IoT era with its billions of devices and exponential data growth [1]. Cellular subscriber expansion, in addition to data increase, results in a greater capacity requirement and

demands additional investment expenses. The amount of cellular customers in Indonesia grows at a non-linear rate each year [2].

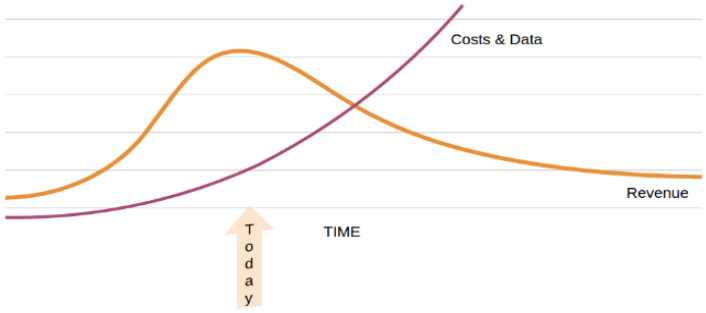

Figure 1.1 The Future of Telco Business [1]

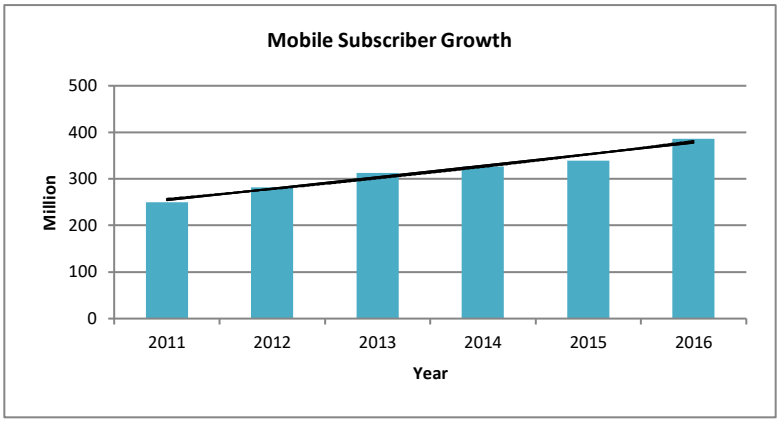

Figure 1.2 Graph of Cellular Customer Growth 2011 - 2016

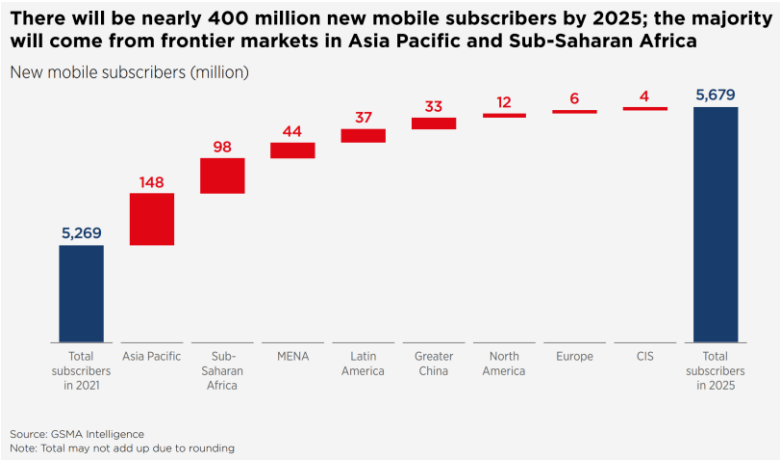

Figure 1.3 Graph of Cellular Customer Growth 2021 - 2025 [3]

One of the statistics offered by the ITU in its 2017 publication of ICT facts and data is that international bandwidth is increasing while telecom income is decreasing. International bandwidth climbed by 32% between 2015 and 2016, while global telecoms revenues fell by 4% between 2014 and 2015; rising economies, including

Indonesia, accounting for 83% of total global bandwidth but only 39% of revenues. [4]. In addition, almost 400 million new mobile users will be added by 2025, with the majority coming from frontier countries in Asia Pacific and Sub-Saharan Africa [3].

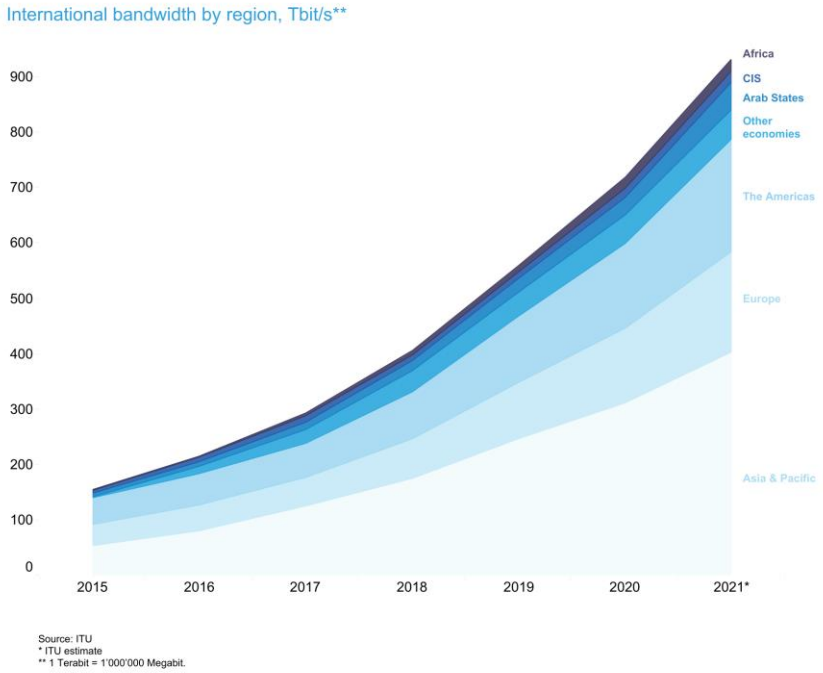

Figure 1.4 International Bandwidth by Region [5]

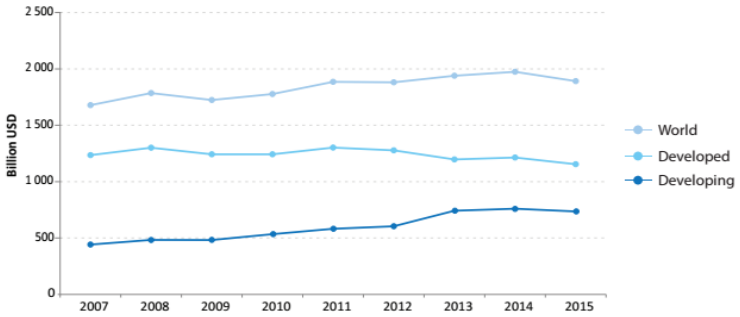

Figure 1.5 Revenue of Telecommunication Company [4]

International bandwidth use reached 932 Tbit/s in 2021, up from 719 Tbit/s in 2020. This represents a 30% increase and follows a similar growth the previous year [5]. More than sixty percent of mobile network operators (MNO) in the worldwide use Radio Access Network-Sharing (RAN-Sharing) to reduce costs. Multi Operator Core Network or also known as MOCN is one type of RAN-Sharing that shares up to the frequency spectrum. The pressure from Earnings Before Interest Taxes Depreciation and Amortization or EBITDA, the limited availability of the frequency spectrum, and government legislation are all driving factors [6].

II. METHODOLOGY

The method undertaken in this paper is by studying the literature from various sources. The introduction discussed in general the factors driving the spectrum of sharing. Then the discussion discussed more detail about the current state of global and Indonesia relating to the impulse of spectrum sharing in Indonesia.

III. LITERATURE STUDY

A. *Radiocommunication System*

The ITU Constitution defines telecommunication as follows: “any transmission, emission or reception of signs, signals, writings, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems.” From the early Hertz and Marconi experiments to the modern smartphone, radiocommunication technologies have advanced significantly. The work of assessing interference is made more challenging by some of the modern radiocommunication systems' sophistication, but at its core, it still revolves around the same idea: power. Issues involving a radio signal's strength, namely the power received, are mostly dealt with by interference analysis. It is typically necessary to simplify in order to concentrate on the important factors that affect the signal strength while analyzing complex radiocommunication systems. A model can be expanded in detail as needed, but it is best to start with a foundation of understanding before adding more complexity [7].

The electromagnetic spectrum contains radio waves, gamma rays, x-rays, ultraviolet, visible light, and infrared radiation. The vast bulk of interference analysis work is done using electromagnetic radiation at frequencies no higher than extremely high frequency (EHF). The frequency unit is measured in cycles per second, or hertz, after the scientist Heinrich Rudolf Hertz, who discovered radio waves. He declared that he did not believe "the wireless waves I have discovered will have any practical application" at the time, considering his research to be entirely theoretical.

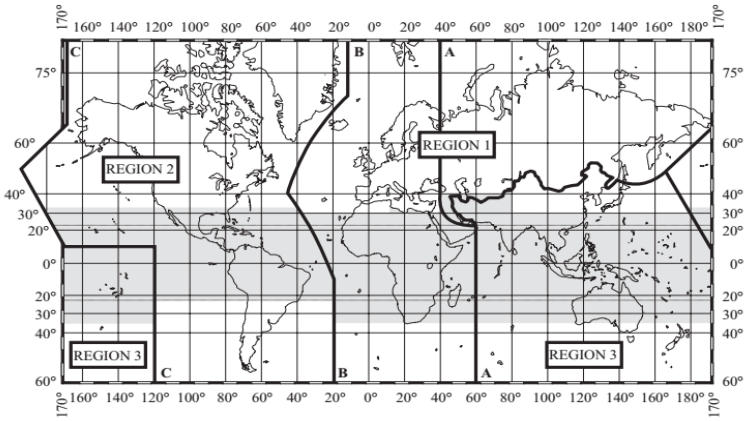

Figure 3.1 Map of Frequency Allocation [8]

The world's spectrum allocation is separated into three regions: Region 1, 2, and 3. Region 1 includes Armenia, Georgia, Azerbaijan, Kazakhstan, Mongolia, Kyrgyzstan, Russia, Uzbekistan, Tajikistan, Turkmenistan, Turkey, and Ukraine, as well as the northern part of Russia between lines A and C, are all included. Region 2 encompasses the area bordered to the east by line B and to the west by line C. Region 3 encompasses the land defined to the east by line C and to the west by line A, excluding Armenia, Azerbaijan, Georgia, Kazakhstan, Mongolia, Kyrgyzstan, Uzbekistan, Russia, Tajikistan, Turkey, Turkmenistan, and Ukraine, as well as Russia's northern territories. This region also includes the territories of the Islamic Republic of Iran that extend beyond the boundaries stated above. Region 3 includes Indonesia [8].

The frequency band for the mobile network operator is the frequency that is on the Ultra High Frequency or UHF band. UHF frequencies extend from 300 MHz to 3 GHz, which at this frequency is also called the “sweet

spot" because it can be used for cellular, TV and Wi-Fi. The following table is the allocation table of existing spectrum bandwidth for mobile network operators in Indonesia which is divided into 6 bands; 2300 MHz, 2100 MHz, 1900 MHz, 1800 MHz, 900 MHz, 850 MHz, and 450 MHz bands.

TABLE I
BANDWIDTH ALLOCATION OPERATOR IN INDONESIA (IN MHZ)

MNO	450 MHz	850 MHz	900 MHz	1800 Mhz	1900 MHz	2100 MHz	2300 MHz	Total
TSEL	-	15	15	45	-	30	30	135
ISAT	-	5	20	40	-	30	-	95
XL	-	-	15	45	-	30	-	90
H3I	-	-	-	20	-	30	-	50
SMART	-	20	-	-	-	-	30	50
STI	15	-	-	-	-	-	-	15

B. Infrastructure Sharing

By lowering construction costs, infrastructure sharing is becoming an increasingly important approach for ensuring universal access to ICT networks and offering affordable broadband services. Given the market's immature nature and the high costs of network construction, well-planned shared policy actions can bring new forms of competition and promote demand for ICT services. Several fundamental ideas are necessary for understanding the policy and legal framework that controls sharing. Passive and active infrastructure; necessary facilities; and open access are examples of these concepts. Following is an explanation of sharing in mobile network aspects based on the reference [9].

TABLE II
TYPE OF RAN-SHARING

TYPE	COMPONENTS
PASSIVE SHARING	Electrical cables, masts and pylons, fiber optic cables, physical space on the ground, rooftops, towers, or other premises, shelter and support cabinets, air conditioning, electrical power supply, alarm systems, and other equipment.
ACTIVE SHARING	The Radio Network Controller, Node-B.

Commercial considerations appear to be driving the increasing trend for MNOs to employ a range of infrastructure models, rather than legislative obligations. The use of mobile network sharing might be found in both developed and developing economies, with 3G providing an extra incentive to investigate network sharing's financial and regulatory viability. Network sharing may take several forms, including passive sharing of cell sites and masts to active sharing of radio RAN and other active features like network roaming and core network [10].

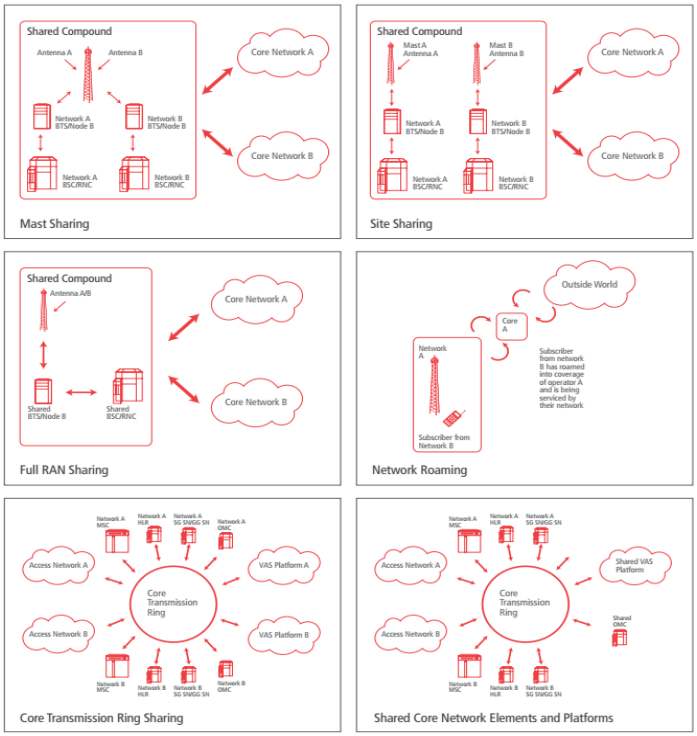

Figure 3.2 Infrastructure Sharing [10]

IV. DISCUSSION

To cut costs, over sixty percent of mobile network operators globally adopt Radio Access Network-Sharing (RAN-Sharing). MOCN is one type of RAN-Sharing that shares up to the frequency spectrum. Pressure from Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA), scarcity of the frequency spectrum, and government legislation are some of the factors driving [6]. Figure 4.1 known as the scissor effect, demonstrates how the arrival of the digital era and falling voice communications cause operators' revenue growth to slow. In the digital age, network expenses will climb, and the revenue will not be worth it. As shown in the EBITDA chart of Indonesian operator margins, EBITDA margin expansion has begun to saturate with rising expense expenses. This graph was created using data from a variety of Indonesian annual report operators.

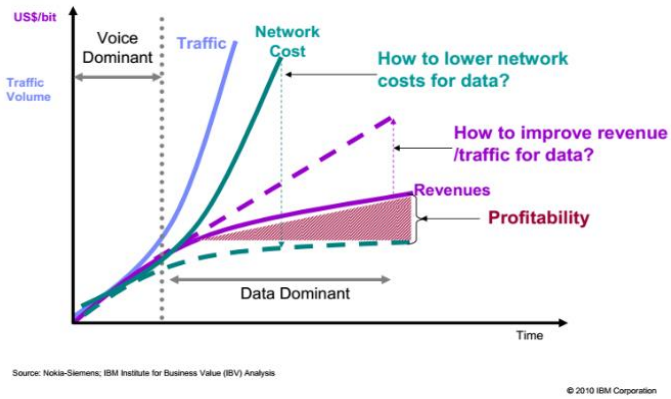

Figure 4.1 Scissor Effect [11]

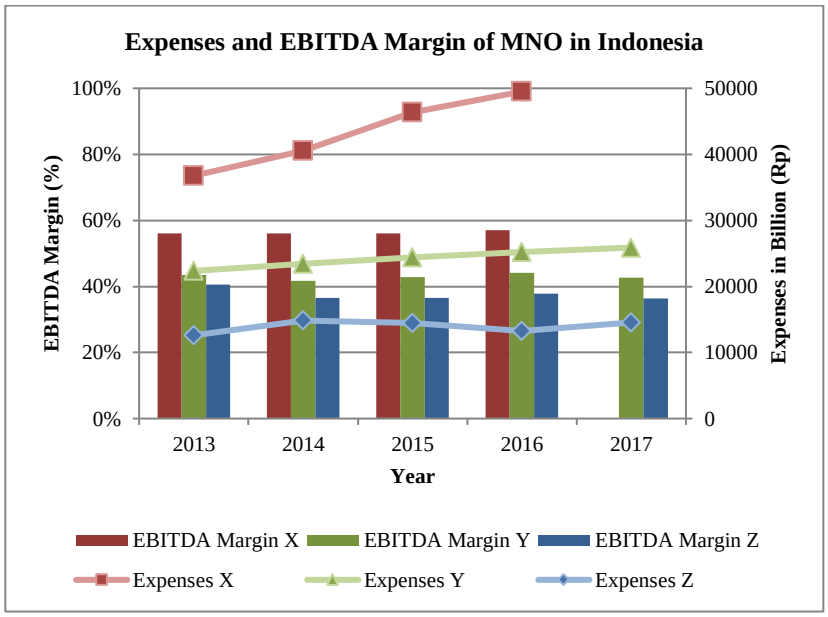

Figure 4.2 Expenses and EBITDA Margin of MNO in Indonesia

ITU-R already assessed the spectrum needs for IMT, as detailed in ITU-R Report M.2078. According to [10], the spectrum has to be increased from 1,280 MHz to 1,720 MHz by 2020. Because of substantial advancements in IMT technology and IMT network implementation. The ITU-R M.2290-0 Report [13], which provides estimated spectrum required ranging from 1,340 MHz to 1,960 MHz by 2020, updates the predicted spectrum requirements for IMT. In 2017, the total area of Indonesia was 1,899,753 km2, with 59.07% 2G signal, 33.50% 3G signal, and 14.15% 4G signal. The area of the settlement in Indonesia is 44,565 km2, the amount of 2G signal is 98.13%, the percentage of 3G signal is 92.91%, and the percentage of 4G signal is 74.09% [2]. Updated by data in 2021, 70,670 villages and Sub-District have 4G mobile broadband connectivity out of 83,218 villages or Sub-Districts served by 4G mobile broadband access. Village or Sub-District Conditions Not Reached by 4G 12,548 Sub-Districts and villages 4G mobile broadband connection is not currently available [14]. The cost savings for each operator from RAN-Sharing may incentivize operators to construct in low-demand areas [10]. As a result, spectrum sharing is one method for lowering network costs, meeting spectrum needs, and encouraging network distribution to regions.

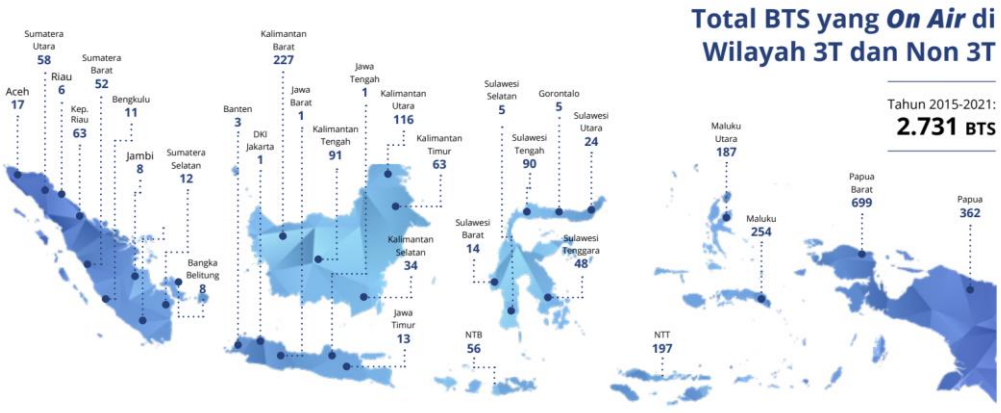

Figure 4.3 Map of On Air BTS Distribution in Indonesia [14]

V. CONCLUSIONS AND FUTURE WORK

Spectrum sharing can be one solution to reduce Capital Expenditure and Operational Expenditure operator costs, address spectrum shortages and promote development across the region in Indonesia. Multi Operator Core Network (MOCN), where active network infrastructure that is used together not only radio access device but to the use of frequency spectrum. With different coverage of underserved areas, the number of assets in the form of BTS and license of frequency spectrum usage owned by each operator. This raises the question of whether it will still benefit the market leader if the MOCN sharing spectrum is organized. So, research on business impacts for operators needs to be assessed to be able to determine business strategy.

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