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ORAN ARCHITECTURE STRATEGY AND TACTICAL MODEL BENCHMARKING SCENARIOS (CASE STUDY: MNO MERGER IMPACT NETWORK COMPETITION IN JAVA ISLAND)

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Abstract

The high level of population and penetration of data users in Indonesia and the number of similar products that have an impact on the tariff war, on the network or network side also has constraints on the limited frequency spectrum, difficulty in building networks or infrastructure with regional demographics that can only be penetrated with satellites or fiber optics, so that with this merger it will be able to increase synergy, growth and increase market position and profit. With the merger of several MNOs, it will certainly be a threat for large MNO-A operators in Indonesia to respond to it with war games from the network or network side to continue providing services with a good and maximum network both in terms of quality and coverage. The benchmarking method as one of the model systems in this paper provides a comprehensive comparison between MNO so that they can provide flexible, simplification and also efficient network solutions that MNO-A can do by applying ORAN technology so that it can accelerate the integration process both in terms of infrastructure to compete with a smart investment. Furthermore, with ORAN, MNO-A can take a more efficient strategy both with basic strategy, optimal strategy, and an aggressive strategy to maintain the pace of competition of all MNO in designing a network, opening up the digital divide and face competition from the impact of this merger, including (i) application carried out in urban areas with an overlay method and (ii) application in rural areas with extension or complement methods, with different levels of efficiency and complexity.

Keywords: MNO, Merger, Threat, Spectrum, Infrastructure, Quality, Benchmarking, ORAN

Introduction

Globally, mergers and acquisitions are the highest strategic move in the company's strata because of the benefits that will be felt. This merger occurs when two companies merge to create a new company, but mergers in the telecommunications sector are mostly horizontal mergers simply because the entities are involved in the same operating industry, namely the telecommunications industry. From the operational side, the merger

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of one company occurs due to the following reasons (Koi-Akrofi, 2014) deregulation, the presence of new and advanced technologies, innovative products and services, building infrastructure in a faster way, mergers bring network benefits or reach to be wide, a variety of products and services with larger customers. Currently, Indonesia has 7 cellular operators, namely, PT. Hutchinson 3 Indonesia (Tri), PT. XL Axiata (XL), PT. Indosat, PT Sampoerna Telekomunikasi Indonesia (STI), PT Telekomunikasi Selular (Telkomsel), PT. Smartfren and PT. Bakrie Telecom. Nevertheless, the number of Indonesian cellular operators itself began to decline, after XL officially acquired Axis last year. Then in February 2020, news circulated that Indosat planned to acquire Tri which would certainly have an impact on major operators (MNO-A) in Indonesia. Gdp growth in the information and communication sector strengthened the terms of the information communication sector (Venardos, 2010). The telecommunications (Telco) subsector is still the main driving force that has transformed so quickly in line with the rapid development of technology. The increase in the value and distribution of the information and communication sector to GDP has increased steadily. Its quarterly distribution average was 3.69% in the last five years (Alexander, 2021). In terms of mobile operator customer data, it reached 348.26 million registered customers at the end of 2020. The three dominating cellular operators are Telkomsel, Indosat and XL Axiata. This figure shows a growth of 3.7% YoY. Considerable growth occurred given the dominance of prepaid services and multiple SIM holdings. The operator's focus on launching mobile networks in rural and disadvantaged areas can also support growth in the sector. Business performance (revenue) trend of cellular operators (Supriadi & Haryadi, 2016) competition slope revenue MNO c+d (merger) is improving past MNO B and reducing the revenue performance gap of MNO A. revenue operator c+d can be an indicator to improve industry competition, which is expected to nourish the telecommunications industry (ARPU). MNO c+d (merger) has a very complete frequency spectrum landscape both at the low band (coverage) and mid/hi band (capacity) range levels. In addition, the C+D MNO (merger) will have a golden spectrum (wider) as a spectrum with a target of 5G Seem less coverage in the mid-band (1800Mhz / 2100Mhz) which has the potential to deploy a massive 5G that can reach all regions (threat MNO-A) and also in terms of 4G coverage will break the gap of competition (close the gap) national coverage with Ops-A. in total the frequency spectrum for mobile MFOs in the country is very limited with a very large amount of user data and population second only to China, thus impacting the quality of service (speed data). With data users (broadband) in Indonesia reaching 461.15 million, it means that cellular MFOs in Indonesia need a frequency spectrum to maintain service quality to compete with other countries. The frequency spectrum division for MNO in Indonesia is currently still very limited, for MNO-A with a total data user of 169.19 million it only has 135 MHz, MNO B with a total data user of 55.44 million has 95 MHz, MNO-C with a total of 59.45 million has 90 MHz and MNO-D with a total of 44.09 million has 50 MHz while MNO-E with a total of 29.63 million has 50 MHz, this means that the customer load/MHz is already very high. The frequency spectrum for mobile MNO in Indonesia is indeed very limited, MNO-A with a load of 1.25 million

subscribers/MHz, while other MNOs are much smaller with a load of 0.62 million subscribers/Mhz. with the merger of the c+d MNO brings good hopes to continue to provide quality service with a very wide total frequency bandwidth (145 MHz dl/ul).

Mergers not only have a positive impact on business revenue and frequency spectrum allocation, but can also make it easier for mobile MNOs to build networks very quickly to all corners of the country or what we know as frontier, remote, and underdeveloped areas (3T). Site builder competition between MNOs is quite pronounced considering the demographics of the region which are quite challenging, both in Java and non-Java (Alexander, 2021). Competition for the number of sites is a challenge for MNO-A in the face of the competition for the merger of MNO c+d. although currently, MNO-A is very dominant as a mobile MNO that has a very wide range visible from the point of the site owned. This point site is the point where cellular MNO can provide signal coverage services through the transmitter tower, the more site points, the wider the signal coverage to reach the area, and the better the signal level (RSL) received by data subscribers (Pratono & Suyanto, 2012). The calculation of the receive signal level (RSL) is the level of the signal received and the value must be greater than the sensitivity of the receiving device (RSL (Rth), the sensitivity of the receiving device is the sensitivity of a device on the receiving side that is used as a threshold. The RSL value standards on each mobile MNO vary, the determination of the standard is the full right of the relevant MNO. It can be said that in this regard, there is indeed no standard that can cover globally, but the standards between one MNO and another MNO are not much different and there are even some that have the same standards. Cellular MNO signals have provided services in 513 districts/cities. MNO-A was very dominant in Java at 98.47% and outside Java at 78.99%, but after the MNO-c+d merger, the dominant signal from MNO-A became not dominant in several cities, especially in districts/cities in Java and outside became a threat from this merger both in terms of term and quality of service (Okoeguale & Loveland, 2018). Today, traditional RAN vendors provide MNOs with out-of-the-box RAN solutions, which have been fully tested and pre-integrated in each vendor's in-lab facility. Each vendor manages its lab and test resources, so the associated overhead in integration complexity is transparent to the MNO. The hardware and software are integrated, and the roadmap for the product is made according to the 3GPP specification for radio functionality. Logical interfaces between subsystems of radio are defined exclusively, so no interoperability between different vendors is possible (Rachman, 2011). Open RAN provides increased flexibility and potential by enabling the selection of proper network components from a multivendor ecosystem, which means a significant reduction in TCO costs for MNO. For an open ecosystem to encourage innovation and new technological developments while reducing costs, product development efforts need to be carried out jointly by all stakeholders (Tyagi, 2019). A coordinated community will ensure full interoperability of the solutions offered. This coordination discusses the full interoperability of multivendor solutions (Aimene et al., 2021). System Integration is one of the key areas to consider, as there is no longer a unique entity responsible for complete E2E, including software lifecycle management, KPI assurance, service management, etc.

Most of the countries that implement the Open RAN are developing countries. This is because the Open RAN trial is mostly carried out in rural areas. Even so, today Open RAN is carried out not only in rural areas but also in dense urban markets. Open RAN can be a strategic solution in expanding the network to face the merger of two major MNO in Indonesia.

Method

Identification System Model

This paper uses a qualitative approach with data collection techniques through several stages with the tactical model benchmarking ORAN Solution:

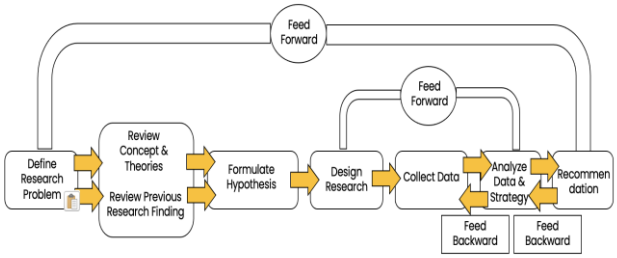


Figure 1. Flow System Model dan Method

Based on the background regarding the merger of mobile MNOs and their impact on MNO-A in preparing its strategic steps, the formulation of the problems raised to obtain the purpose of writing the paper is to obtain possible strategies that are effective, flexible, and also simplification with ORAN technology and scenarios that need to be carried out to face the merger of MNO c +d which is a threat in the future in a competitive climate. To answer the formulation of existing problems, data collection is carried out including business data obtained through financial business data reports, holding, and articles and journals related to mergers in the field of telecommunications and primary data processed from crowdsourcing data tools to process network coverage data. The data were analyzed descriptively using literature data relating to existing business parameters in telecommunications companies. Furthermore, an analysis of technological strategy steps was carried out to deal with the MNO's war competition, which merged with ORAN Strategi and the tactical model benchmarking (Parcu, 2022).

The data processing method in this paper uses the benchmarking method. Benchmark is the process of comparing certain aspects of a company or organization with comparable aspects belonging to companies that are considered the best in the same industry or broader market (Abdalla et al., 2022). The purpose of the benchmark is to get an accurate view of how a business process is carried out in a company with that of competitors to come up with ideas to improve processes, approaches, and technologies. With this benchmark method, an overview of the strategy needed by the MNO will be obtained through the Open RAN is by the needs needed by the MNO in making a strategy to compete with the merged MNO so that smart investment, simplification, and flexibility

of the MNO network can be carried out so that the quality of service remains better. In this paper, the benchmark is carried out on network infrastructure architecture both in terms of spectrum, infrastructure sites, and service coverage from MNO to the merged MNO, so that this paper can make a strategy with ORAN as a solution both as a basic strategy, optimal and aggressive strategy. with this tactical model benchmarking analysis to improve the performance and position of MNO-A with ORAN solution so that a strategy recommendation (mitigation) is obtained that allows MNO-A to remain an MNO that always remains dominant and superior and exceeds the best performance of the company with a benchmarking level:

Strategic benchmarking is used to encourage continuous improvement and sharpen the overall corporate strategy.

Basic Strategy

Benchmarking modeling by comparing the infrastructure and how big the network expansion is, the type of infrastructure tower, and consolidating the infrastructure of each MNO's network and what the next MNO strategy is.

Optimal Strategy

This modeling is by optimizing frequency resources (resources) to service needs and the number of customers and how MNO uses frequencies efficiently for both capacity and reach expansion.

Aggressive Strategy

Modeling in this strategy by carrying out initiative verticals such as by converging services with open RAN so that it has the strategic value of products that are converged to competitors and accelerates the process of building a simple, flexible and efficient network.

Competitive benchmarking is leveraged to match or surpass direct major competitors Spectrum

The impact of this merger can continue to provide service services (QoS) with good competition so that MNO-A can compete with the frequency bandwidth currently owned both in terms of low band frequency, middle band, and high band frequencies so that an ideal spectrum that can be used by MNO-A in the implementation of ORAN will be obtained for network optimization.

Site Infrastructure

Calculating and mapping infrastructure site data as a point that provides transmitter signals, competition for the number of sites impacted by the C+D MNO merger is very dominant, especially for java island with a fairly tight competition map, with ORAN strategy expected MNO-A network deployment quickly and simply.

Coverage

Measure signal coverage using receive signal level (RSL) calculations. with the merger of MNO, c+d will provide a competitive map that makes the dominant signal of MNO-A non-dominant in several cities, especially on the island of Java, Open RAN strategy can quickly help MNO-A expand so that coverage of MNO-A can compete.

Open RAN Standard Analysis MNO Strategy

The three issues of architecture and infrastructure that can be a solution for MNO-A in competing with a flexible open RAN strategy to be able to maintain dominance in the network. The open RAN system used by MNO-A is Open Radio Access Networks, or Open RAN, referring to a disaggregated approach to building cellular networks using open and interoperable protocols and interfaces, which allows for increased flexibility over traditional RAN systems. So that open RAN can be implemented with vendor-neutral hardware and Software-Defined Technology (SDT) based on Open Interface and industry-developed standards and acceleration in network deployment will be faster simple and flexible. In addition, with the ORAN strategy, MNO-A, which is competitively inferior to middle band frequencies (gold frequencies) will get radio efficiency. [20]

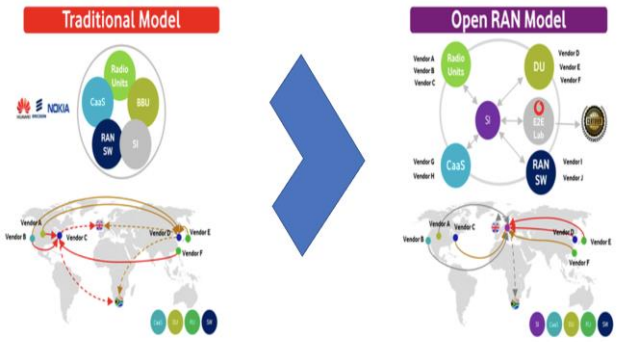


Figure 2. Comparison of Traditional RAN vs Open RAN Model [20]

Currently in the open RAN-related world still using each strategy of each MNO according to the needs of each table 1. The world's MNO incorporated open RAN into its business strategy, with the hope of cutting CAPEX by 40% and OPEX by 30%. This strategy can also be carried out by MNO in Indonesia in the face of mergers between MNO so that they can remain dominant both in business and network. Table 1 illustrates the MNO strategy in the world and uses the standardization of open RAN architecture.

Table 1. ORAN-Globe MNO Strategy [22]

MNO	Partner	Open RAN Starategy
AT&T	Samsung	AT&T trialed ORAN architecture with a successful data session using an enhanced common public radio interface (eCPRI), over an mm-wave ran network.
Rakuten	Nokia	Completed the greenfield ORAN 4G deployment
Vodafone	Mavenir	Vodafone had become the 1st UK mobile to switch on a live ORAN 4G site

Result And Discussion

Based on business parameters, spectrum holding and load, site infrastructure, and service signal coverage which are the key factors of the cellular MNO as a business model to strengthen the initiative scenario in the development of strategies to deal with the merger of MNO c +d, so that in this case the discussion will be more focused on the spectrum, network infrastructure, and service coverage as follows:

Ownership of Spectrum (Holding)

From table 2 related to the spectrum and load of mobile MNOs, the key insight c+d MNO is as follows.

Table 2. Bandwidth Frequency vs Load MNO

MNO	800 / 900	1800	2100	2300	User Data	Load
MNO-A	30	45	30	30	169	1,25
MNO-B	15	45	30		55,4	0,62
MNO-C	25	40	30		59.4	0,63
MNO-D		20	30		44,1	0,88
MNO C+D	25	60	60		103	0,71
MNO F	20			30	29,6	0,59

The c+d (merger) MNO has a complete spectrum landscape from the low band (coverage) to the medium/high band (capacity), which has the potential to increase user addition and coverage. For the low band spectrum, the MNO c+d merger has a frequency band as wide as 145 MHz, while the MNO-A is only 105 MHz. with the islands in Indonesia, it will be a threat for the MNO-A to expand the range with a large capacity. The steps that MNO-A must take to stay ahead of the curve in providing the network are adding a low-band frequency spectrum to continue to expand the range with good capacity. The merger of MNO c+d, having a wider gold spectrum for 5G coverage seamless and massive 4G in the medium band spectrum (1800MHz/2100MHz) has the potential to launch 5G national coverage on a large scale and also existing 4G, in the MNO c+d band has a spectrum as wide as 120MHz, while MNO-A is 75MHz wide, the competition is low/mid-frequency competition will make MNO-A have a long distance to be able to continue to expand coverage with the wide capacity of the frequency band which Sufficient.

Infrastructure Network

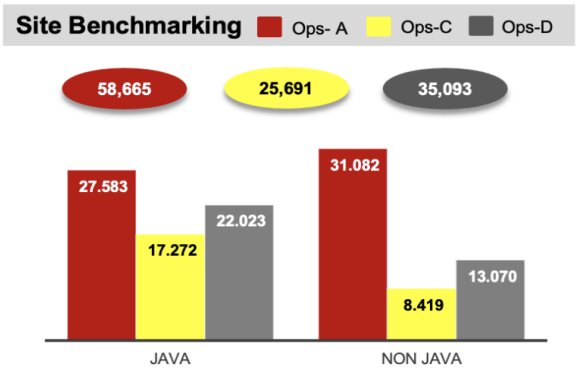


Figure 3. Site Competition MNO

From figure 3, it can be seen that infrastructure competition between cellular operations is quite tight in the Java region, while in non-Java regions it is not so tight for infrastructure network competition. The MNO c+d merger made the competition in Java even tighter, the MNO-A which previously lead 27k sites and is currently far below the MNO c+d merger to 39k or with a gap of 12k sites.

Coverage

Table 3. Signal Dominant Profile

MNO	Before Merger		After Merger	
	Java	Non Java	Java	Non Java
MNO A	94	388	30	371
MNO B	4	4	3	4
MNO C+D	21	2	86	19

From the discussion point b, the impact felt for MNO-A with a difference in the infrastructure of 39K in Java island there was a decrease in the dominance of coverage services which was previously dominant in 94 cities/districts on the island of Java to only be dominant in 30 cities/districts or experienced a decrease of ~ (-68.09%) this is a threat that will be faced by MNO-A when MNO c +d carries out a merger which has the potential to consolidate the network by having network efficiency costs and expanding coverage massively with a wide capacity and coverage. Based on the qualitative data discussed above, there was a change in the dominant composition related to networks, coverage, and frequency bands, so MNO-A needed a simple solution by doing a smart investment in the face of fierce competition with open RAN. ORAN architecture has three pillars of standardization that can be chosen by MNO-A in carrying out network construction or expansion in Java

Recommendation And Implementation Strategies

The development of open RAN technology can be applied by MNO-A to face competition from the impact of this merger, including (i) application carried out in urban areas with an overlay method and (ii) application in rural areas with extension or complement methods, with different levels of efficiency and complexity.

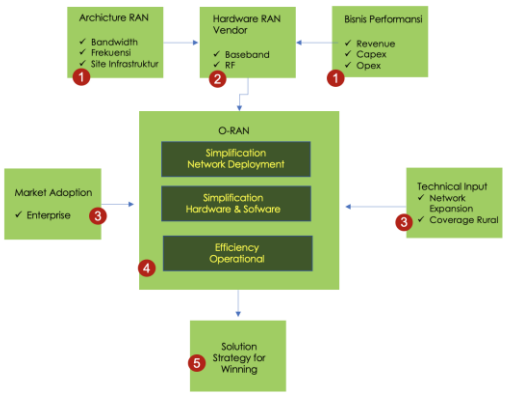


Figure 4. ORAN Solution Recommendation & Strategy

Aspects for the application of ORAN technology for MNO-A according to figure 4 there are five aspects of ORAN solution recommendations and strategies, (i) architecture ran and MNO performance business, (ii) hardware RAN vendors including RF and Baseband, (iii) market adoption and technical input, (iv) ORAN simplification and operational efficiency, and (v) solution strategies for MNO among the three choices of ORAN architecture concepts and all aspects related to ORAN, table 4.

Tablel 4. ORAN type aristektur [22]

	C-RAN	V-RAN	O-RAN
BB HW	Proprietary BBU	COTS-based BBU	
BB SW	Proprietary SW	Proprietary SW	Open Interface SW
RAN HW	Proprietary RRU		COTS RRU
Fronthoul	Proprietary Interface		Open interface
Interoperability	HW/SW same vendor	HW/SW same vendor	HW/SW multiple vendors

The recommendations and implementation strategies for MNO-A to be implemented in Java are a combination of C-RAN (rural area) and ORAN (urban area).

Conclusion

Based on the results of the research discussion and recommendation, it can be concluded several things about the winning strategy that MNO-A can do with open RAN

strategy: (i) Strategy Basic strategy Infrastructure: reconcile all existing resources (existing) with ORAN in areas where MNO-A there is a reduction in coverage dominance, Impact: MNO-A will experience a decrease in the dominance of coverage services, so it requires a large enough CAPEX to strengthen fingering and capacity, especially in java with ORAN TCO value can be more effective and efficient, (ii) Optimal Strategy, Spectrum Strategy: spectrum limitations in low band frequencies with broadband, MNO-A requires a consolidation approach with regulators related to the process and clearance of spectrum ownership. MNO-A has a gap of 40 MHz in the low band frequency so it must have additional spectrum at the low band frequency of 700 MHz (currently still active for analog TV), Impact: MNO-A requires the allocation of low band frequency and large capacity (bandwidth) to be able to continue to expand (expansion) as one of the solutions to the competition strategy., and (iii) Aggressive Strategy, Technology Strategy: carrying out a new consolidation with the concept of FMC (fixed-mobile convergence), this convergence certainly requires a new architecture radio access (open RAN) so that the acceleration of infrastructure development will be simpler, faster and low cost. Open RAN is one way to break down the supply chain from dominant vendors so that the acceleration for technology expansion will be more effective and flexible. Impact: by implementing this technology strategy, MNO-A will still be able to become the number one #1 operator in Indonesia by strengthening technology fundamentals with FMC and open RAN.

Apart from the three conclusions above, this paper related to the strategy with open RAN as standardization in helping MNO-A to be able to win in competitions with low capital, a simple network so that it can become the leading MNO impact of the merger of two major MNO in Indonesia, then a study can be carried out with this ORAN whether each MNO will become more efficient with revenue and network sharing schemes so that it can maintain the pace of competition for all MNO in designing a network and opening up the digital divide.

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