



Legal Challenges of The Operation of LEO Satellite Mega Constellation in Indonesia

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ABSTRACT

The Low Earth Orbit (LEO) satellite constellation technology is rapidly advancing. Tens of thousands of LEO satellites orbit the globe from large mega constellations such as OneWeb, SpaceX StarLink (USA), LeoSat (USA), Kuiper (an Amazon subsidiary USA), TeleSat (Canada), and LeoSat (USA). Starlink is the largest mega constellation with the highest number of satellites and the largest coverage which is needed in Indonesia's unserved rural areas. However, Starlink's operation not only disrupts conventional telecommunications businesses in Indonesia but also causes legal uncertainty. Starlink must obtain permits for network operation, telecommunications services, NAP (Network Access Provider), ISP (Internet Service Provider) licensing, as well as permits for electronic system and transaction operations. There are still no specific rules for its radio station permits, and the provisions for determining the Frequency Usage Fee for satellite clusters remain unclear. This research employs a juridical-normative method, wherein provisions in the legislation will be explained and connected with the rapidly evolving satellite and digital technology. This encompasses regulations, viewpoints, legal doctrines, and related legal systems. The findings indicate that advanced LEO satellite mega constellation technology can be highly beneficial for progressively providing high-speed internet access in remote areas if supported by laws and regulations that are adaptive to new technological innovations. Thus, a legal and legislative transformation is required to facilitate the rapid and massive provision of digital telecommunication networks to remote areas, ensuring fairness while upholding the nation's legal sovereignty.

Keywords: broadband access; digital transformation; mega constellation of LEO satellites; transformative laws.

I. INTRODUCTION

Internet access is a crucial necessity in the digital era,¹ including until now, a huge number of people have not reaped the benefits of the internet because broadband telecommunication networks cannot reach these regions.² As a result, those living in rural Indonesia have not enjoyed digital platform services due to the lack of broadband coverage. Internet access is pivotal in breaking the social isolation that significantly influences the progress of rural communities. The availability of internet access enhances the productivity of the community,³ providing a positive contribution to the national economy,⁴ and thereby promoting progressive growth.⁵ Conversely, limited internet access in rural areas leads to injustice due to the uneven growth of the national economy. Specifically, residents in

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¹ Hong Y and Harwit E, 'China's Globalizing Internet: History, Power, and Governance' (2020) 13 Chinese Journal of Communication 1

² Kahn Z and Burrell J, 'A Sociocultural Explanation of Internet-Enabled Work in Rural Regions' (2021) 28 ACM Transactions on Computer-Human Interaction 1

³ Townsend L and others, 'Enhanced Broadband Access as a Solution to the Social and Economic Problems of the Rural Digital Divide' (2013) 28 Local Economy: The Journal of the Local Economy Policy Unit 580

⁴ Osoro OB and Oughton EJ, 'A Techno-Economic Framework for Satellite Networks Applied to Low Earth Orbit Constellations: Assessing Starlink, OneWeb and Kuiper' (2021) 9 IEEE Access 141611

⁵ Townsend L (et.al), *Loc. Cit.*

rural areas lag behind in many aspects. The limited internet accessibility in these regions stems from the country's constrained ability to finance telecommunication network development in what are commonly categorized as 3T areas (remote, outermost, and underdeveloped regions). On the other hand, private operators prioritize building broadband networks in major cities because it is more profitable from a business perspective.⁶ Public service aspects are considered the government's responsibility. Given the vastness of rural Indonesia, the country requires technological breakthroughs to expedite the provision of broadband access facilities for all residents in remote areas, encompassing both terrestrial and satellite network technologies.

From the perspective of Indonesian laws and regulations, the control by foreign entities over telecommunication networks and internet access poses a threat to Indonesia's interests, especially since Indonesian regulations do not specifically address business models like Starlink. The operation of Starlink in Indonesian territory is not only a serious concern for Indonesian operators but also presents complex legal and regulatory issues in the national telecommunications industry. In essence, the operation of new technology and the utilization of limited national resources should have a positive impact on improving the welfare of the Indonesian people, including the LEO Starlink mega constellation.

In accordance with Article 33 paragraphs (2), (3), and (4) of the 1945 Constitution, the utilization of economic resources should be allocated for the prosperity of the people. The welfare state is considered the most appropriate answer to the form of state involvement in advancing people's welfare. This belief is strengthened by the emergence of empirical reality regarding market failure and government failure in improving people's welfare. The aim of establishing the Republic of Indonesia was basically to improve the welfare of all people without exception. In other words, the Indonesian state aims to form a welfare state. The goal of national development is to increase social welfare, not just economic growth.

The concept of a welfare state can be considered the most appropriate form of state involvement in advancing people's welfare—the government's failure to control the market and realize prosperity for society.

According to the constitution, the Indonesian state aims to form a country that will prosper its people. State development in all fields aims to create social welfare. Therefore, technology and growth must correlate with social welfare, not just economic growth. This research employs a juridical-normative method where the provisions of the legislation will be elucidated and connected with the rapid developments in satellite technology and digital technology. This involves examining regulations, viewpoints, legal doctrines, and related legal systems.

II. RESEARCH METHOD

This research employs a juridical-normative legal research method by examining and analyzing applicable laws and regulations related to telecommunications, digital technology, and the operation of Low Earth Orbit (LEO) satellite mega constellations in Indonesia. The study is conducted through a literature-based approach using legal materials, including statutory regulations, legal doctrines, scholarly opinions, and related legal systems, which are then connected to the rapid development of satellite and digital technologies. Through qualitative legal analysis, the research evaluates the adequacy of the existing regulatory framework governing satellite-based internet services and identifies the legal

⁶ Mishra R, 'An Overview of Backbone Technology behind the Latest Advanced Gadgets in Use: 4G & 5G' (2022) 31 Spatial Information Research 15

challenges arising from the operation of LEO mega-constellation systems, particularly Starlink, to formulate recommendations for adaptive and transformative legal regulation in Indonesia.

III. DISCUSSION AND RESULTS

3.1 Development of LEO (Low Earth Orbit) Mega Constellation Satellite Technology

The rapid advancement of low Earth orbit (LEO)⁷ mega constellation satellite technology is evident through the establishment of several key projects. These include mega constellations like OneWeb, SpaceX StarLink (USA), LeoSat (USA), Kuiper (an Amazon subsidiary), TeleSat (Canada), and LeoSat (USA).⁸ Among these, Starlink, designed and launched by SpaceX, stands out with the largest number of satellites in its constellation. Unlike other satellite launch systems, SpaceX has pioneered rockets that can be reused multiple times, ensuring efficiency in deployment.

Starlink, with its fleet exceeding 40,000 satellites, is able to provide high-quality internet access equivalent to 5G throughout Indonesia⁹ directly from satellites to users, bypassing national operator networks. Starlink network architecture represents a technological breakthrough unparalleled before, posing challenges to existing conventional telecommunications operators in Indonesia.

Mega satellite constellations like Starlink cover the entire world.¹⁰ Satellite internet access, according to studies, can be better than using fiber optic networks.¹¹ Technically, Starlink has a latency of 25 milliseconds,¹² much lower compared to GSO (Geo Stationary Orbit) satellites that are 36,000 kilometers above the Earth's surface. Therefore, LEO (Low Earth Orbit) can compete with Fixed Broadband terrestrial in providing services. The LEO satellite mega constellation network continues to develop,¹³ including using laser beams in its inter-satellite links¹⁴ to achieve low latency. The low latency is obtained from the proximity of the satellite to the Earth's surface, around 500 kilometers from the Earth's surface.¹⁵ SpaceX's rocket technology advancement is instrumental in launching tens of thousands of satellites more efficiently.¹⁶

3.2 Challenges of Broadband Telecommunications Infrastructure Development in Indonesia

Indonesia is an archipelagic country with a population of 278.8 million people and a jurisdictional area of 5,193,250 square kilometers. The land area of Indonesia is 1,916,906.77 square kilometers, consisting of 17,504 islands, while the remaining 3,276,344 square kilometers is maritime territory. The government has not yet succeeded in meeting the needs of telecommunications infrastructure, while

⁷ Osoro OB and Oughton EJ, *Loc.Cit*

⁸ Lawler SM, Boley AC and Rein H, 'Visibility Predictions for Near-Future Satellite Megaconstellations: Latitudes near 50° Will Experience the Worst Light Pollution' (2021) 163 *The Astronomical Journal* 21; Bernhard P, Deschamps M and Zaccour G, 'Large Satellite Constellations and Space Debris: Exploratory Analysis of Strategic Management of the Space Commons' (2023) 304 *European Journal of Operational Research* 1140

⁹ Giannopapa C, Staveris-Poykalas A and Metallinos S, 'Space as an Enabler for Sustainable Digital Transformation: The New Space Race and Benefits for Newcomers' (2022) 198 *Acta Astronautica* 728

¹⁰ Jia L (*et.al*), 'Design of Mega-Constellations for Global Uniform Coverage with Inter-Satellite Links' (2022) 9 *Aerospace* 234

¹¹ Landsbergen D, Shiang J and Byrnes P, 'Fiber Optic Highways and Network Bridges: Planning for the Telecommunications Infrastructure Needs of the City in the 21st Century' (1994) 11 *Telematics and Informatics* 255

¹² Vasisht D, Shenoy J and Chandra R, 'L2D2' [2021] *Proceedings of the 2021 ACM SIGCOMM 2021 Conference* 151

¹³ Pan G and others, 'Latency versus Reliability in LEO Mega-Constellations: Terrestrial, Aerial, or Space Relay' [2022] *IEEE Transactions on Mobile Computing* 1

¹⁴ Zhu Q (*et.al*), 'Laser Inter-Satellite Link Visibility and Topology Optimization for Mega Constellation' (2022) 11 *Electronics* 2232

¹⁵ Cui G and others, 'Latency Optimization for Hybrid GEO–Leo Satellite-Assisted IOT Networks' (2023) 10 *IEEE Internet of Things Journal* 6286

¹⁶ Daniel Kohn, 'The Teledesic Network: Using Low-Earth-Orbit Satellites to Provide Broadband, Wireless, Real-Time Internet Access Worldwide', *Inet* 96, 1996; Stevens.

private companies do not prioritize expanding networks to sparsely populated rural areas.¹⁷ The government collects Universal Service Obligation (USO)¹⁸ fees from private operators to be used to develop areas that still need ICT infrastructure provision, ICT ecosystem provision, and digital economic ecosystems in remote, isolated, outermost, pioneering, and economically unfeasible border areas, as stipulated in the Regulation of the Minister of Communication and Informatics of the Republic of Indonesia Number 10 of 2018 on Implementation of Universal Service Obligation for the Telecommunication and Informatics ("**MOCI Reg. 10/2018**").¹⁹

Furthermore, Article 4 of MOCI Reg. 10/2018 regulates that, the implementation of the telecommunications and information technology USO along with supporting management activities is carried out based on funding from USO contribution to telecommunications and informatics and other legitimate sources in accordance with statutory provisions. However, the accumulated USO funds are insufficient to finance the development of the vast rural areas of Indonesia, resulting in many regions lacking broadband access, crucial for education and the economy in the e-commerce era.²⁰

Starlink can operate without utilizing the national telecommunications network from the configuration of its network. This represents a technological advancement in satellite technology but threatens the existence of conventional telecommunications operators because bypassing their networks means avoiding interconnection fees. The loss to national operators does not just impact the particular operator but has broader repercussions, affecting the workforce and all economic stakeholders supporting the telecommunications industry. Ultimately, this results in financial losses for the country due to the potential reduction in the telecommunications industry's contribution to the national budget. Such a scenario is also inconsistent with the principles of utilizing the country's economic resources as stipulated in Article 33 of the 1945 Constitution and the principle of self-reliance as stated in the Telecommunications Law.²¹ In line with the International Telecommunication Union (ITU) constitution, Indonesia exercises sovereignty over its telecommunications.²² The national telecommunications market is governed by laws²³, and policies formulated by the government are based on Indonesia's national interests. Therefore, all telecommunications providers in Indonesia must comply with Indonesian telecommunications laws and their implementing regulations.

Starlink and other mega satellite constellations that can operate in the Indonesian market by providing direct from satellite high-quality internet access to the Indonesian public. Because it is technically bypassing the national telecommunications network it becomes challenging from the perspective of law and regulation. Law enforcement remains complex to any legal events occurring within these foreign operator networks. Crimes or violations occurring on the OTT platforms using Starlink's network would be challenging to prosecute since they are foreign-owned networks.

¹⁷ Oki O and Lawrence MO, 'Cost-Effectiveness of Fibre Optic Technology Deployment in Rural Area' (2022) 13 Journal on Innovation and Sustainability RISUS 111

¹⁸ Aldiano D and Simatupang DPN, 'Obligation to Pay Telecommunications Operation Rights Fees and Contribution of Universal Service Obligations for The Palapa Ring Project by The Palapa Ring Project Implementing Business Entity' (2022) 11 Legal Brief 2914

¹⁹ Regulation of the Minister of Communication and Informatics of the Republic of Indonesia Number 10 of 2018 on Implementation of Universal Service Obligation for the Telecommunication and Informatics.

²⁰ Muda I and Erlina E, 'Sustainable HR Development to Support Successful Implementation of Offline Accounting Apps by Rural Enterprises in Indonesia' (2020) 13 Journal of International Studies 70

²¹ Law of the Republic Indonesia Number 36 of 1999 on Telecommunication.

²² ITU, *Collection of the Basic Texts of the International Telecommunication Union Adopted by the Plenipotentiary Conference – Edition 2023* (ITU Publications 2023)

²³ Law of the Republic Indonesia Number 36 of 1999 on Telecommunication.

3.3 Laws and Regulations Governing Telecommunications in Indonesia

Starlink is capable of providing broadband connectivity²⁴ services to the remotest areas with quality equivalent to fiber optic. Indonesia is interested in ensuring that Starlink registers as a licensed operator. This licensing mechanism is part of the oversight system for all national telecommunications providers. Licensing serves as a government control tool to ensure that all legal provisions applicable to telecommunications operators and digital platforms are adhered to according to prevailing laws and regulations, including legal certainty in the operation of electronic systems governed by the Law of the Republic of Indonesia Number 11 of 2008 on Electronic Information and Transactions (“**Law 11/2008**”).²⁵

Starlink must obtain a Satellite Close Fixed Network (SCFN) license. Considering that Starlink's network is utilized by Over-The-Top (OTT) service providers, Starlink must adhere to the provisions of Government Regulation of the Republic of Indonesia Number 71 of 2019 on the Organization of Electronic Systems and Transactions (“**GR 71/2019**”),²⁶ both for public and private scopes. As a Internet Service Provider (ISP) Starlink is responsible for preventing illicit content from entering Indonesia. All electronic transactions, including personal data, are regulated and overseen by the government as stipulated in the Regulation of the Minister of Communication and Informatics of the Republic of Indonesia Number 5 of 2020 on Electronic System Provider in the Private Sector (“**MOCI Reg. 5/2020**”). Violations of these provisions can result in the revocation of the license.

The ambiguity surrounding the definition of OTT in both GR 71/2019 and Regulation of the MOCI Reg. 5/2020 poses a weak point in law enforcement. Therefore, the government is striving to create a clearer definition of OTT as outlined in the Minister of Communication and Informatics Circular Letter Number 3 of 2016 on Provision of Application Services and/or Content Via the Internet (Over the Top) (“**MOCI Circular Letter 3/2016**”).

This definition is essential for legal certainty. Activities on OTT platforms present complex legal issues due to the unclear application of the principle of *lex locus delicti* in resolving legal matters occurring in virtual spaces.²⁷ In conventional legal systems, the jurisdiction of a country's laws is based on its geographical territorial boundaries.²⁸

Starlink disrupts the conventional telecommunications industry because it does not require business collaboration with traditional telecommunications operators. The loss to national operators is a threat to conventional telecommunications operators and poses a significant risk to the country's economy. This is considering that the telecommunications industry is one of the major contributors to the state budget (APBN), including various taxes and non-tax revenues.²⁹

The internet, which serves as a primary tool for forming a digital economic ecosystem, accelerates e-commerce that provides a substantial contribution to the national economy. Indonesia's digital economic potential is the largest in the ASEAN region. In total, Indonesian e-commerce revenue in ASEAN in 2022 reached USD 99.5 billion and it means Indonesia's e-commerce businesses make

²⁴ Darwish T (*et.al.*), ‘Leo Satellites in 5G and beyond Networks: A Review from a Standardization Perspective’ (2022) 10 IEEE Access 35040

²⁵ Law of the Republic of Indonesia Number 11 of 2008 on Electronic Information and Transactions.

²⁶ Government Regulation of the Republic of Indonesia Number 71 of 2019 on the Organization of Electronic Systems and Transactions.

²⁷ Koepsell DR, ‘An Emerging Ontology of Jurisdiction in Cyberspace’ (2000) 2 Ethics and Information Technology 99

²⁸ Kleven A, ‘Minimum Virtual Contacts: A Framework for Specific Jurisdiction in Cyberspace’ [2018] Michigan Law Review 785

²⁹ Ramli TS (*et.al.*), ‘The Role of over the Top (OTT) Service on Utilization of Telecommunication Infrastructure Based on Indonesian Tax and Non-Tax Policy’ (2021) 56 Journal of Southwest Jiaotong University 67

up 52% of the total.³⁰ This has the potential to enhance the economic welfare of the community significantly. Access to the internet fosters creativity and innovation across all sectors, including spurring advancements in intellectual property, which is a significant driver of economic growth. Digital economic growth in Indonesia outpaces that of six other Southeast Asian countries. Moreover, Indonesia ranks third globally in terms of social media users, including platforms like Facebook only behind India and the United States.³¹

Studies indicate that Indonesia's digital economy value in 2022 was recorded as the highest in Southeast Asia, amounting to USD 77 billion. It is projected to reach USD 130 billion by 2025.³² If not comprehensively regulated, this digital economic potential could be dominated by global LEO satellite mega-constellation operators.

To create legal certainty and fair treatment for all players in the national telecommunications industry, the Indonesian government must enforce similar provisions on Starlink. This includes imposing equal charges on all operators, such as fees for telecommunication operational permits and the Spectrum Utilization Fee for radio frequency for each radio station. Specifically, telecommunication providers utilizing satellites must pay for the frequency of satellite stations. Starlink's mega-constellation, comprising tens of thousands of NGSO satellites, is not differentiated from GSO satellites in Indonesian regulations. Hence, every NGSO satellite within the mega-constellation must pay the radio frequency *BHP* and need landing rights. Foreign satellites must have a gateway on Earth's surface, ensuring the satellite network integrates with the national network as a backhaul.

3.4 Licenses Required for Starlink's Mega Satellite Constellation

Considering Starlink serves multiple functions simultaneously, such as a backbone network, a network operator, a service provider, a Network Access Provider (NAP), and an Internet Service Provider (ISP) when providing internet access services to end-users, Starlink must have legal entity status in Indonesia. It should comply with licensing requirements and pay all regulatory charges stipulated in the legislation.

Indonesia's independence in regulating its national telecommunications is recognized in international law, as outlined in the ITU constitution.³³ Telecommunications is a crucial economic sector for the country. It acts as an enabler for other sectors, including government institutions. Globally, the radio frequency spectrum is recognized as a limited and scarce natural resource with high economic value, categorizing it as a strategic limited natural resource for the country. The radio frequency spectrum is pivotal in modern telecommunications operations. Satellite networks cannot function without utilizing radio frequencies. Hence, Indonesia has jurisdiction over regulating the operation of mega satellite constellations within its territory.

Although it disrupts the conventional telecommunications industry, Indonesia critically needs a significant leap in accelerating high-speed internet access for people living in remote areas. Mega LEO

³⁰ USA Department of Trade – International Trade Administration, “eCommerce” in *Indonesia Country Commercial Guide*, (USA Department of Trade Publications, 2024)

³¹ Cahyadi A (*et.al*), ‘Market Jurisdiction: Opportunity for Imposing Income Tax for Potential User Countries in the Era of Economic Digitization’ (2023) 24 *Quality - Access to Success*

³² Bain & Company, Google, and Temasek, ‘Fullfilling Its Promise, The Future of Southeast Asia’s Digital Financial Services’, (*Bain & Company*, 2019); Google, *Roaring 20s: The SEA Digital Decade, E-Conomy SEA 2021*, (2021); Stephanie Davis and Nuno Carrilho Neves, ‘E-Conomy SEA 2021: Post-Pandemic Marketing - Think with Google APAC’, (*Think with Google*, 2021); Google, Temasek, and Bain & Company, *E-Conomy SEA 2021 Roaring 20s: The SEA Digital Decade*, (Google Temasek, Bain & Company, 2021).

³³ ITU Constitutions.

satellite constellations have the potential to serve as a communication access tool with global 4G, 5G, and even 6G digital technology platforms.³⁴

Mega LEO satellite constellations like Starlink necessitate a transformation in the telecommunications industry, including a comprehensive restructuring toward a digital ecosystem. An adaptive legal system is essential for a smoother transformation and fostering collaboration between telecommunications operators and OTT platforms for mutual benefit.³⁵

The government must uphold national sovereignty in regulating national telecommunications. Therefore, the interdependence between the foreign operator Starlink's network and the national terrestrial physical network is crucial to enable the government to exercise its constitutional obligation to treat all operators in an equal manner. This facilitates the government in asserting sovereignty, ensuring legal certainty, and safeguarding national economic interests, such as state revenue from taxes and non-taxes derived from the digital industry.³⁶ Telecommunication physical networks used in transactions within Indonesia's jurisdictional areas would make enforcing the law more manageable for the government. Starlink, with its network not integrated with conventional operator terrestrial networks, could potentially complicate law enforcement and weaken the government's ability to control economic aspects of the telecommunications industry.

Some principles that Starlink must not violate in Indonesia are outlined in Article 20 of Law of the Republic Indonesia Number 5 of 1999 on Prohibition of Monopolistic Practices and Unfair Business Competition (“**Law 5/1999**”), this provision prohibits businesses from supplying goods and/or services at a loss or setting very low prices with the intent to eliminate or disable competitors in the relevant market, leading to monopolistic practices and/or unfair business competition. Given that Starlink can provide direct access services from satellites to customers in Indonesia without utilizing existing operator networks, it has the potential to capture existing operator customers and engage in monopolistic practices. Starlink is not burdened with the expensive costs of terrestrial network development, which could distort the prices of telecommunications service market prices. Therefore, there is a need for a legal concept that harmonizes the need for network development with the health of the telecommunications industry ecosystem.

The vast amounts of data transmitted within the Starlink network have strategic value and are also of high economic importance. Smooth digital transactions are crucial for the country's economic progress, impacting welfare. Technological leaps always bring about progressive changes, much like the Fourth Industrial Revolution, which significantly enhanced industrial efficiency.³⁷ The 4G is followed by 5G digital technology that supports the Internet of Things, robotics, and blockchain, enhancing the comparative advantage of industry players.³⁸ Digital technology continues to evolve rapidly, with 6G implementation already underway.³⁹ OTT digital platforms are crucial for digital

³⁴ Xie H (*et.al*), ‘Leo Mega-Constellations for 6G Global Coverage: Challenges and Opportunities’ (2021) 9 IEEE Access 164223

³⁵ Ramli AM (*et.al*), ‘Collaboration Principles between Telecommunication Operators and Over-the-Top (OTT) Platform Providers in the Context of the Indonesian Job Creation Regulation’ (2022) 10 Journal of Telecommunications and the Digital Economy 50

³⁶ Ramli TS (*et.al*), ‘Pengenalan Hukum Teknologi Informasi Dalam Pemanfaatan Over The Top Untuk Pendidikan’ (2021) 5 Acta Diurnal Jurnal Ilmu Hukum Kenotariatan 78

³⁷ Felsberger A and others, ‘The Impact of Industry 4.0 on the Reconciliation of Dynamic Capabilities: Evidence from the European Manufacturing Industries’ (2020) 33 Production Planning & Control 277

³⁸ Adel A, ‘Future of Industry 5.0 in Society: Human-Centric Solutions, Challenges and Prospective Research Areas’ (2022) 11 Journal of Cloud Computing

³⁹ Bassoli R, Fitzek FHP and Strinati EC, ‘Why Do We Need 6G?’ (2021) 2 ITU Journal on Future and Evolving Technologies

transformation across all sectors,⁴⁰ leading to an increase in intellectual property⁴¹ and proving to boost the Gross National Product (GDP).⁴²

Starlink will be utilized as an electronic transaction platform, and thus it must adhere to the regulations of electronic system transactions as stipulated in the EIT Law.⁴³ Starlink holds the function of controlling its network, including managing communication traffic within Indonesia jurisdiction. Starlink also carries the status of the content controller and must facilitate lawful interception for law enforcement in Indonesia to ensure its operations align with Indonesia's telecommunications laws.

Based on international law, Indonesia holds sovereignty in its airspace, this is a valid legal basis for Indonesia to regulate any operation of foreign service in its air territory. Existing laws and regulations shall be applicable to any networks operating in Indonesia regardless of the benefit of new advanced technologies such as mega constellation LEO satellite. Based on current laws, the fast-growing technologies such as global mega-constellation satellite network including Starlink, must streamline their technical architectures to meet Indonesia's legal requirements, therefore. From the existing network regulation standpoint, they have to operate a gateway in Indonesia to make the mega constellation in legal in Indonesia. Because the existing regulation is based on conventional technology operation. The utilization of a ground segment like gateway in their network will eliminate complexity in regulation implementation and law enforcement. On the other hand, this allows the Indonesian government to oversee all data communication traffic within its jurisdiction legally. In the digital era, the government's responsibility extends beyond physical land, sea, and air jurisdictions to the digital domain. Indonesia cyberlaw governs the threat of cybercrime and misuse of private data in digital networks. the Internet Service provider, in this case the Starlink, shall be responsible Since Starlink collects data and transmits them in its digital network.

Since gateways are considered radio stations, every Starlink gateway on Earth's surface must obtain a radio station permit. This permit is valid for a specific period, and the government reserves the right to revoke it for greater national interests. The utilization of limited resources like frequency spectrum within Indonesia's jurisdiction, even by foreign entities, must primarily serve Indonesia's interests.⁴⁴

LEO satellite mega-constellations can serve as backhaul for national operator networks, enhancing network performance when transmitting large-scale data.⁴⁵ Various technologies are continuously developed to improve customer service quality,⁴⁶ including potential consolidations between LEO mega-constellations and GSO satellite networks. Operators are persistently innovating in the operations of LEO mega-constellation satellites, aiming to address limitations and enhance network capabilities, eventually offering advanced broadband services like 6G.⁴⁷

⁴⁰ Melnyk L and others, 'Digital and Economic Transformations for Sustainable Development Promotion: A Case of OECD Countries' (2022) 12 *Environmental Economics* 140

⁴¹ Adel A, *Loc.Cit.*

⁴² Yankovskaya VV and others, 'Digital Education in the Social Investment Model of Gross Domestic Product Growth in the Context of Industry 4.0' (2023) 8 *Frontiers in Education*

⁴³ Law of Republic Indonesia Number 11 of 2008 concerning Electronic Information and Transactions. First amended by Law of Republic Indonesia Number 16 of 2016 and second amendment by Law of Republic Indonesia Number 1 of 2024.

⁴⁴ Government Regulation of the Republic of Indonesia Number 53 of 2000 on the Use of Radio Frequency Spectrum and Satellite Orbits.

⁴⁵ Di B (*et.al.*), 'Ultra-Dense Leo: Integrating Terrestrial-Satellite Networks into 5G and beyond for Data Offloading' (2019) 18 *IEEE Transactions on Wireless Communications* 47

⁴⁶ Zhu TG, Solosa S and Maniani P, 'Modeling and Optimization of Multi-Altitude LEO Satellite Networks Using Cox Point Processes' (2023) 17 *International Journal of Enterprise Modelling* 35

⁴⁷ Lai Z (*et.al.*), 'Starfront: Cooperatively Constructing Pervasive and Low-Latency CDNS upon Emerging LEO Satellites and Clouds' (2023) 31 *IEEE/ACM Transactions on Networking* 2559

The legal issues that may arise include legal actions that are not easily resolved because they occur outside the jurisdiction of Indonesia, while the legal consequences occur in Indonesia. Given the use of Information Technology for Electronic Information and Electronic Transactions, direct connection services to customers would violate telecommunications and electronic information and transaction laws. Apart from violating technical procedures and provisions in the telecommunications sector, it also violates public and private electronic transaction services provisions. Providing internet access services that distort the national telecommunications industry in Indonesia's territorial area without permission is a legal violation.

The provision of broadband access used for digital OTT application platforms creates a new territorial area beyond land, sea, and air. The concept of a state's jurisdiction in the digital realm becomes crucial due to the increasing legal issues arising from legal actions in the digital space, both in virtual and physical spaces. Mireille Hilderbrandt even introduced the term '*cyberspace liberum*' in response to attempts to control cyberspace using extraterritorial principles by states mastering technology.⁴⁸

Law 36/1999 regulates the obligations of business licenses and permits for the use of radio frequencies. The government must carefully formulate licensing policies for telecommunications providers and OTT services that utilize mega-constellations.

Regarding the foreign-owned LEO satellite constellation that will operate in Indonesian territory, in reality, the government benefits from the provision of internet access to every corner through foreign-owned mega LEO satellite constellations like Starlink because there is no need to finance massive infrastructure development to cover such a vast territorial area. However, Indonesia's national policy on the operation of Starlink and similar networks must consider the legal, economic, political, and strategic impacts, including threats to national defense and security. These potential losses can be direct or indirect for Indonesia. Operating a telecommunications network based on a global mega LEO satellite constellation should not threaten Indonesia's sovereignty in regulating telecommunications.

Starlink's LEO mega constellation network serves as the gateway for global OTTs, driving digital transactions in a virtual space that knows no national boundaries, with real consequences occurring within Indonesia's jurisdiction. The EIT Law and its implementing provisions act as the "*Lex digitalis*" governing the conduct of legal entities in the virtual space.⁴⁹ Indonesia has sovereignty over the entire network and spectrum frequencies it uses.⁵⁰

Generally, Indonesian regulations have not comprehensively addressed all aspects of telecommunications operations using LEO mega satellite constellation networks. In Indonesian regulations, satellites are defined as space radio stations, considered supportive devices of a telecommunications network system. Indonesian satellite regulations do not recognize satellites as institutions or legal entities for telecommunications service providers. The Starlink business model is unfamiliar within Indonesia's legal framework, so the licensing applied does not align with the design of the LEO mega satellite constellation infrastructure (not considered as a form of telecommunications service). Starlink must have a registered legal entity in Indonesia as a new telecommunications service provider. The rights and obligations to the existing telecommunications operators shall be applied to Starlink, including adhering to investment regulations.

⁴⁸ Hildebrandt M, 'Extraterritorial Jurisdiction to Enforce in Cyberspace? Bodin, Schmitt, Grotius in Cyberspace' (2013) 63 University of Toronto Law Journal 196

⁴⁹ Ramli TS (*et.al*), 'Pengenalan Hukum Teknologi Informasi Dalam Pemanfaatan Over the Top Untuk Pendidikan', *Loc.Cit.*

⁵⁰ Mainwaring S, 'Always in Control? Sovereign States in Cyberspace' (2020) 5 European Journal of International Security 215

The digital platform facilitated by the LEO mega satellite constellation network disrupts the current conventional telecommunications industry. Therefore, a new legal framework is needed to push the conventional telecommunications industry to transform into a digital ecosystem that can provide high-speed internet services of the latest generation for broader benefits to Indonesia. The conventional telecommunications industry will find a new equilibrium within the digital ecosystem in line with the latest technological advancements. Implementing national laws and regulations regarding the global LEO mega satellite constellation technology in Indonesia's territory is essential to maintain Indonesia's legal sovereignty, including in the cyberspace created by the operation of OTT platforms. If Starlink's mega constellation uses ground stations located on the Earth's surface within Indonesia's territorial boundaries, there will not be complex legal issues, as national legislation directly applies to them, similar to existing conventional telecommunications operators.

The Frequency Fee applied to individual satellites serves as a space radio station. Currently, there are no specific regulatory frameworks addressing LEO mega satellite constellations that comprise tens of thousands of satellites. This raises a pivotal question: Is the fees for radio frequency imposed on each satellite within the mega constellation, or is there a consolidated fee established for the entire constellation, irrespective of its magnitude? The prevailing legislative landscape concerning fees for radio frequencies does not specifically address the fee for Non-GSO satellites. Transformative legal rules are required to ensure that the Non-Tax State Revenue for frequencies does not result in high communication facility costs and limited broadband access in remote areas. The radio frequency fee will impact the access costs charged to the public.⁵¹

For the acceleration of digital transformation, the Indonesian government has enacted Regulation in Lieu of Law No. 6 of 2023 on the Amendment of Government Regulation No. 2 of 2022 on Job Creation into Law. This law aligns 76 existing laws, including telecommunications laws, to eliminate various business and investment barriers. Through this law, the telecommunications sector experiences revitalization by optimizing its passive infrastructure and ensuring efficient use of limited resources like the radio frequency spectrum. Such harmonization of laws is pivotal for broader strategic goals. The implementation of 5G digital technology and subsequent advanced technologies necessitates a sufficient frequency spectrum. For instance, policies on reallocating radio frequency spectrum and digitizing the broadcasting sector have yielded digital dividends in the 700 MHz bandwidth for broadband services, which are crucial infrastructure in the digital transformation process. The Job Creation Law exemplifies transformative legal measures, fostering rapid digital advancement across all sectors, enhancing the country's global competitiveness on the international stage.

IV. CONCLUSION

Telecommunication infrastructure in remote areas significantly lags behind urban areas. LEO satellite mega constellations like Starlink represent a satellite technology leap capable of bridging the digital isolation across vast, unreachable terrestrial areas of Indonesia. This assists the government in its mission to establish high-speed internet access networks in the expansive remote areas of Indonesia. The availability of broadband access will enhance creativity, innovation, and production efficiency among rural communities, addressing the digital divide between urban and rural areas. The growth of e-commerce in rural areas will significantly contribute to national digital economic growth. From the perspective of telecommunications law, indirectly, it also plays a role in realizing the strategic objectives of telecommunications provision, such as strengthening national unity, facilitating

⁵¹ ITU, *Guidelines for the Review of Spectrum Pricing Methodologies and the Preparation of Spectrum Fees Schedules Infrastructure* (ITU Publications 2016)

government activities, supporting equitable development goals and their outcomes, as well as enhancing international relations as outlined in the considerations of Law Number 36 of 1999 on Telecommunication.⁵²

Internet and OTT platforms have become crucial elements in supporting economies and are key to boosting productivity across all sectors of the national economy. In the constitution, they are recognized as essential production branches for the country and control the livelihood of many. Therefore, telecommunications networks must be controlled by the state to ensure the operation of advanced technology remains fair for Indonesia's broader national interests comprehensively.

The emergence of competition among mega satellite constellations has a positive impact on competition in bringing increased internet connectivity globally which is beneficial for residents of countries throughout the world. This progress in internet access infrastructure encourages economic activity but can also have international geopolitical and national security implications.

The provision of telecommunications with a mega-constellation LEO satellite network architecture, such as Starlink, theoretically requires a new classification of service providers, namely the licensing of integrated satellite network operators that encompass network functions and internet access provision. This is not only a breakthrough in advanced technology but also a key to digital transformation for the holistic advancement of the nation. Therefore, laws and regulations must be transformative and highly adaptable to technological revolutions. However, the transformation of the digital industry must remain in line with principles of justice and national objectives as stipulated in the 1945 Constitution.

Laws regulating the satellite-based internet are still developing. There is an urgent need for international cooperation to harmonize regulations on internet services directly from satellites. To facilitate the acceleration of development in remote areas and realize an equal digital ecosystem throughout the country, transformative laws are essential. The disruption of this new satellite technology on conventional telecommunications business models needs to be harnessed to reconstruct the entire national telecommunications ecosystem holistically. Indonesia can address its digital infrastructure backlog and harness the potential for creativity and innovation to drive massive national digital economic growth.

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⁵² Law of the Republic Indonesia Number 36 of 1999 on Telecommunication.

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