Taxation Strategies in The Global Space Economy for Global Digital Inclusion Through Starlink

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Abstract

This study investigates the taxation strategies that can support the expansion of the space economy, with a specific focus on Starlink and its role in bridging the global digital divide. Our methodology combines an extensive review of existing literature, in-depth analysis of tax policies across various jurisdictions, and comparative studies to identify best practices that can support the expansion of Starlink services and similar initiatives. Special attention is given to how tax policies can influence investment in space infrastructure and the availability of broadband internet services in remote areas. Our findings suggest that innovative tax frameworks and collaborations between the public and private sectors are key to optimizing the economic and social benefits of the space economy. We offer recommendations for policymakers in designing tax policies that encourage innovation and investment in space technology, while also strengthening public-private partnerships as a means to accelerate the reduction of the digital divide. This research contributes significantly to the literature on the space economy, taxation strategies, and global efforts to address digital exclusion. By integrating economic theory, tax law, and public policy, we provide new insights into how the world can leverage projects like Starlink to advance sustainable development goals and digital inclusion.

Introduction

In the global digital era, widespread internet access is key to socio-economic progress and inclusion. Around 67% or 5.4 billion people of the global population are already online, indicating a 4.7% increase from 2022 [7]. However, a striking disparity exists between high and low-income countries regarding internet access, highlighting a significant global digital divide that serves as a major barrier to universal connectivity. Despite the global mobile internet user base reaching 4.6 billion or 57% of the world's population, its growth is hindered by disparities in usage and access to mobile broadband [6]. In fact, 38% of the population remains unconnected despite being in areas with broadband coverage, emphasizing the importance of seeking innovative and inclusive solutions to overcome these barriers. The importance of digital infrastructure in narrowing the digital divide underscores the need for quality, affordable, and reliable internet access [15]. With one-third of the world, or 2.6 billion people, still offline in 2023, digital technologies, including Low Earth Orbit (LEO) satellites like SpaceX's Starlink, are deemed vital to enhancing digital inclusion and driving economic growth and social progress, particularly in remote areas and developing countries. Starlink offers advantages in high download speeds and extensive global coverage due to its dense LEO satellite constellation. This innovative technology sets it apart from other satellite solutions with its unique ability to provide stable and fast internet connectivity in remote areas [12].

Previous research has explored the necessity of developing adaptive and responsive tax strategies to accommodate the dynamics of the space industry, ensuring fair profit distribution and effectively supporting sector growth [13]. This is reinforced by the exponential growth of the space economy, estimated to reach up to $3 trillion in the coming years [2], underscoring the importance of careful tax strategies to ensure fair revenue and support the sustainable development of space activities. Taxation cases involving commercial space operations, such as satellite bandwidth usage, emphasize the need for clear and coordinated international tax strategies to comply with Value Added Tax provisions across jurisdictions [11]. Discussions on space economy regulation and taxation, still in their early stages, receive support from academics and practitioners for the development of new tax policies capable of supporting sector growth while ensuring fairness and inclusion [3]. The use of satellite technology complicates jurisdiction determination and tax base, necessitating innovative international tax strategies and multilateral coordination to address taxation challenges in the digital economy and outer space industry.

Effective tax strategies and collaboration between the public and private sectors are crucial in supporting initiatives like Starlink, which plays a vital role in expanding affordable internet access worldwide. The World Bank has identified investment in digital infrastructure as a key factor in bridging the digital divide and supporting inclusive economic growth, highlighting the need for synergy between technological innovation, supportive tax policies, and cross-sector cooperation. Low Earth Orbit (LEO) satellite projects like Starlink offer the potential for widespread and stable global internet access, particularly in remote areas, ushering in a new era in digital infrastructure development and facilitating broader digital inclusion. The success of these initiatives heavily depends on innovative approaches to tax policies, including cross-border tax management and incentives for research and development (R&D), which would facilitate the development and application of such technologies, attract investment, and strengthen strategic cooperation. The OECD recommends tailored tax policies as a crucial aspect in effectively harnessing such technologies and ensuring fair profit distribution.

This research aims to examine the impact of Low Earth Orbit (LEO) broadband satellite technology on digital inclusion and infrastructure development, with a specific focus on developing tax strategies that can maximize the potential of satellite technology for global digital inclusion objectives. Through in-depth analysis, this study is expected to generate strategic recommendations for the implementation of tax policies and public-private partnerships that can accelerate the adoption of LEO satellite technology, improve internet access in remote areas, and support inclusive and sustainable digital development.

Method

Our methodology integrates a thorough literature review with in-depth analyses to illuminate the interplay between taxation strategies, the space economy, and efforts to bridge the digital divide, focusing notably on satellite-based services like Starlink. By examining scholarly articles, industry reports from entities such as the ITU and GSMA Intelligence, we aim to grasp the current dynamics of the space economy, identify disparities in digital access, and assess the influence of tax policies on technological progress. Our investigation extends to a global analysis of tax frameworks, dissecting how they impact space-based operations and their potential to either foster or hinder economic growth within this sector, particularly in financing infrastructure and extending broadband to remote areas. Additionally, through comparative studies, we delve into the variegated effects of tax policies on the rollout and adoption of broadband satellite services across different jurisdictions, providing a nuanced understanding of policy effectiveness in technological proliferation. Aggregating and qualitatively analyzing data from these diverse strands of inquiry allows us to synthesize insights into

how tax strategies and public-private partnerships can enhance the expansion of the space economy and mitigate digital exclusion.

Results and Discussion

3.1 Analysis of Satellite Tax Jurisdiction

In analyzing the tax jurisdiction over satellites, a unique set of challenges arises from their operations outside any terrestrial jurisdiction, creating complexities in determining their 'operational location' for taxation purposes. Legal cases such as CoT v Resource Capital Fund and Inmarsat Global Ltd v HMRC have underscored the critical role of tax law interpretation, regulations, and international agreements, with an emphasis on the nature of transactions, ownership, and satellite usage rather than their physical location (Schwarz, 2019). From these cases, key principles have emerged: Article 13 of the OECD Model and tax litigation underscore the significance of property characteristics and transactions, while cases like Vodacom Nigeria v FIRS identify the service recipient's location as the determinant for tax treatment, indicating that the provision of bandwidth capacity is regarded as service provision in the recipient's country. These factors—transaction nature, ownership, satellite usage, and the location of the service recipient—are pivotal in determining tax jurisdiction [11].

[5] proposes an innovative approach by adapting regulations applicable to the high seas to design a tax jurisdiction framework that accommodates the uniqueness of commercial space activities. This issue is complicated by the ambiguity regarding the boundary where a country's airspace ends and outer space begins, with various national approaches—such as distance rules, the Von Kármán line, or orbit lines—adding complexity to tax jurisdiction determination. The Asia Satellite Communications Co. Ltd. v. DIT case highlights this complexity, underlining the necessity of interpreting international agreements and domestic laws to determine tax obligations. The Bogota Declaration presents an additional challenge of sovereignty, with equatorial nations claiming sovereignty over the geostationary orbit space above them, emphasizing the urgent need for international cooperation in creating a global consensus on the applicable tax jurisdiction for space operations [8] [9]. This integrated approach is essential to prevent conflicts and ensure a fair and efficient allocation of tax rights, mirroring the challenges encountered in digital service taxation and supporting the sustainable growth of the commercial space industry.

In efforts to understand and simplify tax jurisdiction for satellites and space operations, the consideration of residency status becomes central to the debate. Different countries adopt varied approaches to defining residency within the tax context. For instance, India determines residency status based on the physical presence of an individual over a specified duration, while the United States considers all citizens and green card holders as tax subjects, irrespective of their physical location. In the UK, the concept of residency is more complex, incorporating elements such as home ownership, bank accounts, and investments as indicators of a strong connection to the country. These differences highlight the challenges in creating a consistent definition of residency for international taxation purposes, especially when considering space operations and satellites that are outside traditional territorial jurisdictions [10].

International conventions frequently reference domestic law to ascertain residency, yet this approach engenders complications when national legislation does not explicitly define 'resident'. In the context of space operations, the concept of residency beyond Earth or in outer space emerges as a novel area necessitating attention. For example, nations have established legal statuses for seafarers, which could serve as a foundation for applying similar principles to astronauts and commercial space activities. Through Notification No. 70 of 2015, India illustrates how domestic regulations can adapt day-counting for seafarers, offering a potentially adaptable framework to address the complexities of space and satellite taxation, while considering jurisdictional differences and avoiding issues such as

space debris. This underscores the significance of international collaboration and legal adaptation to ensure fair and effective tax jurisdiction in the evolving era of space exploration [10].

An analysis of national laws and regulations across 25 countries reveals diverse approaches to the regulation of space exploration and utilization, encompassing the establishment of national space agencies to the registration of objects launched into space and the definition of space activities. These approaches range from relatively narrow definitions, as seen in Austria and Denmark, which limit space activities to the launch and operation of space objects, to broader definitions in Kazakhstan and Russia, which include scientific, economic, and commercial activities. Meanwhile, at the international level, the OECD Model Convention aims to address taxation issues through the Double Taxation Convention, yet complexities arise in the space context, particularly regarding the status of satellites as permanent establishments and how satellite exploitation is taxed. India challenges the OECD perspective, asserting that a satellite's footprint in the source territory could be considered a permanent establishment, highlighting the importance of sovereignty over the geostationary orbit which is vital for developing countries. India's stance and the adoption of the Bogota Declaration by seven equatorial countries, demanding sovereignty over their segment of the geostationary orbit, emphasize the need to address international tax law to recognize and adapt to the uniqueness of space activities, including the taxation of income generated from terrestrial connections to satellites. This highlights gaps in the existing tax framework and the need for innovative solutions to ensure fairness and efficiency in the taxation of space activities [4].

Determining tax jurisdiction for satellite operations requires an approach considering transactional and usage aspects, ownership and service recipient location factors. This approach should support the adoption of a new definition of permanent establishment, fair income allocation mechanisms, and the implementation of digital tax arrangements that align with the unique nature of satellite operations. The importance of international cooperation and the harmonization of tax regulations cannot be overstated, ensuring that the contributions of satellite operations, such as Starlink, to the global economy are not impeded by unnecessary tax barriers, thereby creating a fair and efficient environment for all stakeholders involved.

The analysis of satellite tax jurisdiction, particularly in the context of Starlink's role in global digital inclusion, reveals unique challenges not fully accommodated by traditional taxation frameworks. These include difficulties in determining the physical location for taxation purposes, given that satellites operate outside any national jurisdiction. [11] [1]. underscore the need for an updated or even new taxation framework capable of accommodating the uniqueness of space economic activities. [5] proposes an innovative approach by adapting regulations applicable to the high seas to design a tax jurisdiction framework that accommodates the uniqueness of commercial space activities. This issue is further complicated by the ambiguity regarding the boundary between a country's airspace and outer space, with diverse national approaches—ranging from distance rules, the Von Kármán line, to orbit lines—adding complexity to tax jurisdiction determination.

The Asia Satellite Communications Co. Ltd. v. DIT case and the Bogota Declaration underscore the complexity and sovereignty challenges in determining tax obligations, highlighting the need for international cooperation to create a global consensus on the applicable tax jurisdiction for space operations. This integrated approach is critical to preventing conflicts and ensuring a fair and efficient allocation of tax rights, mirroring similar challenges faced in digital service taxation and supporting the sustainable growth of the commercial space industry. This analysis is pertinent to Starlink, which aims to provide global internet access through its satellite network and stands at the forefront of innovation in the space economy. While bringing benefits in terms of digital inclusion, this initiative also introduces complex taxation challenges due to the cross-jurisdictional nature of its operations. Recognizing satellite operations as a permanent establishment, or adapting the definition to

encompass space economic activities, would facilitate a fairer and more efficient allocation of tax rights. Harmonization of international tax agreements is crucial, requiring inter-country cooperation and support from international organizations to develop consistent taxation standards that support innovation in the space sector while ensuring tax compliance..

3.2 Analysis of Satellite Revenue and Costs

In the context of Satellite Revenue and Operational Costs Analysis, the discussion on corporate taxation, especially related to commercial space activities, underscores the importance of considering tax aspects in evaluating satellites' revenue and operational costs. Given that direct taxation can be imposed on corporate entities operating in space through corporate vehicles, and that the tax position of satellites and the territories they serve is traditionally not deemed significant from the perspective of direct taxes—except for the tax domicile of the satellite operator—it's a critical factor to consider. This indicates that, although satellites operate beyond conventional territorial limits, the revenue generated from such activities and related tax costs depend on the tax regulations within the tax domicile jurisdiction of the operator. Hence, understanding the applicable tax implications, including the potential for double taxation and how to address it through bilateral tax treaties and the impact of legal uncertainty regarding sovereignty over space on tax obligations, is crucial in analyzing satellite revenue and costs [5].

Analyzing the revenue and operational costs of satellites, it is essential to consider the applicable international regulations, particularly the role of the International Telecommunications Union (ITU) in allocating radio/electronic spectrum and orbital slots. These allocations are fundamental to the operational capabilities of communication satellites and have significant financial impacts. The costs to acquire and maintain access to the spectrum and orbital slots can be a major component of the total operational expenses. Furthermore, ITU policies and changes in spectrum allocation can affect the expected revenue from satellites by altering resource availability or increasing competition. Therefore, companies operating in the outer space sector must actively monitor changes in policies and spectrum allocation to manage risks and maximize revenue potential [8].

The legal uncertainty related to the boundary between space and national sovereignty territories and issues like the right to exploit outer space resources also play a critical role in analyzing satellite revenue and costs. For instance, ambiguity regarding where space begins can raise questions about which jurisdiction and regulations apply to satellites operating at those boundaries, potentially affecting operational costs and tax liabilities. Further, discussions on mining and exploiting outer space resources, although not directly related to satellites, provide insights into how future regulations or the lack thereof could affect other economic activities in outer space, including satellite operations. This highlights the importance of a comprehensive understanding of the current legal environment and potential for changes, as factors affecting revenue and cost projections for outer space activities [8].

In the technical analysis of satellite revenue and operational costs, key considerations include a deep understanding of outer space law formulated since the mid-1960s and how international treaties, such as the 1967 Outer Space Treaty and related conventions, form a legal foundation affecting satellite operations. Factors like spectrum allocation by the International Telecommunications Union (ITU) and orbital slot arrangements become crucial as they determine accessibility and potential conflicts in the use of outer space resources that could impact operational costs. Moreover, the shift towards the commercialization of outer space and extraterrestrial activities by private entities introduces new taxation challenges, including the determination of tax domicile for entities operating transnationally through satellites. Legal cases such as Asia Satellite Communications Co. Ltd. vs DIT, addressing the interpretation of satellite activities as a form of permanent establishment and related

tax obligations, highlight the complexities of determining income sources and applying taxes on transactions crossing national jurisdictional boundaries. Consequently, revenue from the use of transponder capacity and other satellite services must be analyzed considering the applicable international taxation framework, potential double taxation, and prevailing legal uncertainties, all adding complexity to calculating operational costs and net revenue from satellite operations [9].

The case study of Asia Satellite Communications Co. Ltd. vs DIT provides critical insights into the challenges of determining satellite revenue and operational costs in cross-border taxation. The primary consideration in this case was whether satellites operating in geostationary orbit, providing services to various countries, including India, could be considered a form of permanent establishment inciting tax obligations in that country. The court's decision to exempt satellites from being considered a form of permanent establishment in India because they were not within India's airspace or orbital slot highlights the variability in the interpretation of outer space law and cross-national taxation. Comparisons with similar decisions in California (Comsat) and Nigeria (Vodacom Nigeria), exploring the technical operation of satellites in the taxation context, underscore the lack of uniformity in the taxation approach towards revenue generated by satellites. This emphasizes the importance of understanding specific country law and taxation frameworks as well as international tax treaties when calculating operational costs and determining net revenue for entities operating in the outer space sector, where legal complexities and double taxation uncertainties can significantly affect the profitability of satellite operations [14].

Through this approach, tax strategies in the global space economy can more effectively support digital inclusion goals, ensuring that satellite operations like Starlink can significantly contribute to global economic development while fulfilling tax obligations in a fair and transparent manner. The analysis of satellite income and costs outlined above provides valuable insights into current tax regulations' challenges and adaptation needs. The relevance of this analysis in the context of Starlink and global digital inclusion efforts:

- The Vodacom Nigeria v FIRS case highlights how services provided by satellites, such as bandwidth, may be subject to VAT based on the location of the service recipient. This case is highly relevant to Starlink, which provides satellite internet services to users in various jurisdictions. A tax approach that considers the location of the service recipient helps ensure that countries where these services are consumed receive fair tax revenues, supporting digital inclusion efforts with infrastructure funding and public services.
- The Inmarsat Global Ltd v HMRC case demonstrates the challenges in deducting the costs of acquiring and launching satellites as business expenses. For Starlink, the ability to deduct these costs is crucial for the financial sustainability of the project. Adaptations in tax law that recognize significant investments in space technology and allow companies to fairly reduce operational costs are key steps in supporting the expansion of services essential for digital inclusion.
- References from [11], [3], [1] underscore the need for consistent tax standards for the aerospace industry. International cooperation in developing harmonized tax regulations is critical to avoid the challenges of navigating different tax regulations across jurisdictions for companies like Starlink. This cooperation strengthens the case for developing new international tax agreements specifically addressing the uniqueness of space activities, supporting digital inclusion while ensuring tax fairness.

3.3 Analysis of Permanent Establishment of Satellites

The concept of Permanent Establishment (PE) traditionally hinges on a significant physical presence within a tax jurisdiction, serving as a cornerstone for attributing tax rights to a country. This principle, however, encounters complex challenges when applied to satellite operations, which inherently occur beyond any national territorial boundaries. Analyzing landmark cases like Vodacom Nigeria v FIRS and Asia Satellite Communications Co. Ltd. v. DIT, it becomes evident that satellite operations juxtapose uniquely against conventional tax norms. For instance, the Vodacom case underscores how satellite bandwidth provision can incur tax liabilities such as VAT in the service recipient's country without establishing a traditional PE. Conversely, the Asia Satellite case articulates that satellites in geostationary orbit, despite providing transponder services, do not constitute a PE within India. This dichotomy suggests that while satellite operations might not conform to the traditional PE criteria, the services rendered are still subject to indirect taxation in jurisdictions where they are consumed, signaling a nuanced approach to taxation that accommodates satellite services' global and extraterritorial nature.

The evolution from an intergovernmental organization to a privatized entity as observed in the transition of INTELSAT to Intelsat, Ltd., elucidates the changing tax landscape for satellite operations. Originally, INTELSAT's intergovernmental status afforded it exemptions from various taxes, a privilege that significantly altered upon its privatization. This transformation highlights the critical role of PE in the taxation of satellite operations, where the unique operational dynamics of satellites — such as their placement in geostationary orbit — challenge traditional notions of tax jurisdiction and physical presence. The cases of Vodacom Nigeria v FIRS and Asia Satellite Communications Co. Ltd. v. DIT further complicate the PE determination, spotlighting the importance of income nature, service recipient location, and the interplay between international tax agreements and domestic regulations. This progression underscores an emerging need for adaptable tax frameworks that recognize the distinct characteristics of satellite operations and their contribution to the global telecommunications ecosystem.

In the broader context of the expanding space industry, particularly with the advent of Low Earth Orbit (LEO) constellations, the imperative for revising traditional tax frameworks becomes increasingly apparent. The sector's commercialization, underscored by substantial private investment and a surge in satellite launches, necessitates an innovative taxation approach that can reconcile satellite operations' borderless and dynamic nature with equitable tax principles. The challenge lies in crafting a tax framework that acknowledges the operational and regulatory idiosyncrasies of space activities, ensuring just taxation while fostering industry growth and innovation. An international collaborative effort, potentially spearheaded by organizations such as the International Telecommunication Union (ITU) or through new international agreements, is crucial for establishing a consensus on tax principles that mirror the satellite operations' global scale and the collective human endeavor in space exploration [1].

In conclusion, the transition in the satellite industry, from the cases of INTELSAT's tax exemptions to the complex scenarios presented by Vodacom and Asia Satellite Communications, illustrates a shift towards a more nuanced understanding of PE in satellite operations. The necessity for an updated international tax framework that can accommodate the unique aspects of satellite operations without hindering the space industry's progress is evident. The future of space economy taxation hinges on global cooperation and regulatory ingenuity to develop standards that align with the contemporary realities of space exploration and use [1].

The discussion on the analysis of Permanent Establishment (PE) of satellites in the context of international taxation highlights how the traditional concept of PE requires significant adaptation to accommodate space economic activities. With a focus on the Starlink initiative by SpaceX for global digital inclusion, this analysis considers how satellite operations challenge existing tax boundaries and demonstrates the need for evolution in international tax law.

References from [11], [3], [1] support the argument that, although satellite operations like Starlink may not create traditional PE due to the lack of physical presence in certain tax jurisdictions, they can still trigger tax obligations, particularly consumption taxes such as VAT or GST, in recipient countries. This highlights how cross-border digital services, increasingly common in the era of global digital inclusion, require a more flexible and inclusive tax approach.

The provision of satellite services may be subject to taxation in countries where the services are consumed, even without creating a physical PE. This underscores the importance of carefully navigating international tax treaties to avoid double taxation and optimize tax obligations for satellite operators like Starlink, whose goal is to expand global digital access.

This discussion also emphasizes the need for transparency and collaboration between space entities and tax authorities to develop more consistent and equitable guidelines that can support digital inclusion while ensuring tax compliance. It reflects an understanding that the tax challenges faced by space economic activities require not only technical solutions but also a collaborative approach to tax regulation reform. Adaptation of international and domestic tax regulations is crucial to support the expansion of satellite services essential for digital inclusion. The next steps involve international cooperation, through forums such as the OECD and the UN, to develop consistent and equitable global tax standards for space activities. This approach will ensure that Starlink and similar initiatives can significantly contribute to global economic development while fulfilling their tax obligations fairly and efficiently.

3.4 Analysis of International Tax Treaties and Space Activities

In advancing global digital inclusion through initiatives such as Starlink, our in-depth analysis of international tax treaties related to space activities reveals the urgent need for adaptation and innovation within the global tax framework. Currently, international tax treaties, mostly based on terrestrial economic structures and activities, face significant challenges in regulating tax rights over income generated by outer space activities.

The allocation of tax rights among countries becomes complex when confronted with economic activities outside any country's territorial jurisdiction, as demonstrated by Starlink operations. Specifically, the traditional concept of Permanent Establishment (PE) fails to accommodate satellite operations without physical presence in any country, as illustrated by the Asia Satellite Communications Co. Ltd. v. DIT case.

As humanity's endeavors stretch into the cosmos, the application of international tax treaties to space activities prompts a reevaluation of established fiscal doctrines, notably concerning Permanent Establishment (PE), tax residency, and the source of income. Traditional PE concepts, grounded in physical presence within a jurisdiction, grapple with the extraterritorial nature of satellite operations and beyond-Earth ventures, challenging the current tax treaty frameworks exemplified in cases like Vodacom Nigeria v FIRS and Asia Satellite Communications Co. Ltd. v. DIT. Similarly, defining tax residency for entities operating in or from space necessitates innovative legal approaches, potentially transforming how jurisdiction is determined for orbital and celestial bodies' activities. This scenario underscores the pressing need for adapting international tax norms to the realities of space exploration and commercialization, ensuring that space-based operations are equitably taxed and regulated [10].

The complexities of source-based taxation further illustrate the intricacies of taxing space activities, where income generation transcends terrestrial borders, raising questions about the allocation of taxing rights for extraterritorial sources, such as asteroid mining. The future of space economy regulation hinges on the global community's ability to forge a cohesive framework that accommodates the unique aspects of space operations, fostering sustainable development and utilization of outer space resources. Collaborative international efforts are essential for crafting legal and tax structures that support the burgeoning space sector, advocating for clear guidelines on PE, residency, and income sources. As we venture further into space, establishing a fair, well-regulated tax environment will be crucial for the harmonious expansion of human activities beyond our planet, requiring a unified approach from nations, space agencies, commercial entities, and international organizations [10].

Our analysis emphasizes the importance of developing new space tax treaties that can specifically address the unique issues of space economy. This includes adjusting the definition of PE, allocating tax rights fairly, and addressing the taxation of specific types of income originating from space. Such policies should aim to support economic innovation while ensuring fair and effective distribution of tax rights. To optimize tax obligations while complying with local and international regulations, tax strategies are required, including:

- Development of Universal Taxation Principles: Urgently creating universal taxation principles for space activities that can be applied globally and reduce the risk of inconsistent tax interpretations.
- Adaptation of PE Definitions: Adapting PE definitions to explicitly include space operations, facilitating clearer determination of tax liabilities related to satellite activities.
- Income Allocation Mechanisms: Developing mechanisms for fair and transparent income allocation and tax rights between countries, considering each country's contribution to space infrastructure and related services.
- Initiation of Space Tax Treaties: Encouraging the formation of specific international tax treaties that recognize and address the complexities of space economy, including promoting intergovernmental cooperation and international organizations to reach consistent agreements.

The discussion on the analysis of international tax treaties and space activities, particularly in the context of Starlink operations and its contribution to global digital inclusion, highlights the urgent need for adaptation and innovation within the global tax framework. This analysis acknowledges that current international tax treaties, based on terrestrial economic activities, face significant challenges in adapting to the new reality of space activities that transcend traditional geographic boundaries.

Referring to references from [11], [3], [1], this discussion asserts that the tax challenges faced by satellite operations like Starlink require a different approach from what has been previously applied. Starlink operations, aiming to expand global internet access and promote digital inclusion, encounter constraints within the traditional tax framework, such as the issue of Permanent Establishment (PE) and tax allocation.

Furthermore, the discussion highlights the importance of developing universal taxation principles for space activities that can be applied globally, reducing the risk of inconsistent tax interpretations. This is particularly relevant to initiatives like Starlink, whose operations span multiple jurisdictions and offer cross-border services, requiring a tax framework that acknowledges this cross-border nature and ensures fair and transparent taxation.

To address the issue of tax allocation rights over income generated by space activities, the discussion urges the development of fair and transparent allocation mechanisms, considering each country's contribution to space infrastructure and related services. This approach will ensure that tax rights are fairly distributed among the countries involved, supporting Starlink's goal of global digital inclusion while ensuring fair distribution of tax rights.

The discussion also emphasizes the unprecedented need for international cooperation, involving international organizations and countries in the development of a consistent and effective tax framework for space activities. Such cooperation will facilitate the creation of new space tax treaties specifically designed to address the complexities of space economy, supporting the growth of global digital inclusion through initiatives like Starlink.

Conclusion

The unique challenges faced by the space economy, particularly satellite operations like Starlink, necessitate adaptation within traditional tax strategies. Specifically, the need to update the concept of Permanent Establishment (PE), fair allocation of tax rights, and the development of universal taxation principles becomes evident. Additionally, collaboration between the public and private sectors on a global scale is imperative to facilitate the development and implementation of Low Earth Orbit (LEO) satellite broadband technology, such as Starlink, to reduce the digital divide.

This research recommends several strategic steps as follows:

- Urgently advocate for the establishment of globally applicable taxation principles for space activities, ensuring fair and transparent taxation. These principles should recognize the cross-border nature of satellite operations and provide clear guidelines for tax rights allocation.
- Revise the definition of Permanent Establishment in international tax law to encompass space operations. This will facilitate clearer determination of tax liabilities related to economic activities originating from space.
- Strengthen partnerships between the public and private sectors to expedite developing and implementing LEO satellite broadband technology. These partnerships may involve joint investments, research and development, and infrastructure procurement.
- Encourage international cooperation through forums such as the OECD and the UN to develop a consistent and effective tax framework for space activities, supporting the growth of global digital inclusion.
- Design tax strategies and partnerships that support the use of LEO satellite technology in expanding internet access in remote areas and developing countries, in line with sustainable development goals.

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