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SGAC SPACE LAW & POLICY GROUP
Commercial Space in Africa Sub-Group

**BEST PRACTICES FRAMEWORK FOR DEVELOPING SPACE
LEGISLATION IN AFRICA**

AUTHORS:

Jéssyka Nunes¹

Nifemi Awe²

Madeline Carlson³

Matthew Ramos⁴

Marie Vanolli⁵

Margaret Ahn⁶

Rodney Davis⁷

¹ Jéssyka Maria Nunes Galvão. Co-lead of the SGAC SLP Commercial Space in Africa. PHD in International Law (Federal University of Pernambuco- Brazil). Member of the Moon Village Association (MVA). Prospective Member of the International Institute of Space Law (IISL).

² Nifemi Awe. Co-lead of the SGAC SLP Commercial Space in Africa. LL.M Air & Space Law, McGill University, Montreal, Canada.

³ Madeline Carlson. Coordinator of Membership and Standards at the Aerospace Industries Association (AIA). Degree in International Affairs and Art History from George Washington University.

⁴ Matthew Ramos. B.Sc. Candidate in Aerospace Engineering, Minor in Engineering Management (University of Colorado Boulder).

⁵ Marie Vanolli. MSc Candidate in Public Policy & Management (University of Lausanne). Graduate in Political Economy (University of Oxford).

⁶ Margaret Ahn. Graduate in Legal Studies (New York University Abu Dhabi).

⁷ Rodney Davis. B.Sc. Candidate in Mechanical Engineering (Virginia Commonwealth University). Associate of Science degrees in Engineering- Piedmont Virginia Community College - Charlottesville, VA



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Project Overview

The main goal of this research is to develop a White Paper on Best practices framework/examples that can serve as a model for developing relevant space legislation in African countries lacking space legislation.

The project analyzes the cost-benefit analysis of commercial space activities, suggesting opportunities and an action plan for the development of legislation for the implementation of those activities in African States. Best practices for developing commercial space in Africa are also analyzed and suggested, based on the experience of countries outside Africa, as a way of contributing to the formulation of legislation on the space sector.

In the end, it is demonstrated the importance that the regulations drawn up by African countries follow the parameters already defined by the International Law, helping to ensure the cohesion of Space Law; but regulating according to their specificities and needs.



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Unveiling Potential: A Cost-Benefit Analysis of Commercial Space Activities in Africa

Introduction:

The vast African continent, with its diverse landscapes and rich cultural tapestry, has long been a cradle of innovation and untapped opportunities. Today, as we stand on the cusp of a new era in space exploration and technology, Africa emerges as a frontier brimming with immense potential for commercial space activities. In this section of the white paper, entitled, “Unveiling Potential: A Cost-Benefit Analysis of Commercial Space Activities in Africa”, we embark on a journey to uncover the captivating story of Africa's commercial space sector and conduct a comprehensive cost-benefit analysis that showcases the economic prospects and transformative power that lie beyond Earth's atmosphere from Africa's emerging economic prowess. Imagine a continent where satellite constellations illuminate the night sky, fostering connectivity and driving communication networks to previously unreachable corners of the planet. Picture a land where high-resolution Earth observation satellites assist in managing natural resources, tracking climate change, and ensuring sustainable development of countries that have never had that capability. Envision a future where indigenous launch capabilities propel African and international payloads into orbit, unlocking unprecedented access to space for scientific exploration, telecommunications, and beyond.

While the African space industry is still in its nascent stage, its current trajectory hints at remarkable possibilities. By scrutinizing the intricate interplay between the cost and benefit, this section seeks to unravel the economic fabric of commercial space activities. It delves deep into the financial investments required, while carefully illuminating the substantial returns that can be reaped both in monetary terms and the socio-economic progress of the continent. Beyond the allure of distant stars and the fascination with cosmic frontiers, the commercialization of space in Africa holds profound implications for its people, industries, and future generations. From job creation and skills development to enhancing agricultural productivity, from leapfrogging



SPACE GENERATION
ADVISORY COUNCIL

technological advancements to bolstering regional and global collaborations, the benefits are far-reaching and transformative. However, as we embark on this exploration of the cost-benefit landscape, we acknowledge the challenges that lie ahead. Complex regulatory frameworks, funding constraints, and the need for robust infrastructure are all significant hurdles. It is precisely through understanding these challenges and devising strategic solutions that we can unlock the immense potential that awaits in Africa.

The current challenges facing the burgeoning space economy in Africa is lack of dedicated infrastructure, educated workforce, government policy that rewards entrepreneurial activities, and partnerships with established space programs in the developed world (Sarah, 2013). A private space sector in Africa will open up a new paradigm shift on the African continent, opening a bridge to unifying the various scientific disciplines and endeavors.

On this voyage of discovery—a journey that transcends boundaries, embraces innovation, and charts a new course for Africa's future in the realm of commercial space. By conducting a rigorous cost-benefit analysis, we aim to provide valuable insights that empower policymakers, investors, and visionaries to seize the opportunities and navigate the challenges that lie ahead.

Economic Landscape of Africa

At the center of Africa's evolving space industry lies an economy that has shown a considerable amount of promise in the past couple of decades. However, in order to understand Africa's current economy, one must know its background. Currently, the population of Africa is expected to grow to 2.5 billion by 2050, giving the continent the youngest and fastest-growing population on the planet ready to tackle upcoming problems in the growing space sector. Accompanying this growth in population is a land of vast natural resources. The natural resources that lay within the continent alone make Africa one of the richest continents in the world. This combination of human potential and natural assets is an opportunity for many African countries to boost their slowing economies. Over the decades many factors have led to the slow-growing, stagnant, and declining economies that plague many African countries. The



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ADVISORY COUNCIL

political fragmentation that began circa 1960, following the independence of most African countries from colonial occupation, was detrimental to the continent's industrial growth. This fragmentation led to a segregated form of development, which created numerous small – competing – markets. This commonality between African countries ended up preventing regional cooperation. Eventually, most countries would end up producing more products than were needed in the market. The resulting effect would lead countries to develop an industrial excess. Combined with an ever-increasing population, many African countries saw their GDP decreasing at ever-increasing rates. In order to help combat poor economic performance, many African countries were forced to seek foreign aid. While this may have been a temporary solution for some countries, for most this aid would increase the country's debt, with little permanent effect on economic growth.

By the end of the 1970's decolonization was essentially complete throughout most African regions. However, the era of decolonization was a long and far from frictionless process. During the period of decolonization, most countries experienced some form of economic and industrial growth in each of their respective regions. Unfortunately little of this growth was due to a flourishing African economy. Instead, this growth came from the investment of the country's former colonizers. The investment into many African countries came in the form of bilateral loans from Western countries. These loans were often required to be spent on some form of export from the lending country. In many cases, this came in the form of building commercial projects or the purchase of military equipment. In the end, most commercial projects produced returns that were often insufficient to repay the debts at the agreed interest rates.

In 1980, inflation was at an all-time high across the globe leading many Western countries to not only raise their interest rates but also call in on their loans. This had economic implications on many African countries, which were further indebted since they were unable to repay their loans. However, since no single African country posed a threat to the international banking system, this accumulation of debt was allowed to go on. By the mid-1980's much of Africa's commercial debt was deemed to be unmanageable. Multilateral lending between African countries and various boards of investors was being used as an attempt to help restart an African



SPACE GENERATION
ADVISORY COUNCIL

economy; that at this point had become stagnant more than anything. Yet in the end, most of the money African countries received due to these efforts was spent paying off debts that had already grown unmanageable. Very little was left for investment in industrial and economic development. This would continue through the 1990s until Africa's commercial debt became so unmanageable that banks had no choice but to cut debt; allowing countries to restructure their debt stocks. The major economic difficulties that many African countries have faced since the beginning of decolonization can be attributed to mismanagement and misfortune. Since many African countries and regions had little internal markets, countries relied on the exports of their crops and natural resources. Yet the value of these commodities tends to fluctuate heavily, leaving many countries at the mercy of the trade value of their goods. Combined with inflexible economic planning that was based on the short-term revenue of their commodity, many plans for industrial growth stalled and failed.

In the past couple of decades, Africa's increase in GDP has averaged only around 1.1 percent a year. Sixty percent of the continent's population lives below the poverty line, hinting at its low economic potential. Nevertheless, there are some countries in Africa that have gained a fair share of economic success. The regional divisions and political fragmentation that initially defined Africa meant that there was no true "one Africa", at least from an economical standpoint. Instead, each spur of industrial growth had to rely on its own resources for success or failure. Yet those ventures that proved successful were often hidden by the economic problems of the continent as a whole. In the past two decades, more than ten countries such as Ethiopia, Ghana, and the Democratic Republic of Congo have actually surpassed the continent's average increase in GDP by a factor of four. These countries also happen to contain half of Africa's population. There is also an observation that industries in these countries are switching from mining and agriculture to service-oriented industries. Meanwhile, more than half of the African population still relies on agriculture and mining.

Increases in productivity, exports, urbanization, and investment all generated meaningful benefits for these midsized economies. These countries provide a good example of the potential to be achieved with changes in its economic landscape. Unfortunately, by only making up about



SPACE GENERATION
ADVISORY COUNCIL

25 percent of the continent's GDP, these nations can only do so much in helping Africa's economy. The three largest African economies (South Africa, Egypt, and Nigeria) have all slowed down in their economic growth. Combined with other countries, roughly 75% of the continent's GDP is made up of economies that are slowing down. Despite this, the success of many mid-sized African economies has led to the service sector becoming the main contributor to the continent's economic output. The shift to urbanization and service-oriented industries have shown that growth can be sustained. The current economic landscape is ripe for opportunities and the ever growing commercialization of the space sector in Africa. As Africa opens its borders to new economic powers, educated a growing skilled workforce, and new business opportunities presents itself, it is causing a shift in the economic resources. These new shifts are going to pose Africa to be in a position to extend well beyond the service oriented industry and into the private space sector. This new position will allow Africa to not only make major contributions to the launch industry but also to the communications and satellite industry.

However, the underlying cause of its limited impact on Africa's economy despite its promise, can be attributed to low productivity. Economies can only grow by so much before the productivity of its population must increase. For example, trade data on Africa indicates that intercontinental trade is more prevalent. Out of the \$438 billion dollars worth of African importation in 2021, only \$10 billion came from countries in the continent. Similarly, out of the \$371 billion dollars worth of African exportation in 2021 only \$17 billion went to African destinations (Undseth, 2020).

Potential drivers of Africa's commercial space sector:

In response to the pressing need for economic transformation, it is imperative that Africa seizes the opportunity to develop internal markets and foster collaboration between countries and regions. This approach can drive entrepreneurial initiatives and establish stronger ties with local governments, catalyzing a wave of innovation and growth. While the challenge of creating the necessary infrastructure is formidable, the benefits it promises make it a venture worth pursuing. These infrastructural projects would need to be of significant scale to accommodate the diverse



SPACE GENERATION
ADVISORY COUNCIL

sectors involved in cross-country and cross-region trade. This development would not only bolster Africa's economy but also amplify the productivity of the entire continent. Given the rapid pace of urbanization across many African nations, the current moment presents an opportune juncture to embark on this transformative journey.

International cooperation among African nations holds the key to the establishment of expansive internal infrastructures that can harness the full potential of the African Continental Free Trade Agreement (AfCFTA). The African continental fair trade agreement is a trade agreement among 54 of the 55 African Union member states. The goal is to create a single market for goods and services, facilitate the movement of people, and overall promote economic integration across the continent. This agreement was adopted in March 2018 in Kigali, Rwanda, and entered into action on January 1, 2021. The African Continental free trade agreement is in a position to be leveraged to plant the seeds of the commercialization of space in Africa with the many benefits and policies that it covers. Some of these policies which will help are included but not limited to collaborative research and development, technology transfer, common standards and regulations, infrastructure development, education and capacity building, incentives for private investment, space industry clusters, African space agency collaboration, and cross-border projects. Under these initiatives with AfCFTA, Africa will be able to develop the infrastructure necessary to help Africa be the leaders in the private space sector. The key components that the agreement will focus on are the training and education of skilled workers, the building of infrastructure, the deployment of technology, and eventually research and development of more competitive technologies. The initial seed funding for this project will have to come from a collaboration between many African countries and outside investment as the barrier to entry for entering the space economy is large but with ample cooperation and incentives, Africa can make it quite achievable and beneficial in the long-term while fulfilling short-term needs for continually growth (Way, Tyler, 2018).

As stated above, this endeavor requires audacious investments and skillful governmental management. The challenges are formidable, but the potential rewards are even greater. As



SPACE GENERATION
ADVISORY COUNCIL

Africa works toward building these internal markets, it can leverage its burgeoning population, the momentum of urbanization, abundant natural resources, and the creativity of its youth to position itself as a trailblazer in the emerging New Space sector. Technology will play a pivotal role in this transformation, supported by international collaboration and the education of the next generation. An illustrative example is the burgeoning space industry within the African economy, currently valued at \$19.49 billion – over half the total inter-African trade (Undseth, 2020). This burgeoning sector has been a catalyst for discussions addressing the roadblocks hindering Africa's economic advancement. Key topics at the recent NewSpace Conference include diversifying the African market toward critical infrastructure and investments, creating enabling policy frameworks for emerging technologies, and consolidating Africa's Earth observation market. All these discussions are steps toward the regional cooperation necessary for Africa's sustained economic growth. By capitalizing on these opportunities, Africa can shape its own destiny, bolstered by thriving internal markets, innovative policies, and the transformative power of a united continent. This multifaceted approach ensures that Africa's journey toward economic leadership in the New Space sector and beyond is one of both boldness and sustainability.

The supporting evidence presented in this section forms a robust foundation for the comprehensive assessment of the cost-benefit dynamics of commercial space activities in Africa. Drawing from a diverse range of reputable sources including governmental reports, academic research, and industry analyses, this evidence highlights the substantial advantages and opportunities that commercial space endeavors can bring to the African continent (Juma, C. et al, 2017). Notably, the African Union's 2019 study underscores the potential for the African space industry to create over 100,000 high-skilled jobs and generate revenue exceeding \$10 billion annually by 2030. Research from the African Development Bank further accentuates the economic benefits, demonstrating that each dollar invested in space programs can yield returns ranging from \$4 to \$20. Moreover, the United Nations Economic Commission for Africa's 2018 report emphasizes the transformative role of space technology in enhancing agricultural productivity, potentially increasing crop yields by up to 30% and addressing food security concerns. These findings are substantiated by case studies such as Nigeria's satellite-based



SPACE GENERATION
ADVISORY COUNCIL

precision agriculture initiatives and the positive outcomes witnessed in terms of increased crop yields and farmer income (Ferreira, J., 2023).

Additionally, space activities are instrumental in natural resource management and environmental conservation, as highlighted by the African Union, with evidence from the African Space Agency's successful applications in disaster identification and response. Case studies from Kenya and Rwanda provide tangible evidence of these improvements across various sectors. Lastly, the existence of international agreements and partnerships with esteemed space agencies underscores Africa's global potential in the space sector. The African Union's "Space for Africa Strategy 2024-2030" outlines a roadmap for enhanced cooperation and collaboration, emphasizing the mutual benefits of such partnerships. In subsequent sections of this white paper, we will conduct a detailed analysis of the cost-benefit dynamics, while addressing potential challenges and presenting policy recommendations that leverage this wealth of information to unlock the full potential of commercial space activities in Africa.

Implementation and Action Plan:

The action plan below, strategically outlines harnessing the potential of commercial space activities in Africa for economic growth, agricultural transformation, natural resource management, digital connectivity, and international collaboration, as substantiated by the supporting evidence. Given the above information, it is best to lay the foundation in steps so that the process is sustainable and consistent. The current action plan involves developing the infrastructure, educated workforce to maintain the infrastructure, and the implementation of an economically viable system that would lead to Africa's prosperity in the private space sector closing the gap of equality (Ferreira, J., 2023).



SPACE GENERATION
ADVISORY COUNCIL

Establish a Coordinating Body for Space Activities:

Action: Form an African Space Coordination Committee comprising representatives from relevant government agencies, research institutions, and industry stakeholders.

Timeline: Within the first six months.

Investment and Infrastructure Development:

Action: Allocate funding for space infrastructure development, including satellite systems, ground stations, and research facilities.

Timeline: Over the next five years.

Educational and Workforce Development:

Action: Foster partnerships with universities and training centers to create space technology-focused educational programs.

Timeline: Start within one year, with ongoing initiatives.

Promote Agricultural Transformation:

Action: Develop a National Space for Agriculture Program to integrate satellite technology for precision farming and data-driven agricultural practices.

Timeline: Initiate within the first year, with continuous expansion.

Enhance Disaster Management and Resource Conservation:

Action: Strengthen collaboration with the African Space Agency and other international partners to enhance satellite-based disaster monitoring and natural resource management.

Timeline: Immediate, with continuous improvement.



Digital Connectivity and Inclusivity:

Action: Invest in satellite-based broadband infrastructure to extend internet access to underserved regions.

Timeline: Initiate within the first year, with a phased rollout.

International Collaboration and Partnerships:

Action: Actively engage in existing agreements and explore new partnerships with renowned space agencies, promoting knowledge exchange and collaborative missions.

Timeline: Ongoing with continuous exploration.

Policy and Regulatory Framework:

Action: Develop a comprehensive space policy framework that includes licensing, regulations, and intellectual property rights to encourage private sector involvement.

Timeline: Within two years.

Monitoring and Evaluation:

Action: Establish a dedicated monitoring and evaluation system to assess the impact of space activities on the economy, agriculture, and other sectors.

Timeline: Begin within the first year, with periodic assessments.

Public Awareness and Outreach:

Action: Launch a public awareness campaign to inform citizens about the benefits of space activities and foster support for the initiatives.

Timeline: Start immediately and continue as an ongoing effort.



Review and Adaptation:

Action: Periodically review and adapt the implementation plan based on progress, challenges, and evolving technologies and opportunities.

Timeline: Ongoing, with regular assessments every two years.

Collaboration with Regional Bodies:

Action: Collaborate with regional economic communities (e.g., ECOWAS, SADC) to align space activities with broader regional development agendas.

Timeline: Ongoing engagement.

Investment Attraction:

Action: Create incentives and mechanisms to attract private sector investment in space-related startups and businesses.

Timeline: Start within the first year, with continuous promotion.

This implementation and action plan outlines a comprehensive roadmap for harnessing the potential of commercial space activities in Africa. It encompasses strategic initiatives aimed at maximum economic development of the commercialization of Space activities in Africa.



SPACE GENERATION
ADVISORY COUNCIL

Conclusion:

In "Unveiling Potential: A Cost-Benefit Analysis of Commercial Space Activities in Africa," we have explored the compelling case for leveraging the vast opportunities offered by the space sector across the African continent. Supported by a wealth of evidence from government reports, academic research, and industry analyses, this white paper has demonstrated that the benefits of commercial space activities extend far beyond the realm of technology and exploration. The potential to generate high-skilled jobs, stimulate economic growth, enhance agricultural productivity, improve resource management, bridge the digital divide, and foster international collaboration is undeniable. As Africa embarks on this transformative journey into the space age, our implementation and action plan provides a strategic roadmap to maximize the positive impacts of space activities. It emphasizes the importance of coordination, investment, education, and regulatory frameworks to ensure that the benefits are accessible to all and that the continent's development is both sustainable and inclusive (Mlisa, A. et al., 2022). The evidence presented in this white paper leaves no doubt that space activities are not just a technological aspiration but a tangible driver of socioeconomic progress.

As African nations rise to embrace the opportunities of the cosmos, we are poised to unleash the continent's full potential and pave the way for a brighter and more prosperous future. Through collaboration, innovation, and a steadfast commitment to harnessing the benefits of commercial space activities, Africa stands ready to unveil its boundless potential on the global stage. Furthermore, this analysis highlights the pivotal role that the African space sector can play in enhancing the continent's international influence. By actively engaging in collaborative ventures with established space agencies, such as NASA, ESA, and the Russian Space Agency, Africa not only gains access to advanced space technology but also positions itself as a valuable partner in the global space community (Mjawara, P. et al., 2019).



SPACE GENERATION
ADVISORY COUNCIL

These partnerships not only facilitate knowledge exchange and technology transfer but also open doors to joint missions, research initiatives, and shared goals in space exploration. Africa's participation on the global space stage is not just an aspiration but a tangible demonstration of its capability to contribute to cutting-edge science, innovation, and technological advancement, further elevating the continent's status on the world stage.

In conclusion, "Unveiling Potential" signifies more than just the integration of space technology into Africa's socio economic fabric. It represents a vision for sustainable development that prioritizes inclusive growth, environmental conservation, and technological empowerment. As we look forward to the future, it is clear that the benefits of commercial space activities in Africa extend far beyond economic considerations. They encompass a broader vision of progress that encompasses improved living standards, enhanced environmental stewardship, and greater connectivity both within the continent and with the wider world. This white paper underscores the potential for Africa to not only reap the rewards of space activities but also to champion a new era of sustainable, inclusive, and innovative development that resonates with the aspirations of its people and the global community. In embracing the cosmos, Africa unveils not only its potential but also its commitment to a brighter, more equitable future for all.



SPACE GENERATION
ADVISORY COUNCIL

Best practices for developing commercial space in Africa: recommendations based on the experience of countries outside Africa

Introduction

The development of the commercial space sector is a recent phenomenon that has gained considerable momentum, particularly in the last decade. For the countries concerned, there are many advantages to this development: economic development, greater accessibility to space, increased innovation and terrestrial applications of space technologies, etc.

Governments have an important role to play in the development of this sector by adopting appropriate policies. As Lisk and De Zwart highlight, “there is no argument that regulatory regimes can deleteriously impact on the commercial efficacy of an industry” (Lisk and De Zwart, 2019, p.455). In this context, it is necessary for countries wishing to encourage the development of a commercial space sector to audit and adapt their legislative framework so that it evolves towards a model favorable to the development of the commercial space sector.

African countries wishing to promote the commercial development of the space sector are no exception. This essay will therefore aim to reference a list of recommendations based on a set of legislative best practices found outside the African continent and for which research is available. With the aim of enabling African countries to take advantage of their common institutions, existing collaboration platforms, their differentiated resources and the size and specificities of the continent, this text will also aim to highlight the various opportunities for continental collaboration offered by these legislative adaptations.



SPACE GENERATION
ADVISORY COUNCIL

Theoretical context

Adopting a national legislative framework: general characteristics

The adoption of effective legislation to foster the development of the commercial space sector requires a targeted approach that addresses the specificities of each of the sector's branches. However, several general characteristics common to all sectors should be highlighted.

Whatever the area it targets, legislation must be clear, transparent, and stable. These factors are instrumental in creating an atmosphere of predictability, which is crucial in attracting investment into this industry, which generally takes some time to become profitable (Din Subari and Hassan, 2014).

In addition, the space legislation must protect a number of national interests. It should always guarantee the promotion of safety and the protection of citizens, the territory, property and the environment against any harm (Dempsey, 2016). The need to comply with international law and the country's resulting obligations is also a requirement specifically mentioned in the spatial legal framework of a wide range of countries (Dempsey, 2016). Some states also choose to offer a clear protection to the financial health of the national treasury, and this choice might be particularly relevant for developing countries (Dempsey, 2016).

From a theoretical point of view, Munsami (2014) summarises that the main general actions to be taken to develop the commercial space include at least some of the following steps : Improvement of coordination ; Promotion of capacity building ; Fostering research and development ; Creation of a supportive regulatory environment ; Promotion of a competitive domestic space sector ; Promotion of space awareness. With regard to the legal part specifically and the environment that can enable the development of a commercial space sector by attracting entrepreneurs, Smith et al. (2023) note that, from the point of view of companies, the elements taken into consideration include : simplicity of establishing the company, obtaining the needed series of approvals, permits and licences, filing certificates of incorporation, fulfilling minimum capital requirements, and completing all essential notifications and verifications.



SPACE GENERATION
ADVISORY COUNCIL

Leveraging continental infrastructures to complement national efforts: the case for cooperation among African countries

Developing a commercial space sector in Africa is both a necessity and a major opportunity for cooperation between the continent's countries. As Dempsey (2016, p.44) points out, “the global nature of the field makes it difficult for any single nation to regulate the industry alone”. In addition, regional space cooperation is an effective way of increasing the participation of emerging space nations in the international regulatory process for the sector. Dennerley (2016, p.30) stresses that “this will inevitably lead to these States having some influence over the direction in which space law develops”, enabling the creation of a legislative framework better adapted to African issues and to the development of the continent’s own commercial sector. Finally, it should also be noted that intensified collaboration between the countries of the African continent could help to create an 'internal' market that is large enough and generates sufficient demand for space products and services to attract entrepreneurs and investors (Liu et al., 2019). This essay will explore these different opportunities for collaboration and will propose some specific measures for this cross-country dimension in the section below.

Recommendations

1. Adopt a space policy law

General considerations

The adoption of a space policy is recognized as a major factor in the development of a commercial space sector (Hassan and Subari, 2021; Din Subari and Hassan, 2014). A space policy meets several needs of the commercial space sector. Firstly, it provides a degree of clarity regarding the conduct of space-related business activities, which is necessary for the industry's proper development (Nagendra and Basu, 2016; Liu et al., 2019). A space policy also brings together under one roof the legislative acts that are directly relevant to commercial space, making it easier for entrepreneurs to navigate the legislative framework with which they have to



SPACE GENERATION
ADVISORY COUNCIL

comply and thus facilitating their activities (Liu et al., 2019). A space policy also highlights government support for industry, which is an important element in the development of a commercial space sector (Hassan and Subari, 2021). Furthermore, a space policy is the place where the State can recognize the value of commercial space to the country, which can open the door to interpreting other legislation in the light of that value and thus remove some legislative barriers.

The space legal regime of a country sets the objectives and direction of the development of the commercial space sector, enabling a clear prioritisation of actions and the adoption of a development timeline tailored to the country's existing resources, potential opportunities and national interests (Ferreira et al., 2023). From the point of view of demand, this selection by space policy can also be an instrumental tool in building a strong and sustainable space sector. Indeed, it is through space policy that a state can decide to prioritise certain branches of the industry to speed its development. In China, industrial business-oriented applications are favored over experimental and scientific applications (Liu et al., 2019). In the case of Africa, it would be more beneficial to prioritize sectors that have a direct interest in solving problems specific to the continent. This would ensure that entrepreneurs have a certain demand for their services, which could fuel the development of the industry.

A space policy also sets a framework that allows the sector to develop within the limits of what the State can endorse. An interesting example of this framework is the "rule of three" applied in the United States which, as Goehring (2022) explained, an ideal commercial space regulatory environment satisfies three main policy objectives to promote industry growth, satisfy international obligations, and preserve national security. The law deciding on space policy can also be the place where certain terms in the space sector are defined, making it possible to differentiate between certain devices, systems or activities and then to legislate in a differentiated and separate way on each of these subjects (Hancock, 2005). Mitigating risks by establishing such a framework can also help to avoid weaponization, technology theft or any other risk to the State and its ability to gain the confidence of other States to authorise the international collaborations that will enable the commercial space sector to develop.



SPACE GENERATION
ADVISORY COUNCIL

Creation of a national space agency

A space policy can help to meet the need for coordination, the lack of which can “[reduce] the impact of space activities amidst duplication and the blurring of roles and responsibilities among various stakeholders and institutions” (Munsami, 2014, p.116). Space policy can respond to this need by deciding, for example, to create a national space agency that supports, promotes, and grows the industry through various activities. In India and South Africa, there are separate state agencies dedicated solely to coordinating the commercial space sector and managing its needs (Shabbir et al., 2021).

Granting of access to state space infrastructures

Finally, in a space policy, the question of granting access to state space infrastructures - whether civil or military - to private entities is an important question that can enable private companies to take advantage of existing resources, thereby encouraging accelerated development of the sector. In China (Liu et al., 2019), companies active in commercial space have access to these public infrastructures (supply chains, launch sites, etc.). It can be suggested that this access, if granted, may also involve other resources, such as state-trained space human resources.

Opportunities for continental cooperation: the African Space Agency and other tools

All the measures mentioned and described above are intended to be taken as part of the definition of a national space policy. However, they can also be applied, or even simply transferred to the continental level. A country could, indeed, decide to take advantage of the recent creation of the African Space Agency to coordinate its national space policy with the objectives of the broader African continent, or even transfer some of its competencies in terms of defining space policy directly to the continental institution. The latter possibility would require an adaptation of the legislative framework to allow the delegation of space policy powers (general and/or commercial) to this continental entity. Alternatively, countries wishing to retain more direct control over their space policy cooperation can collaborate via multilateral treaties,



SPACE GENERATION
ADVISORY COUNCIL

existing cooperation platforms or the use of soft law to move towards standardization of practices at the African level (Dennerley, 2016).

2. Adopt intellectual property and patent law

Offering adequate protection adapted to the long cycles of the space sector

One of the main characteristics of the commercial space sector is the long time it takes for the technology developed to become profitable, and the large amount of investment it requires. As Smith et al. (2023) summarize, breaking even is a long process. Due to these market-specific factors, equity fundraising becomes necessary to secure funds and resources for managing important tasks like product and business development, technological advancement, hiring and retaining staff, and other tasks that are essential for start-ups to advance and reach market-entry and profitability. This means that the patent law of a country interested in developing a commercial space sector must be adapted to these development cycles and offer adequate protection, long enough to allow technologies to reach the break-even point and protective enough to allow private actors to confidently invest in R&D activities. This additional protection, over and above the standard provisions of the Patent Cooperation Treaty (PCT), can take the form of patent extensions based on the model already existing for certain industries (particularly pharmaceuticals) in certain countries. It is to be complemented by a strong and reliable judicial system to effectively protect the registered technology. Actual access to patents, which includes elements such as the simplicity of the application procedure, low cost and speed of processing, can also help to encourage private players to file their patents in the country and develop their technology there.

An opportunity for continental cooperation

Above all, the adaptation of the intellectual property and patent law offers African countries a major opportunity for collaboration. The time and economic burden on private companies wishing to file a patent in a given country can be reduced by pooling and standardizing the system for granting and protecting patents between African countries (Malmen,



SPACE GENERATION
ADVISORY COUNCIL

2021). Other ideas for ensuring respect for space patents registered in other African countries (prohibition of profits derived from the use of a technology that infringes the patents of one of the member countries; reciprocity systems; etc.) could be explored via a multilateral treaty or via the African Space Agency (Malmen, 2021).

3. Create an efficient, lightweight and safe licensing system

An increasing number of nations decide to regulate the commercial space sector by introducing a licensing system (Dempsey, 2016). Such a licensing system is necessary for a number of reasons, the majority of which relate to the protection of a public interest. Issuing licences enables the State to have an overview of the major space developments taking place on its territory and, as Dempsey (2016, p.19) highlights it, “governmental oversight of space activities is essential to protect public safety, property, and the environment, and to fulfill State obligations under international law”. But these licences may also be necessary since they act as a facilitator for the development of a commercial space sector, as expressed by certain entrepreneurs in China who explained that the absence of regulations hindered their commercial activity and growth (Liu et al., 2019).

Generally speaking, there are several types of licence: they can cover launches within the country, launches by citizens in another country, and they can be valid for a single launch or for a period of several years. Each type of licence protects a different public interest, but can consequently add an additional burden to companies (particularly when licences have to be renewed regularly, for example for each launch). To obtain a licence, companies must in most cases (Dempsey, 2016) prove that their technology works, that it will not endanger the territory, inhabitants or environment of the State, that it complies with international requirements and that it will not cause diplomatic harm to the State.

However, despite the advantages it offers to the State and, to a certain extent, to entrepreneurs, this licensing system involves aspects that may slow down the development of the space sector by creating a number of barriers for companies active in the field. One of these barriers is the time it takes to apply for these procedures: entrepreneurs have to provide a large



SPACE GENERATION
ADVISORY COUNCIL

amount of information and documents, which takes time, which translates into a certain cost (Lisk and de Zwart, 2019). In addition, there is sometimes a procedural fee – it is for example the case in Australia, which can add to the financial burden (Lisk and de Zwart, 2019) of this industry that already struggle with profitability in the early years of companies. The higher the real costs of accessing a licence, the less likely it is that SMEs will be able to apply for a licence to test their technologies. The development of a commercial space sector *de facto* includes a large number of medium-sized companies, particularly at the start of the process. Thus, this financial barrier can prevent the development of a commercial space sector. Another barrier is the potential administrative complexity of these procedures, which can add to the burden on companies (Lisk and de Zwart, 2019) and thus slow down the development of the commercial space sector.

To mitigate these burdens and give the commercial sector some room to manoeuvre, some countries, such as the United States, have created a system of lighter "experimental licences" that allow technologies to be tested without having to invest as much time and money in an administrative procedure (Hancock, 2005).

In summary, it is therefore important that a licensing system exists to protect a number of public interests. However, these licences should be as business-friendly as possible by being reasonably light and inexpensive. In addition, the requirements for obtaining a licence should be as clear as possible.

4. Limit the liability of governments and companies

Under Article 5 of the Outer Space Treaty, states are liable for the actions of the operators, which is why a significant number of them use the legislative framework to transfer their responsibility to private companies wishing to carry out their space activities from national territory (Dempsey, 2016; Lisk and de Zwart, 2019). This avoids imposing a burden on public finances in the event of a costly incident, and can be a particularly attractive mechanism for developing countries with fewer financial resources. However, as Lisk and de Zwart (2019, p.459) emphasise, “the imposition on launch operators of unlimited liability is neither



commercially tenable nor desirable from a competitive standpoint ». This is why commercial operators can turn to insurance. Some states make it compulsory for private companies to be insured, sometimes with extremely high caps (Lisk and de Zwart, 2019). However, in most cases, these insurance requirements have been seen as a brake on the development of commercial space activities (Lisk and de Zwart, 2019). This is why, in this area, governments need to strike the right balance between protecting public finances and developing commercial space. In addition, whatever the amount of the cap, it must be clearly announced to enable contractors to budget and plan (Lisk and de Zwart, 2019).

5. Work on export control systems

It is necessary to work on export control systems to facilitate the growth of the commercial space sector in a country. Access to foreign technologies is often subject to restrictions. However, “companies/countries that aim at moving toward already developed industrial fields may acquire valuable knowledge from the access to foreign technology sources, especially in the first stages of the process” (López et al., 2018, p.55) and “the strategy of making collaborative efforts with space superpowers has been used by almost all the countries to gain access to advanced technologies and build up capabilities” (Shabbir et al., 2021, p.7). For example, in 2019, the United States restricted space technology exports to China. As a result, Chinese companies were unable to access the latest space technologies or potential customers for these technologies (Liu et al., 2019).

These export restrictions are sometimes adopted for security reasons or out of fear that the technology will be stolen. To encourage the lifting of these export bans, which prevent the transfer of technology, governments can modify their legislative framework to gain greater international confidence by providing a series of guarantees in terms of security, non-militarisation of technology and protection of technology. Again with the aim of strengthening confidence, governments can also introduce sanctions for non-compliance with laws that guarantee the security and integrity of technologies. Finally, it should be noted that a



SPACE GENERATION
ADVISORY COUNCIL

degree of political and institutional stability in the State is an important factor in the development of confidence in the State and its system.

As Smith et al. (2023) suggest, lawmakers and policymakers could need to do more than just update the export control categories on the lists that are already in place; they might even need to establish a brand-new category that would safeguard and promote technological advancements in the NewSpace sector.

6. Facilitating investment

Since the commercial space industry is capital-intensive, its development requires substantial financing. This can be provided in particular by foreign venture capital. This means of financing not only provides substantial amounts of financial resources, but also brings “access to additional resources like connections to other space companies that are also funded by the same VC, knowledge about the regulations and laws, etc. of the country in which the VC is based in [which would be helpful for a company wishing to enter that foreign market]” (Liu et al., 2019, p.79). But to attract this venture capital, a strong legal framework that protects investor rights and allows for efficient, low cost contract enforcement is needed (Smith et al., 2023).

Another crucial source of funding to help bring products to market is asset-based financing. However, the effectiveness and affordability of asset-based financing for space assets depend on creditors' faith that, in the event of a debtor's insolvency, their security rights in an asset will be enforced (Smith et al., 2023). In order to address this issue, the Space Protocol of the Cape Town Convention grants creditors recognized property rights over the debtor's collateral, even in jurisdictions where domestic law regulations may not establish such rights. These rights are applicable in all treaty contracting states and provide a strong international legal framework for the protection of creditors' rights (Smith et al., 2023). Signing this protocol could therefore be an effective way of enabling asset-based financing, thereby removing one of the financial barriers to the development of the commercial space industry.



SPACE GENERATION
ADVISORY COUNCIL

7. Add measures specifically aimed at the commercial space sector to general economic promotion policy

To encourage the development of a commercial space sector, the State may also decide to amend its economic promotion policies to adapt them to the space sector in particular. Thus, the State can offer a wide variety of tax exemptions, tax incentives, zoning, rewards, credits, grants and exemptions to accelerate the development of the commercial space sector (Blasingame, 2010).

Generally speaking, in order to take an interest in a market, an entrepreneur must be able to perceive a potential for profit, or a particular demand (Carter and Pezeshkan, 2023). Another way of promoting the economy could therefore be to create a certain demand or guarantee a certain profit. This can be done by authorising the State, within the legislative framework, to place orders or create public-private partnerships for certain space services, by extending the period of patent protection to guarantee a longer period of protected profit, or by choosing in space policy to prioritise areas where, because of the country's specific characteristics, the expected demand will be strong.

It could also mean direct state investment in the growth of the industry by amending and restructuring funding laws and state budgets to allow a sum to be allocated to efforts to develop the commercial space industry.

In the area of funding, there are opportunities for continental cooperation that African countries could leverage. The development of space projects, a particularly capital-intensive sector in many cases, requires significant availability of funding. Offering access to public funding to cover part of these needs can support the development of a commercial space industry. However, it is not necessarily possible or desirable for some countries to make such an amount of funding available to the space sector. Collaboration at the continental level (via the African Space Agency, for example, or via other institutions such as the African Development Bank or the African Development Fund) to propose joint – and more substantial – funding could therefore appear to be an interesting avenue to explore.



SPACE GENERATION
ADVISORY COUNCIL

8. Encourage the development of infrastructure and the training/education system to build local capacity

The development of a commercial space sector requires the presence of efficient transport and energy infrastructures on which companies can rely (Ferreira et al., 2023).

To develop a sustainable industry that can sustain itself and work in a context where many technologies are unavailable due to export control restrictions, a country must also be able to build its local capacity (Subari and Hassan, 2021).

To do so, it is needed to improve the higher education and professional training system to produce a skilled workforce. However, as Froehlich and Siebrits (2019) note, the African average for the current quality of basic STEM education is low. In addition, the content of the curricula seems, on average, to be poorly adapted to the needs of industry (Froehlich and Siebrits, 2019). It should be noted, however, that the creation of a space hub by the Pan-African University and the opportunities for potential collaboration between this institution and the United States and the European Union give hope for the future of African space-related higher education (Froehlich and Siebrits, 2019).

It is also needed to invest in academia to give industry easier access to the latest scientific developments, and it is needed to encourage the creation of networks that connect all the players needed to develop a commercial space industry. As López et al. (2018, p.56) summarise, a country needs “efficient systems for creating, disseminating, and sharing knowledge”.

In order to be implemented, these fundamental measures require the amendment of a whole series of laws from various legislative areas, which are highly dependent on the organization chosen by the country for its education scheme, its infrastructure management system, etc.



SPACE GENERATION
ADVISORY COUNCIL

9. Further opportunities for continental cooperation

Harmonizing standards

As Dennerley (2016, p.29) notes, “the establishment of global regulatory and trade regimes, and the setting of international technical standards, will become integral to the evolution of the global space business”. Thus, it may seem necessary for African countries to develop this type of standard to develop their commercial space sector, but also to join forces to harmonize these standards at the continental level and thus enable wider development of the commercial sector.

Creating a common market

Finally, it should be noted that effective cooperation between the countries of the African continent can help to broaden the scope of economic opportunities for the private sector, thereby encouraging these private players to develop their activities in Africa and attract substantial investments. Thus, if African countries - or at least African spacefaring nations - agree to create some form of integrated or even common market for space-related products and services, this can drastically increase the size of the 'domestic' market, which is an important force for the development of a commercial space sector (Liu et al., 2019).

Conclusion

In conclusion, the main recommendations for the development of a commercial space sector in African countries are the adoption of a space policy, the adaptation of patent and intellectual property law, the creation of an efficient, light and secure licensing system, the limitation of liability for governments and companies, the adaptation of export control systems, the facilitation of investment, the inclusion of measures targeted at the space sector in general economic promotion, and the encouragement of the development of infrastructure and the training system.



SPACE GENERATION
ADVISORY COUNCIL

Although these recommendations have been designed and presented in isolation from each other to facilitate their identification and implementation process in African countries that have varying current capacities, it is important to bear in mind that they function as a network. In fact, they each constitute an essential – in some cases mandatory – part of a set of framework conditions enabling the creation and flourishing of a commercial space sector. It is therefore critical to conceive this list as a package on which to work continuously over the medium term.

This essay also sought to identify various opportunities for cooperation between African countries in implementing these legislative changes. At a continental level, the opportunities highlighted concern the mutual recognition and protection of patents, the harmonization of standards, the creation of a common market, and the development of shared funding mechanisms.



SPACE GENERATION
ADVISORY COUNCIL

Current International and Regional Instruments to Support African Countries in Developing Relevant Space Legislation

African participation dates back to the beginning of the international concern about space exploration, such as the participation, as an original member of the UNCOPUOS, of the United Arab Republic (now Egypt), in 1958; or of Chad, Morocco and Sierra Leone, in 1961; also of Kenya, Nigeria and Sudan, in 1973, and over the years the list has grown.

African States are also signatories of some of the main international treaties on space, such as the Outer Space Treaty of 1967, which has as signatories: Algeria, Angola, Egypt, Ghana, Kenya, Libya, Morocco, Nigeria, Senegal, South Africa and Sudan. Also, some African countries are signatories of the Treaty on International Liability for Damage Caused by Space Objects (1972), such as: Algeria, Egypt, Ghana, Nigeria and South Africa. These same countries signed the Convention on Registration of Objects Launched into Outer Space (1974).

Despite not having the full participation of all African countries in the main international discussions on space, there is a continuous and increasingly growing inclusion of African nations in the space sector. Such direction gives voice to the countries that may be most harmed by the commercialization resulting from space exploration. Many African states are the largest exporters in the world in the mining sector, something that can be directly affected by the commercialization of ores coming from the moon or asteroids. The institution of a space commerce should be discussed by African countries as the most interested in the regulation of such activities.

Therefore, the importance of inserting African countries in international discussions, in UNCOPUOS, and as signatories of the main international space agreements is relevant to guarantee the participation of some of the main players in the mining sector, among other activities that will be directly affected by space exploration.



SPACE GENERATION
ADVISORY COUNCIL

The discussion on the scope of international regulation also permeates soft law mechanisms, such as the Artemis Accords, which represent a set of principles, initiated by the American Space Agency (NASA), which aim to establish an international consensus for the future commercial exploration of space. Currently, few African states participate in this initiative, such as Rwanda and Nigeria. The perspective that such Accords will direct future space exploration must be taken into account, therefore it is relevant to guarantee the presence of African nations at the discussion table. Still, it must be ensured that African participation is not only symbolic, it is necessary to guarantee an effective voice, especially regarding relevant issues in the future, such as the sharing of benefits with nations that are not yet developed in the space sector.

African countries should be seen as directly interested in the regulation and results of space exploration, such as the benefit sharing. The contribution of the expertise of African nations regarding the regulation of the mining sector, as well as its advantages and disadvantages (such as the environmental issue) is vital for the creation of regulations.

Regional Instruments

International and regional norms provide inspiration for national norms, helping to delimit general and principled matters, in addition to concepts already established in these scenarios. International and regional norms establish rules already accepted by several countries and many are even guaranteed as international custom, such as the Space Treaty of 1967.

Thus, even if a certain African State is not a signatory to the Space Treaty, it must comply with such regulations, since they have been validated by the international community in the customary format. However, even norms that have not yet become an international custom have the power to influence national rules, since they generate political and economic pressure, because there is a respect for such norms already accepted by several countries.

Therefore, in a context of best practices, it is recommended that African countries seek to respect established international and regional regulations, in order not to create friction or



damage in terms of international funding and partnerships between space agencies. The national norm to be created must aim at a balance between international, regional and local governance, regulating the national scope in a harmonious way with the rules already accepted internationally and regionally. At the same time, it is important to guarantee the participation of African countries in the main forums for discussion and regulation, guaranteeing actually harmonic and equitable standards.



SPACE GENERATION
ADVISORY COUNCIL

Conclusion

This research took a three-part approach to exploring and highlighting best practices framework for developing space legislation in Africa.

The first part of this research delved into a cost-benefit analysis of commercial space activities in Africa highlighting Africa's economic landscape and potential drivers of Africa's commercial space sector.

The research explored the compelling case for leveraging the vast opportunities offered by the space sector across the African continent. The research further draws up an implementation and action plan that provides a strategic roadmap emphasizing the role of coordination, investment, education and regulatory frameworks to maximize the positive impacts of space activities as Africa embarks on its transformative journey into the space age.

The research further explores best practices for space commercialization in Africa drawing recommendations on the experience of key space actors. By exploring the general characteristics for adopting a national legislative framework, this research expounded the case for cooperation among African countries in leveraging the African Space Agency as a channel for building continental cooperation and infrastructure to complement national efforts.

On recommendations for a sustainable space regulatory framework for African countries, this research examined the adoption of intellectual property and patent laws for adequate protection adapted to the long cycles of the space sector. In addition, the research recommends the creation of an efficient and safe licensing system with a well-rounded framework for export controls and the promotion of investment in the African space sector for the socioeconomic development of the African Continent.

The last part of this research examines current international and regional instruments to support African countries in developing relevant and sustainable space legislation that promotes economic development, indigenous capacity building and cooperation for harnessing the benefits of space exploration and space technologies for Africa's development.

Through collaboration, innovation, and a steadfast commitment to harnessing the benefits of commercial space activities, Africa stands ready to unveil its boundless potential globally.



SPACE GENERATION
ADVISORY COUNCIL

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