

BRIDGING THE GAP OF SPACE INFRASTRUCTURAL DEFICIT IN AFRICA THROUGH PRIVATE FINANCE INITIATIVES

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ABSTRACT

Private Finance Initiative (PFI) or Public Private Partnership (PPP) as it is known in some countries has become the 'silver bullet' with which governments across the globe solve their infrastructural deficit. In Africa, the space expenditure has risen to over USD 400 Million in the last decades despite the availability of a handful of indigenous space agencies developing their own space capacity within the region. However, looking forward to the future 5-10 years, the African region through its existing indigenous space agencies as well as the African Space Agency which was recently approved to be hosted in Egypt could be addressing issues ranging from telemedicine, agriculture, telecommunication, disaster management/monitoring, security and climate change with possible investments of almost USD 5 Billion or more. This raises an important question - does the existing indigenous space agencies in Africa have the infrastructural capacity to tackle these issues and or will the proposed African Space Agency meet up the infrastructural requirement of such a space growth? What are the impediments to a fully operational Africa Space System? What are the direct benefits of PFI's to emerging space states and developing nations? This paper sought to answer these questions in two phases; The first phase developed an understanding of space infrastructure deficit within the African continent by examining space assets in Egypt, Nigeria and South Africa. The second phase determined the suitability of PFI's in order to improve space assets in those African countries mentioned while considering same from a policy perspective. The doctrinal method of research was adopted in which books, journals, articles and internet sourced materials were used. The finding of this paper which includes amongst others; the urgent need to develop a comprehensive work plan for Private Finance Initiative in the Africa Space Sector to make investments more beneficial and lucrative to both the private sector and the indigenous space agencies. It was also proposed and recommended that all the emerging space states in Africa should develop their own policy framework for PFI's while taking into consideration the region's collective interest for space development within the purview of the AU Agenda 2063.

i. INTRODUCTION

Globally, Private Finance Initiative (PFI) projects are fast becoming the cornerstone for the development of small- and large-scale infrastructures in various sectors of the economy. The recent African Development Bank (AfDB) indications, sets the continent's infrastructural need to a range of about \$130 - \$170 billion annually with a financial gap of \$68 -108 billion.¹ Despite having this mammoth of infrastructural needs - lack of funding has and would still be a significant problem for the African Space Industry.²

Private Finance Initiative is totally not a new concept in space infrastructural development, as one of the great examples of PFI model that is currently working in space is the ISS U.S. National Laboratory which has stewarded more than 200 ISS research projects, ranging from drug therapies, to monitoring of cyclones and the production of fibre-optics materials in outer space since 2011.³ Although, over the last couple of decades, most of the key players in the African Space Sector have majorly focused on building infrastructure capacity in Earth

¹ African Development Bank, 2018. "*Africa's Infrastructure: Great Potential but Little Impact on Inclusive Growth*". P. 63, available at [http://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/2018AEO/African Economic Outlook 2018 - EN_Chapter3.pdf&ved=2ahUKEwjx4KzF78jkAhVIdcAKHVkpDjIQFjAAegQIAxAB&usg=AOvVaw2FPIXQDNgtMiaekLC8s_wf](http://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/2018AEO/African_Economic_Outlook_2018_-_EN_Chapter3.pdf&ved=2ahUKEwjx4KzF78jkAhVIdcAKHVkpDjIQFjAAegQIAxAB&usg=AOvVaw2FPIXQDNgtMiaekLC8s_wf) (Retrieved on 15/9/19).

² Oniosun T.I., "*The Space Industry in Africa: From an IGNITE Talk Given at the Sixth Space Generation Advisory Council Fusion Forum*". Available at <http://satmagazine.com/story.php?number=2053010540> (Retrieved on 15/9/19).

³ ISS National Lab, "Public-Private Partnership in Space". Available at <http://www.issnationallab.org/research-on-the-iss/public-private-partnerships-in-space/> (Retrieved on 15/9/19).

Observation, Satellite Communications, Remote Sensing and Astronomy with their national governments as the major financiers despite having huge budgetary constraint with little priority given to the space sectors amongst other national pressing needs.

This article seeks to (1) provide a fundamental understanding of the African Space Sector thereby examining space assets amongst the major key players in the continent i.e. Nigeria, South Africa and Egypt. (2) It goes further to investigate space-based PFI project around the world thereby identifying the strength and weakness and plausible lessons that can be learnt and improved upon by the emerging space states and developing nations who experience the highest amount of space infrastructural deficit globally. (3) Proffers a suitable approach to be considered by African Space Actors while bearing in mind the potentials of PFI as an alternative source of funding to improve their space infrastructure.

ii. AN OVERVIEW OF THE AFRICAN SPACE INDUSTRY

African countries are currently participating in a plethora of science and technology initiatives within the continent which has seen to the adoption of the African Space Policy and Strategy in 2016 and the further establishment of the African Space Agency (AfSA) in Egypt in 2018. However, this research will focus on two key areas namely: Earth Observation and Satellite Communication infrastructure in Nigeria, South Africa and Egypt.

The National Space Research and Development Agency (NASDRA) was established under the Olusegun Obasanjo’s Administration⁴ with an initial budget of \$93 million to operate and manage the Nigeria Space

Program.⁵ The Agency is supervised by the Federal Ministry of Science and Technology⁶ and overseen by the National Council on Space Science Technology.

The Agency operates a couple of activity centers across the six (6) geo-political zones in Nigeria which focuses on Geodesy and Geodynamics, Satellite Technology Development, Remote Sensing, Space Science and Technology Education, Space Transport and Propulsion,⁷ Basic Space Science, Atmospheric Research and Space Application Laboratories.⁸ Thus, in a bid to fulfil it’s established mandate, the Agency have been able to successfully launch a couple of Earth Observation and Communication Satellite missions.

Table 1. Satellites Missions Launched under the Nigeria Space Program (Source: NASDRA, Wikipedia & SpaceinAfrica).

Satellite	Launch	Purpose
NIGERIA EDUSAT -1	3/7/17	Tech. Demonstration and Earth Observation
NIGCOMSAT – 1R	19/12/11	Communications
NIGERIASAT - X	17/8/11	Earth Observation
NIGERIASAT - 2	17/8/11	Earth Observation
NIGCOMSAT- 1	13/5/7	Communications
NIGERIA SAT - 1	27/10/3	Earth Observation

In 2005, the Federal Executive Council (FEC) approved a twenty-five (25) year roadmap for the Nigeria Space Program (Horizon 2005- 2030).⁹ The major highlight of

⁴ Chizea F.D., ‘Space Technology Development in Nigeria’, <http://www.unoosa.org/documents/pdf/psa/activities/2017/SouthAfrica/slides/Presentation11.pdf>

⁵ Robert C. H., ‘Space Policy in Developing Countries: The Search for Security and Development on the Final Frontier’, (Abingdon: Routledge, 2013) at. p. 168

⁶ NASDRA, ‘About Us’. Available at <https://nasrdra.gov.ng/en/about-us/> (Retrieved on 20/9/19).

⁷ NASDRA, ‘Activity Centers’. Available at <https://nasrdra.gov.ng/en/about-us/nasdra-centers/> (Retrieved on 20/9/19).

⁸ NASDRA-CBSS, ‘Our Historical Background’ <https://www.nasdraacbss.com/our-historical-background/> (Retrieved on 20/9/19).

⁹ Boston University, ‘Klinger Tours Nigeria’s Space Research and Development Agency’, Available at <https://www.bu.edu/pardeeschool/2019/05/28/klinger>

the roadmap includes sending a Nigerian Astronaut to space by 2030 as well as launching a Nigerian built satellite on a Nigeria Launch Vehicle from a Launch site located in Nigeria.

On the other hand, South Africa launched its first satellite into space ‘SUNSAT (Stellenbosch University Satellite)’ which was a working collaboration with National Aeronautics and Space Administration (NASA) on 23rd February, 1999.¹⁰ The major function of the satellite was for Earth Observation which lasted until the 1st of February, 2001 just three weeks short of its two (2) years on orbit operation.^{11 12} Although, on 17th day of September, 2009 South Africa developed and launch its second Earth Observation Satellite called ‘SUMBANDILA SAT’ with collaboration with the Russian Space Agency which demonstrated South Africa’s high-tech industrial capabilities.¹³

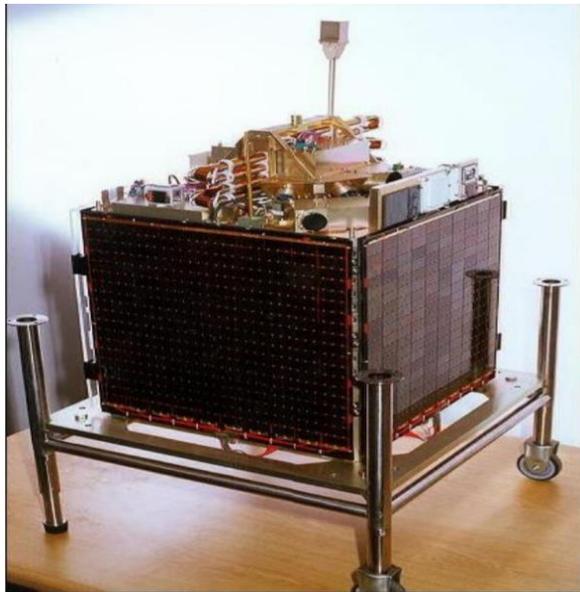


Fig.1. SUNSAT (Photo Credit: Stellenbosch University).

[-tours-nigerias-space-research-and-development-agency/](#) (Retrieved on 22/9/19)

¹⁰ Business Insider, ‘4 African Countries with Satellites in the Orbit’. Available at <https://www.pulse.ng/bi/tech-4-african-countries-with-satellites-in-the-orbit/5fsh4x4> (Retrieved on 22/9/19).

¹¹ Ngcofe L., et. al., *The Growth of Space Science in African Countries for Earth Observation in the 21st*

In addition, these laudable projects led to the establishment of essential space infrastructure to support space activities in South Africa as well as the development of industrial capacity to also support a space programme.¹⁴

On the 9th day of December, 2010 the South African National Space Agency Act came into force which established the South African National Space Agency (SANSA). Thus, South Africa have been able to develop its own Earth Observation Strategy which primarily focus on coordinating the collection, assimilation and dissemination of Earth Observation Data to support policy, decision-making, economic growth and sustainable development for South Africa. Furthermore,

Table 2. Satellites Missions Launched by South Africa (Source: n2yo.com, SANews, RussianSpaceWeb.com).

Satellite	Launch	Purpose
ZACUBE 2	27/12/18	Remote Sensing & Communication
KONDOR-E	19/12/14	Reconnaissance
ZACUBE	21/11/13	Space Weather
SUMBANDILA	17/9/09	Earth Observation
SUNSAT	23/2/99	Earth Observation

South Africa and its Nigerian counterparts are part of the African Resource Management Constellation which is an initiative to develop a constellation of satellite in order to

Century’. South African Journal of Science (2013) Vol. 109 at p.2.

¹² Martinez P., ‘*Space Science and Technology in South Africa: An Overview*’. African Skies, (2008) Vol.12 at p. 48.

¹³ Gottschalk K. South Africa’s space heritage: The hidden decade of the 1980s. In: Proceedings of the 62nd International Astronautical Congress; 2011 Oct 3–7; Cape Town, South Africa.

¹⁴ Martinez P., *Op. Cit.*, at. p. 47.

provide real time, unrestricted and affordable access to satellite data to support effective environmental and resource management in Africa.¹⁵

The Egyptian Satellite Program is run under the National Authority for Remote Sensing & Space Science (NARSS). Although the law to establish the country's Space Agency was approved in 2017. Thereby allowing the President the power to establish the first Egyptian Space Agency (ESA) with the mandate to coordinate Egypt's national space programme.¹⁶ However, Egypt's place in the African Space Sector is well rooted as its space program dates as far back as the nineteen fifties which led to the establishment of the Egyptian Space Council on the 16th of May, 1998 and then the creation of the National Authority of Remote Sensing and Space Sciences the following year. Since then, Egypt has successfully launched a couple of Satellites for Earth Observation, Communications and Educational CubeSat.

Table 2. Satellites Missions Launched by Egypt
(Source: n2yo.com, pixalystictld, Space-in-Africa, nanosats.edu).

Satellite	Launch	Purpose
NARSSCUBE-2	17/4/2019	Education CubeSat for Earth Observation
EGYPTSAT A (or MISRSAT-A)	21/2/2019	Earth Observation
EGYPTSAT 2	16/4/2014	Earth Observation
NILESAT 201	4/8/2010	Communication Satellite

EGYPTSAT1	17/4/2007	Earth Observation
NILESAT 102	17/8/2000	Communication
NILESAT	28/4/1998	Communication

Finally, Egypt hopes that within the next seven (7) years their space and satellite technology city will contribute at least 10% of their National Income.¹⁷

iii. ANALYSIS OF SPACE BASED PRIVATE FINANCE INITIATIVE PROJECT

The Galileo program was joint initiative of the Private Sector, the European Space Agency (ESA) and the European Union (EU). Under this program, every party had its own distinct responsibilities as the EU were responsible for the political dimension and mission requirements.¹⁸ While, the ESA were charged with the responsibility of defining, developing and validating the Galileo in-orbit system, the private partners were expected to invest in the deployment and operation phase thereafter acquiring revenues from user charges in form of royalties for the system's intellectual property right and direct access fees for value-added commercial services to offset the operating cost of the program.¹⁹ However, one major factor impeded the full actualization of this program; The conflict of interest over private funding due to the merger of the two consortia and the subsequent withdrawal of funding commitments in 2007.²⁰ Divergent interests arose with different expectations with the lack of a joint vision as this resulted in internal disagreement over work and responsibility distributions. In the Galileo program, the consortium was required to invest in the deployment

¹⁵ SAGEO, 'The Earth Observations Community and Initiatives'. Available at: <https://sageo.org.za/about/the-earth-observations-community-and-initiatives/>

¹⁶ Space-in-Africa., 'Egypt Commences Implementation Phase of China-funded MisrSatII Satellite and AIT Center'. Available at <https://africanews.space/egypt-commences-implementation-phase-of-china-funded-misrat-ii-satellite-and-ait-center/>

¹⁷ Shall S., 'Egypt and the "space race"'. Available at

<https://www.idc.ac.il/he/research/ips/Documents/publication/2/ShaulShay>

¹⁸ Masafumi H., 'Public-Private 'Partnerships in Space Projects: An Analysis of Stakeholder Dynamics'. Available at <https://>

¹⁹ *Ibid.*

²⁰ Space News, "Europe Faces More Government Financing for Galileo Program," *Space News*, March 14, 2007. Available at http://www.space.com/spacenews/archive07/galimess_0312.html, retrieved April 2009.

phase and to offset it in the operational phase. However, because of the merger, eight members of the consortium had divergent interests and different expectations with the lack of a joint vision. This complex partnership resulted in internal disagreement over work and responsibility distributions.²¹

iv. **DEVELOPING A SUITABLE PFI APPROACH FOR THE AFRICAN SPACE SECTOR**

One of the major factors that have led to private investments into space projects around the globe has been as a result of huge capital requirement of space the projects amidst tight of budgetary constraints of the agencies. In Africa, the major financiers of space program as illustrated from the early part of this research has most notable been the national governments. However, if Africa intend achieving it dreams towards space sciences and technology as encapsulated in in the Vision 2063, it would need to considered opening its windows to space based PFI arrangements while considering the following success factors. a. The development of a sound regulatory and legal framework for PFI arrangement which will allocate risks and responsibilities to governments, spaces agencies and private partner investors. This is essential while taking into account some of the incident of the Galileo Project which saw the alteration of terms of the contracts occurring on a shorter frame as a result of political decisions against the project duration which created strain on the partnership.²² b. Clear Vision and Project Goals for the African Space Industry. From the analysis gotten from the space projects in the three African countries as earlier highlighted during the study of the African Space Sector, two key areas stood out which are earth observation and satellite communications. Hence, in developing a suitable PFI approach, African policymakers might need to consider the potential missions which might derive more benefits for the region as they should pay more attention to new and existing

lessons because each space project have its own distinct circumstance with regards to affordability issues, delivery of value for money and challenges in allocation and management of risk.

v. **CONCLUSION**

Space Domain which was once dominated by the super powers of the world is now opening doors to private investments. However, the case of Africa seems to be uncertain as space based regulatory PFI framework remains fragmented which makes the entire private investment environment within the African space sector unclear. Going forward, this research analysed the space assets in the African Space Sector by looking at three major players which includes Nigeria, South Africa and Egypt. Hence, it was observed that most of the investment in space assets in these countries were majorly on earth observation and satellite communications. However, budgetary constraint is still the major factor impeding growth of the African Space System. Hence, this research suggests the need for the key players in the African Space Sector to consider the alternative of PFI arrangements as an investment option for space based infrastructural project in order to augment funding challenges the encounter. Although, a clear PFI framework needs to be enacted that will foster for a competitive space industry in Africa which will develop its own indigenous technologies while saving cost in a suitable investment climate that will increase the appetite of private investment in the country concerned

²¹ Masafumi H., op cit.

²² Stefan Barensky 'Galileo Public-Private Partnership Crashes to Earth'. *Politico May 9 2007*.

