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The Space Gap, Access to Technology, and the Perpetuation of Poverty

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The Space Gap: Unequal Access to Technology, and the Perpetuation of Poverty

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Abstract

States with economies big enough to support space programs and invest in those programs use technology that has revitalized the international system. States without access to space and these scientific inventions are often left behind when it comes to investment opportunities and participation in the international market. States utilize space technology to perpetuate intentionally or unintentionally the poverty of developing states. By examining how investing in space telecommunications technology can boost the economies of developing states, this paper aims to highlight an unconventional path toward the further development of the Global South.

Introduction

Outer space generally plays a larger role in humans' everyday lives than is generally acknowledged. The technologies involved that depend on outer space for their use are numerous.

Global Positioning Systems (GPS), communications, internet, and weather satellites are some of the most prominent applications of human-made satellites orbiting earth. The phrase "Space Gap" refers to a capabilities gap formed between developed states that are capable of accessing the technological opportunities gained through space-faring and those developing states that either still have no access to those technologies or must pay exorbitant amounts of money to foreign governments for basic levels of access (Pappalardo). Examining this widening gap as an indicator of broader economic development challenges of less developed countries can aid in the pursuit of a solution to the issue of global poverty. Connected with the issue of access to technology is the debate whether access to the information and communication technologies is or should be a human right. Is access to the internet such an integral factor of 21st century development that, without it, a state cannot develop its economy to its fullest potential? Without access to space programs in the developing world, developed states will continue to dominate the space sector and thus dominate the market. The paper therefore argues that the unequal access to space-related technology represents yet another obstacle for the economic development prospects of the Global South.

The Role of Space Technology for Promoting Economic Development and Inequality

Scholars in Economics and International Relations (IR) have looked at the costs and benefits of investing in the space sector as an economic development tool for rich and poor states. Scholars and practitioners of space technology politics reach divergent conclusions regarding this issue.[1] Weeks (2012) examines the consequences of the space gap caused by increasing capabilities in space technologies by developed states, which is disproportionate to the level achieved by developing states. She proposes solutions for dealing with the inevitable growth of wealth

inequality in the world: “this is the time to discuss equality. Once societies in outer space are established it will be too late” (Weeks, 171). Her views on the inequality which is continuously reproduced stands in contrast to others in the discipline of international relations. In her opinion, the international community must educate the populations of all states to mitigate the issue of inequality.

In stark contrast to this view, Julian Reid argues that the information gap, created by increased connectivity, is inevitable, and the competition between those connected and disconnected to the technology is nothing more than a cultural battle between the majority and the minority (Reid, 613). His commentary ignores issues such as wealth inequality created or perpetuated by this information and technology gap, thereby implying that this gap is ultimately inevitable. The work of Reid discounts the need to establish connectivity among developing countries by identifying it as a form of western imperialism. According to him, connectivity is the true “future normal,” but information disconnect is equally valid. Establishing connectivity as the sole method of engaging in a modern world leaves out the possibility for a non-connected life to be chosen and viewed as equally viable. Reid means to articulate the lower level of connectivity should not imply lesser contemporary cultural value.

Reid’s argument relies on the premise that not acting to combat the digital divide would benefit all states on earth. This is an example of non-decision as a use of power to maintain the status quo. Non-decision is the strategy to avoid deliberately making a decision regarding an issue in order to preserve the power structure put in place (Dahl). In International Relations, non-decision can be a tool of realism in a zero-sum system. In other words, one views any theoretical gain by an adversary as a loss by the state. In regards to technology development by the developing world, the developed world could decide not to act or aid in the development process

whereas giving this aid would be equal to giving up the power these states hold over the technology-starved global south.

Economist Vernon Ruttan looks at whether a perceived military threat is a prerequisite for development in the realm of space in addition to other facets of technology. This analysis will focus on his work regarding the development of space technology, in particular, how conflict serves as a necessary requirement for such development. Fueling technology development are two drivers of innovation. Whether space technology is created through technology-push and/or a demand-pull, the result is the same; both are incredibly vital to widespread innovation within technology policy and development (Peters). Ruttan traces the development of most weather, communications, and navigation satellite technology to their origins within NASA and the Department of Defense, although these technologies nowadays are primarily used by civilian government agencies and purposes (Ruttan). Ozgur Gurtuna's work (2013), on the other hand, further adds to the exploration of the economics that impact the evolution of private and public space sectors. He describes the revenue streams that are generated by the space industry. The statistics in Gurtuna's research clearly highlight the extent to which the space industry has contributed to the economic welfare of the United States.

As Gurtuna indicates, worldwide, space budgets for governments have steadily risen in the past decades. Globally, $64.4 billion were spent in 2009, and $87.12 billion in 2010 were budgeted for national space agencies. Commercially, space revenue ranged from $170-190 billion in 2010, a large portion of this coming from the commercial satellite industry. Therefore, he argues, this kind of research also demonstrates the potential relevancy of space-related investments for less developed countries' economic development prospects (Gurtuna 31).

Breakdown of Satellites by Country

United States	Russia	China	Other	Total
803	142	204	589	1,738

(Union of Concerned Scientists, 2017)

Breakdown of American Satellites by Purpose

Civil	Commercial	Government	Military
18	476	150	159

(Union of Concerned Scientists, 2017)

The Union of Concerned Scientists (UCS)[2] breaks down the number of satellites operated by each of the other three main space powers and compares those to the rest of the world's satellite operations. Showing this breakdown clarifies the divide between the states that have technology and those that do not. In addition to these statistics, the UCS compares the states that have satellites operational today and the states that had them in 1966. The only regions that remain without that technology today are Central America and sub-Saharan Africa (UCS, 2017). The divide between the haves and the have-nots in regard to space technology becomes evident in the economic development of states. This is an issue that has deep roots in the Cold War Space Race.

A Brief History of the Space Age

The history of space exploration and research puts into perspective the future potential benefits and required processes that can promote the economic development of the Global South. The space race of the Cold War encouraged many new and innovative endeavors that were initially considered impossible and that have proven to have lasting effects on the international

community and more importantly, on the economic and technological capacities of global society. The space race was a competition between the United States and the Soviet Union focusing on the rapid development of space technology with both nations sending large numbers of satellites and humans into space for the purpose of furthering communications and earth observation (Ruttan). Moltz (2014) and DeVorkin (1992) discuss the key fact that without the knowledge that ballistic missiles could be used as rockets, as discovered by the German scientists during World War II, space exploration might still be a dream (Moltz). Therefore, these technologies were, indeed, used for communications and observational purposes. Their primary purpose, however, was to engage in a military technology race between superpowers.

After the Second World War, the main driver of innovation was national security, and the field of scientific exploration was no exception. Developing new technology that had national security applications was the most important prerequisite for scientific development during the Cold War Space Race (DeVorkin). The goal of the United States during the space race was to establish a new world order of technology that would be capable of bringing together [sic] Western, neutral, and Communist societies alike. More importantly, the underlying goal was to keep neutral states away from the forceful or coercive sway of Communism (McDougall, 344). This competition between West and East fueled a frenzy of technological innovations without which the contemporary world would not be the same. Innovations that emerged during the space race include the sale of products and services that were originally invented for use in space exploration. High optical imagery, sold to either the private or public sectors, is the result of space research and development. In addition, there are many societal benefits. Weather satellites, for example, have improved over the years. The increased effectiveness of weather prediction has been a catalyst for weather-dependent economic sectors (tourism, airlines, maritime

operations, etc.) to improve the quality of life for the average citizen, along with increased economic activity (Gurtuna).

The participation in this new world order of space exploration and utilization proved to be a path to further economic development and increased involvement in the global market economy for the Soviet Union and the United States. Historically, developments in space technology had impacts on the world that were small, but carried much weight in areas such as science and technology, military spending, and various civilian sectors of the economy. From a macroeconomic perspective, it can be concluded that space research and development had a positive effect on the economy. Military expenditures were decreased, allowing for a more efficient use of funds. Remote sensing and global positioning satellites made earth observation and tracking much easier and cheaper than air- or land-based methods. Spin-off economies were created as a result of the necessities of space travel and research. The contractors associated with the research done by NASA are given credit for 31,356 new inventions. In addition to both the military and economic benefits of space research seen in the early era of the space race, the sciences boomed with new observational methods due to the need to monitor astronauts in a new environment. An example of the real-world impact of innovation in space technology are new procedures for the administration of X-Ray scans (Goldman, 121). Increasing the effectiveness of technology in other areas of life has allowed for the more effective use of resources within other fields.

Innovations that were made during the Space Race have benefited the lives of the citizens as well as the economies of the developed states. These benefits were not shared with the developing states and therefore have created a space gap that has led to the further widening

between the economic develop of the global north and the global south. The global north has continued to perpetuate this gap today.

Space and Imperialistic Domination

Currently, the United States and other developed states utilize outer space as a tool of dominance over less developed states. The only way to challenge the dominance of industrialized countries is to develop independent technology inside the less developed states that can provide alternatives to the oppressive space regimes established and reproduced by the developed world. Bormann and Sheehan argue that confronting the issue of sovereignty explains the issue facing many less developed states (2012): "Regimes for outer space, codified in outer space treaties have unbundled sovereignty by establishing sovereignty of states over their own objects in space, despite the fact that objects are de-linked from states' terrestrial territory" (Bormann and Sheehan, 12). Disassociating sovereignty and *terra firma* (solid ground) has implications that affect all states. In separating these concepts, state sovereignty is able to be projected into space, albeit only onto the objects sent to space by the aforementioned state(s). Although outer space is – from a normative perspective – still considered a common good accessible to all mankind, de facto only a few wealthy states have been able to enjoy the privilege of exploring and exploiting the advantages outer space has to offer.

Therefore, states who have access to these advantages can leverage their capabilities in their relations with those states that have no access. By analyzing how policy-makers make use of the issue of sovereignty to promote their achievements in outer space can lead to a deeper understanding of how developed states use this technological power to perpetuate the poverty of developing states: they limit access to the technology necessary to participate in the market economy of the space age. The United States has actively found ways to prevent the use of space that contradict its own policy goals. This is seen in the 2006 space policy put in place by George W. Bush:

> "The Secretary of Defense and the Director of National Intelligence … shall develop and deploy space capabilities that sustain U.S. advantage, and support defense and intelligence transformation; and … develop capabilities, plans, and options to ensure freedom of action in space, and, if directed, deny such freedom of action to adversaries…" (Rinne, 9).

Directly aiming to deny access to states wishing to pursue a policy counter to that of the United States is a clear attempt to prevent use of space by another sovereign power. While not affecting the developing states that do not currently conduct space activities, this policy demonstrates a possible problem for developing states who wish to launch satellites to provide their own telecommunications services.

Power is an important factor to consider when debating the level to which developed states control earth and, ultimately, outer space. The idea of *astropolitik* is essentially the theory of *realpolitik* applied to outer space. This concept proposes that powerful states will ultimately dominate on Earth through competitive mastery of outer space (Bormann & Sheehan, 43). Through *astropolitik* theory, states will naturally dominate due to superior economic and

technological power. States without this level of power could find it hard to develop in the face of the oppressive space regimes of the United States, China, Russia, etc. Economically, these states have a choke hold on the rest of the world in regards to the development of outer space. According to the *Air and Space Magazine*, there are about fifty satellites operating above Africa, but there is yet to be an information revolution in the region due to the high costs of renting the bandwidth of these foreign-owned satellites (Pappalardo). The problem is not that there is no opportunity for the states to use satellites; instead, the services provided by these satellites are too expensive and unattainable for the majority of African nations. A solution to this issue has been offered up by the Chinese government in the form of investment and information sharing. Sharing information and funds to jumpstart the Nigerian Space Program, for instance, will allow Nigeria to launch a satellite to provide the desired services to the people of sub-Saharan Africa in packages that they can afford and will use (Pappalardo).

Space as Common Good: The Outer Space Treaty

Currently the most all-encompassing treaty governing outer space—and the states that utilize it—is the Treaty on Principles Covering the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (Outer Space Treaty). This treaty is the basis for all laws that govern outer space. The most important parts of this treaty for the purpose of this paper are articles I, IX, and X. Article I states "The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind (Outer Space Treaty)." All states parties to the treaty

deserve to have the same right to access to outer space and therefore the same access to the advantages that space technology brings to an economy. Without being in space, however, developing states must abide by rules set forth by developed states whose satellites are vital for market activity.

Outer space operations undertaken and financed by the state are meant to benefit specifically that state's economy and nation. Jennifer Frakes takes this stance in her texts. She asks, why do states have to share in access and the results of exploring outer space. Space is known as a Common Heritage of Mankind (CHM) Principle and states that outer space by its very existence is a common realm for all mankind; it must be shared peacefully between all mankind (Frakes). She argues further that the principles that are meant to guide the use of outer space are vague and need more definition. Without a specific definition for the terms lacking in the CHM principle, it is stated that mankind is not entitled to the spoils of outer space exploration. This idea, if brought to fruition, could leave developing states behind as developed states continue to work toward greater exploitation of outer space.

Article X notes that states wishing to observe any space launch or process may do so with the approval of the state in question (Outer Space Treaty). This aspect of the treaty becomes significant when one examines who has the most satellites and technological connections coming from outer space. Developing states have some access but mostly rely on satellites of more developed nations for their space-reliant technology. Allowing the sharing of information between the developed, space-faring states and the developing states can aid in the development of space programs in the Global South. This aspect of international law allows for the greatest ability for growth among developing states.

International Law is inherently public in its most basic components. The concerns of the totality of states must be considered when making decisions, and in no aspect of international law is this more evident than in international space law. The laws that govern states' actions in space have an impact on the earth and therefore are a concern of all the states on the Earth (Basaran). When these concerns are voiced to a body that is willing to hear them, the concerns of developing states are often not much different than those of the developed states. Enforcing the public nature of outer space by widening the range of valued opinions represented will help to challenge the idea that all states are not guaranteed the access to space that was laid out in Frakes' article. In light of this innate public nature of space access, all states are part of the discussion no matter the level of their national space technology.

Case Studies in International Space-Technology: Cooperation between China and Nigeria and India's Rise as a Space Power

In the last years, two countries have begun to close the space gap: India and Nigeria. The contrast of these two cases highlights two quite different pathways to closing that gap; in India, technological innovation has developed nationally whereas sub-Saharan Africa has relied on foreign investment and support. In fact, Nigeria has come to the forefront of the space industry for the region. An obvious solution to this issue is investing in an African space program so that African states can potentially own satellites to provide the communications coverage desired by the people of sub-Saharan Africa. Increasingly, in the last few years, China has been expanding its influence into sub-Saharan Africa. One such area that the People's Republic has affected is the development of the satellite capabilities of sub-Saharan African States. Solutions to combat

the implications of the space gap have come from around the world, however, the most impactful have proven to be those proposed by China.

According to the Chinese media source CCTV, Nigerian scientists along with China are working towards the development of a Nigerian-owned satellite (McGregor). This economic development in Africa is part of the Chinese plan to invest in the continent and bolster relations with developing states in the region. As a result of this collaboration, Nigerian Communications Satellite (NigComSat) will provide cheap communication capabilities for the region of sub-Saharan Africa (Pappalardo). This would be the first satellite launched by China on behalf of the African continent (McGregor). The implications of this development remain to be evaluated by the academic community. Economically, however, this move will possibly have tremendous, positive results for the African continent; many of the African nations cannot afford the foreign-owned satellites and related services currently positioned above the continent. This investment by China is part of the state's "no-strings-attached" "win-win" policy toward the continent, and it has five major parts:

- Non-interference in the internal affairs of other states;
- Peaceful coexistence with other states;
- Equality and mutual respect for others;
- Mutual non-aggression;
- Respect for others' territorial integrity (Akinola).

A major part of the policy of the People's Republic is the investment in the infrastructure and development of African states like Nigeria. With investment come connections and trade

opportunities for both partners. In about twenty-five years, Nigerian-Chinese trade relations climbed from $90 million in 1994 to $7.268 billion in 2008 (Akinola), and Nigeria imports mostly Chinese manufactured goods at a cheap price.

Nigeria's main export is oil, and a majority of its oil is imported by China. This oil is exchanged for investment in Nigeria's infrastructure coming from China. The agreement has revitalized roads and other structural needs of Nigeria (Akinola). The investment in Nigerian infrastructure includes China's creation and launch of a Nigerian satellite. This investment on the part of the Chinese will go toward advancing the economically deprived sub-Saharan African states.

Moltz (2014) distinguishes between Nigeria and other more developed states in the outer space development area. He states that China provides subsidized satellite exports to promote friendly relations, and unlike other countries, Nigeria pays for these satellites with raw resource exports. For Nigeria, this is primarily oil (Moltz). Africa as a whole is woefully forgotten when it comes to the technology development of communication. This immoral action by the community of developed states has perpetuated the poverty of the region. Communication technology is of paramount importance to be involved in the world market of the 21st century (Pappalardo). Investing in the Nigerian space program will allow the sub-Saharan region to gain access to the world cheaply and efficiently. Without having access to other methods of technological development, satellites are the easiest way to achieve the level of technological development necessary to ignite an information revolution.

Chinese investment is looked at with an eye of criticism by the Western World, however, the results cannot be overlooked. Chinese investment has resulted in the creation and launch of a satellite in Nigeria (Pappalardo). With future investment on the sides of Nigeria and China,

Nigeria could launch and operate its own satellite, further improving the conditions of the continent in terms of technological connectivity. Africa could reach a new level of development due to the communications technologies these satellites provide. Nigerian-Chinese trade relations show that through the investment in satellite technology and the interconnectivity that accompanies such projects, the implications of the space gap can be alleviated.

The second example of a nation that has joined the ranks of space-faring states is India. Nobrega (2008) explores the incredible progress of India's economy, because until recently, India was considered undeveloped and an industrial latecomer (Nobrega). As a member of the BRICS nations (Brazil, Russia, India, China, and South Africa), India is considered a rapidly developing state. India is, moreover, also one of the leading actors in regards to outer space research and development. Early in 2017, the Indian Space Agency launched one hundred and four satellites on one rocket and placed them in orbit within eighteen minutes, nearly tripling the previous record set by Russia in 2014 (Barry). The rate at which India has developed its space program is a shining example of how a state can, within decades, move from being an undeveloped state to being one of the most influential space-faring state of the 21st century. Compared to other states' expenses with launching space objects into orbit, India's costs are minimal. India launched a satellite into orbit for $74 million, while the US launched a satellite in the same year for $671 million. These cost differences are partly due to the pay difference in the scientists involved in the projects (Barry). This comes after decades of increasing economic involvement by India, in the betterment of ICTs internationally, focusing specifically in Africa (Akinola). The two cases of Nigeria and India are significant in that they highlight successful strategies for providing developing nations with access to space technology.

The Impact of Privatization for the Space Race

Stagnating prices in public-sector space industries and decreasing prices in private-sector space industries may provide a viable solution to the widening space gaps. Since joining the international market for satellite launches, Space Exploration Technologies Corporation (SpaceX) has had tremendous success in competing on the international level. According to Moltz (2014), the expanding company has been able to offer prices at 50% of what the top provider, Russia, has been able to offer due to the streamlined manufacturing process (Moltz). This level of competition will allow these private-sector providers to pass the most prominent national programs, and, if trends continue, offer services to less developed states for less. This arrangement is unlike the one adopted by China. It is unclear whether SpaceX could receive raw materials as payment as the Chinese have (Moltz). Moltz (2014) continues his observation by noting that through SpaceX's decreasing prices, the company is able to offer the international community opportunities for diversifying their capabilities. SpaceX has been moving forward its *DragonRider* program which would allow it to carry astronauts to the International Space Station (ISS) in addition to their already booming satellite launching abilities.

With the increasing demand for technology in outer space, government-run agencies are unable to keep up with the demand for lower cost space travel. Private space agencies are appearing to fill this gap in the demand. Currently they are working on public-private partnerships, but as the gap in regulations prevents the industry from moving forward, space agencies remain dominant (Orr & Way, 2018). The increasing movement toward privatization of the American Space industry can begin to challenge the dominance of national space agencies. With regulations for the American Space Industry creating a certain and stable environment for action, the American

space industry could lower costs and compete with the Indian Space Agency and, ultimately, create a better environment for the continued innovation of space.

Conclusion

This paper has examined the many facets of the space industry affecting the economic development of states in the Global South and has established that the space gap is a consequence of the militarized space race of the Cold War. Indeed, through the research, one can acknowledge that the space gap has had a long history of existing in the power structures of the West and the developed world. Few states have been able to develop space programs to the degree that the United States or Russia have been able to. Most of these states are rapidly developing BRICS member status and developed allies of the United States. By showing the level of economic development that has occurred due to the investment in outer space it has become possible to increase our understanding why expectations are high regarding investments in developing space programs.

These issues have external implications in other areas such as the discourse of Human Rights. Human Rights are attributed to humans by the very existence of their humanity (UDHR). This being said, it is also the responsibility of the state to protect these rights. Are the rights of citizens in the developing world taken into account during negotiations focused on space treaties? And if not, how are governments able to make the voices of these citizens heard? Are there aspects of Human Rights that can be applied to outer space technology that need to be acknowledged in treaties? Space law is an immensely important area of study that applies directly to human rights and to the rights of developing states.

It is an ever-changing field when one examine scholars' work on the rights of humans in regards to the space technology and access to such innovations and when one compares how this technology can impact the economy of developing states. This paper has demonstrated that the economy-stimulating role of investing in outer space programs in Africa by the Chinese and Indian governments can bring a fuller and more equal access to the services granted by these technologies. Without investment, and, ultimately, participation in outer space, developing states face the great challenge of engaging in a globalized world where access to space-age technologies are vital to the flourishing of a modern economy.

[1] Edythe Weeks, Julian Reid, Vernon Ruttan, and Michael Peters examine the issue of space in conjunction with economic development, utilizing economics and international relations theories.

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[2]The Union of Concerned Scientists (UCS) is an organization made up of scientists dedicated to highlighting issues facing the world through academic research. They have compiled a database detailing the current numbers of satellites and which states own them (https://www.ucsusa.org/) .

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