

Developing Agriculture: A Political Divide


STS Research Paper
Presented to the Faculty of the
School of Engineering and Applied Science
University of Virginia

By

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May 11, 2021

On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction

The motivation for examining the development of agriculture infrastructure in developing nations is because the globe is in the midst of a catastrophic problem of climate change. The major issues that climate change causes are increased sea levels, drastically different seasonal changes, flooding with increased frequency and intensity. Increased sea levels are due to the melting of the ice caps and areas near the coast have been impacted directly by this. Seasonal changes include longer or shorter seasons as well as irregular seasonal patterns which can have an effect on crop yield for farmers. The flooding of more severe and frequent storms has an effect on the livelihood of many, but impacts coastal cities the hardest and can disrupt farmers immensely. It is critical from an ethical standpoint that all nations are able to adapt to increased sea levels, seasonal changes, flooding and increased frequency and intensity of extreme storms. If these nations are not prepared many lives and homes will be lost.

The purpose of the study is to examine how political influences have stagnated the growth in agricultural and environmental progress in developing nations. The case study will focus around Guyana and nearby Latin American countries as to how their decisions as a nation have set them back in the race for a greener and more sustainable earth. The study seeks to answer the research question, how politics and global trade hurt Guyana's health and environment? The goal is to analyze the historic decisions made by politicians and determine as well if there were other factors besides trade influencing the changes in Guyana's health and environment.

Case Context

The goal of the study is to identify and verify drivers that lead to a detrimental environment in Guyana and nearby Latin American nations. To do so one must examine the

economic make-up of these areas to get an understanding of how economic factors have had an influence on these nations. It is expected that there is an upward trend of land expansion and deforestation due to an increase in globalization according to Andrade-Nunez et al. (2020). Possible other factors in the deforestation process include farming increase in native lands and a push toward commercial farming. There is also a timber harvest in the native lands according to Bellfield et al. (2015). In relation to the economic growth of Guyana specifically the main export of the nation is gold and there have been political battles disputing legislation harm on the industry but also the environment, Lowe (2014). Other industries having an impact on the environment include the logging industry that has been influenced by corrupt politics according to Bulkan and Palmer (2016). There is also a possibility that foreign investment is having influence on how these Latin American countries operate according to Gransow (2015) there has been investment from China and it is important to dissect China's motivation for investing here as well as why Latin America is accepting the investment.

In a study from Filho et al. (2019) it examined the infrastructure of cities and their preparedness to climate change and the study examined the city of Georgetown, Guyana to Shanghai and attempted to understand how wealth, population, and governance played a role in the city's resilience to future natural disasters. Research from Mahlkecht et al. (2020) concluded that Latin American countries were in demand for energy, water and food security. The urban infrastructure is going to need to step up as it is projected that 90% of the population in Latin America and the Caribbean will be urban, Romero-Duque (2020), an influx of the population can have major strains on the already unsatisfactory infrastructure so there is major concern there. The article from Pelling (1998) particularly describes Guyana's vulnerability to flood hazards, representing their struggle with investing in infrastructure and the many actors

involved in those means of investment. In regards to health it can be seen that the industrial expansion of Latin America can also have a negative effective on the health of the people as a study recent study shows that toxins are being measured in adolescents and breast milk, much is still to be determined as to future effects on children, Dorea (2021).

STS Framework

This section references the work of Thomas P. Hughes of his book chapter The Evolution of Large Technological Systems. Large socio-technical systems framework will be used to examine the research question as there are a variety of actors involved in technological development. Technological systems are complex, with need for problem-solving as they are socially constructed and society shaping. As a system each component has an essential role and if taken out can change the system's characteristics. A technological system interacts with the management structure as management is choosing what components can support that system. Management is also a reflection of what an overarching system has to provide and as such it is connected to the business strategy and political influence contributing to its style. These systems tend to follow a hierarchical structure, similar to that of a Russian doll; a system will have subsystems within.

Technological systems solve problems to fulfill goals using what is available and appropriate, reordering the physical world in ways considered useful or desirable, at least by those designing or employing a technological system. This makes it possible for markets to stimulate the need for something creating a problem and they have their technology there as a solution. There are two kinds of environments: one which the system is dependent on and one in which the environment is dependent on the system. One-way influences, such as environmental factors affecting the system should not be mistaken for components of the system.

Phases of evolution are critical in understanding how Large Technical Systems penetrate society: Invention, development, innovation, transfer, growth, competition, and consolidation. The phases are not simply sequential, there is a lot of overlap and backtracking between phases. There are three different types of entrepreneurs throughout that push the system and allow for its success with society. The inventor-entrepreneurs whom are present during the invention and development. The manager-entrepreneur whom contributes during the innovation, competition and growth phases. Lastly, the financier-entrepreneurs whom are present during consolidation

The invention phase is the first phase and the phase that can potentially create a new system. In large technical systems there are two types of inventions; radical inventions are when a new system has to be introduced as components do not fit in existing systems. Conservative inventions are modifications and improvements on components in existing systems that allow the system to become more efficient. It is vital that inventions come under the nurturing care of large organizations as there are many inventions that fail to become innovations. Even radical inventions are just improvements of earlier work. It is important to note that Radical inventions do not thrive under large organizations because they can be distributive for the organization, but will implement an invention into their system as an innovation if it does not completely disrupt how they operate.

Inventors thrived on the possibility to create something new that people wanted as it solved hard problems that large organizations could not focus on. In exchange for their intellectual property, they would receive substantial financial reimbursement. These circumstances have changed now as large organizations can financially exhaust individuals through litigation which is a possible reason for the decrease in inventors.

The Development phase the inventor-entrepreneurs embody in their invention economic, political, and social characteristics that it needs for survival in the useful world. The invention goes from a simple idea to being able to function in an environment that will encounter various factors and forces. During this phase problems arise out of the systematic relationship and solutions continually become easier as the innovation progresses.

Radical innovation on the other hand would want to be manufactured by inventors as the large organizations do not want disruptive technology, but will implement it if it can fit nicely into the system they already have. Manager-entrepreneurs replaced the inventors once innovation is completed to solve principal reverse salient and the solver of critical problems associated with them. The transfer of technology phase includes adapting to the new environment, such as laws, customs, etc. The environment can request how the design is stylized to meet needs and many examples also show geography playing a major role in style.

The later phases; growth, competition and consolidation are all about economies of scale and how well they manage organization structure such as small managers with authority vs large organizations holding those small managers to have lesser roles and less control. Tools used to examine these phases include the load factor, a ratio of average output to the maximum output during a period of time. This allows the organization to plan to acquire more diversity to sustain a higher load factor leading to growth and or to push for optimization especially in capitalistic societies. During these phases lagging components known as the reverse salients, would be addressed in order to increase output of components affecting the overall system. If the reverse salient could not be addressed in the system it would then require a radical solution. In conclusion these systems constantly require momentum as they are not autonomous (Hughes, 1987).

Method

How has Guyanese politics on agriculture infrastructure impacted Guyanese farmers and citizens over the last century? The reason as to why this question is important is because the leaders of the country are critically determining the outcome of their citizens lives in terms of if their people will have a good quality of life.

A way to conduct this study is to analyze historical documents such as Guyanese newspapers, press releases, Guyanese government records and GIS maps to gain qualitative and quantitative data. It will also be key to gain the perspective of those living in Guyana and their outlook on the situation; this can be done through an interview process, preferably getting perspective of all political viewpoints.

The newspapers and press releases will observe the sentiment of the people, and how the government introduced sustainable and green ideas to Guyana, as well as the news of foreign entities building in Guyana.

GIS maps on green infrastructure currently implemented, water quality maps, flooding, the interview gives complex detail and information that a survey cannot. The interviews hope to answer the how, challenges, needs and constraints. Interview questions consist of: How do farms irrigate the land in Guyana? What challenges are there with the current approach to agriculture irrigation? What are the infrastructure needs for irrigation? What challenges prevent farmers from meeting needs? What are the reasons you believe the infrastructure of Guyana has suffered? What changes have you seen in your lifetime or in the last 15-20 Years in regards to infrastructure? What was the sentiment about foreigner investment in Guyana and how their role affected international markets? How did this influence the farmers?

The plan for the research is to have a collection of interviews as evidence of the socioeconomic factors that contributed to the development of infrastructure in Guyana. The research paper hopes to point out possible solutions in understanding how developing nations can make social and political changes in how they approach environmental issues. The paper also hopes to spotlight the severity of socioeconomic factors on environmental issues that can be used to examine other nations that are also facing hardships in environmental development.

Results

Guyana means land of many waters, a word in Amerindian, so water control has been a prominent characteristic of the nation since the first European colonists arrived in the seventh century. Guyana has rainfall in excess of 200 cm so as a nation it has to ensure that it can control its water at the coast for cultivation. There is a need to protect the coastal plain below sea level from marine flooding and then to have the capacity to drain the area to allow for sugarcane cultivation. There has also been an increase for supplemental water supplies as the preferred crop was moving toward rice instead of sugar. This need required enlarging existing systems and the construction of new ones (Strachan).

In the capital city of Georgetown there is an extensive canal system in which there is a drain outside every house. The canals and drains take storm-water to the sea, however the quality of these systems is in a devastating state as they are filled with trash. In 2005 Georgetown experienced one the worst floods resulting in millions of dollars in damages. The government has placed redemption fees on returnable plastic bottles in 2017 that generated \$6 million dollars, in the view of Melinda Janki the spending is not spent on ending the environmental damaging waste and there is still no environmental plan for Georgetown (Janki, 2018)

According to the U.S. Army Corps they note that the drainage and irrigation systems have deteriorated because of lack of maintenance and no longer provide sufficient irrigation and other water uses. There was a lack of storage capacity that has hindered agricultural production, the most important sector of Guyana's economy. Currently the water supply has shifted to groundwater from surface water storages supporting 90 percent of the domestic water for the country. Between 1913 and 1993 the main aquifer has fallen almost 20 meters; long-term studies are to be conducted to determine its future capabilities to sustain the potential increase in withdrawals. No hydropower exists, the water resources of the country offer great potential, but development is limited due to access to lack of roads. Wastewater treatment is minimal nationwide as surface water is laden with sewage especially across the coastal region.

Sea defenses were constructed by the Dutch that consisted of seawalls on the Atlantic coast. Through the years, more concrete seawalls, earthen embankments, canals, pumping stations, and drainage outfall sluices. Over time the sea defenses encountered damages that were repaired; however, the lack of maintenance has caused breaches in the dikes, resulting in occasional flooding of the coastal plains (US Army Corps of Engineers, 1998). To support these findings, I will offer evidence from the interviews first.

Interview

For an introduction to the infrastructure of Guyana I interviewed Dr. Muniram Budhu, a Civil Engineer Professor at the University of Arizona and who is currently the CEO of an engineering company, Trinity Engineering Services in Guyana which is a consulting firm that deals with program management in the field of structural, technical as well as working with the government and their online presence. He is seeking engineers who are from the Guyanese diaspora to join him in his mission to reestablish and rebuild the country.

During his interview Dr. Budhu gave an overview of the current infrastructure plan and reasons as to why he believes general infrastructure was lacking in Guyana. He begins with the roads and irrigation, the problem started because Guyana was a colony and as such has to deal with the common issues that inhabit most former colony nations. The colonizer had been draining the country of its resources for a long time and only built infrastructure that benefited the colonizer such as roads to farms to shipping ports and storage spaces for them to store sugar cane. He then stated that the leaders after the colonizers were not any better in his view, they were corrupt such as President Burnham, who used his power for personal benefit. Many people left under the Burnham era which contributed to a brain drain of Guyana's most talented individuals. He notes two projects under President Burnham were the Soesdyke Linden Highway and the Corentyne Highway that were good for the country. However, he sees President Burnham stopping rail road transportation because he was not a fan of railways and was receiving money for building roads instead from external sources such as the US.

Current issue is that since most people live on the coastline, infrastructure on the interior is inferior, however new leadership is making strides to make progress and build substantial access to the interior. New projects consist of Bartica, roads to Brazil, and a 4-way highway on the east and west coast. Money and funding have been a problem in the past, however there is optimism that the new found oil source found in Guyana will be able to fund these new infrastructure ventures such as gas to shore and hotels.

Dr. Budhu is hopeful that Guyana will diversify its funding using the plentiful amount of resources Guyana has to offer such as minerals, that could potentially be economically feasible to excavate now since they have the oil funding to pursue these ventures, as oil is not the future as it is not sustainable and environmentally friendly. Guyana has shown interest in green

infrastructure such as solar, wind and hydropower. When asked about foreign investment he mentioned that China has been restricted as Guyana has noticed the negative treatment that they have caused to other Caribbean nations and Africa. The ExxonMobil investment is the oil funding as referenced before and there is also, European investment, and Guyanese private investments that are taking place in Guyana adding to his optimism.

The second interview was conducted with a former student of Guyana's School of Agriculture Amanda Donaldson. She explained that Guyana's major cash crop has been rice and sugarcane. The Dutch a former colonizer of Guyana had developed canals and had a system that was sequenced so that all farmers planted and harvested at the same time. There was also a development of dams to protect the land from the sea. Ms. Donaldson worked for Mahaica Mahaicony Abary - Agricultural Development Authority (MMA) a company funded by Dutch government that oversaw the agriculture proceedings of Guyana. Problems that were present during her time working were the need for acres of flat land to grow rice, access to potable water, rural regions were lacking in water treatment facilities and were using wells with pumps such as standpipes. Pressure has been a problem as she noted, she wondered why are people using water tanks now? Expertise is a problem as there has been a brain-drain the Guyanese are getting trained but then are leaving as they do not feel well compensated. Foreign engineers, scientists and innovators are able to come and thrive in Guyana as they were well funded versus the lacking internal sustainable Guyanese funding. With lacking resources farmers were not getting paid well. The IMF Funding, USA ID and World Bank has caused issues for Guyana as these institutions have come to economically save the country through loans that come with stipulations. These stipulations affected how farmers produced and traded attempting to control their economy and have the nation dependent on the institutions.

The last interview was with Arnold De Mendonca, a Sustainable Rural Development Specialist working in Guyana. Mr. De Mendonca also worked with MMA and mentioned that the cash crop was sugar cane and it was farmed on the coastal plain of Guyana. Agriculture infrastructure included having the water from the interior kept in reservoirs using spill weirs and sluices and kokers. He mentioned that the National Drainage and Irrigation Authority is in control of the waterways and a number of canals networked with the rivers that are connected to the farms and allow flow from north to south. Since the coast is 6ft below sea level a sea wall was built by the Dutch to assist in sugar cane production.

Current challenges being addressed is the excessive rainfall from weather changes and revamping of the drainage network is under way. There is installation of high velocity pumps for emergency purposes of preventing the fresh water from flooding the coast.

Current projects include various expenditures in Region 2, 3, 4, 5 as shown in Figure 1. Guyana is composed of 10 regions as a systematic strategy of the government to effectively govern, each region is controlled by a Regional Executive Officer according to Guyana Lands and Surveys.

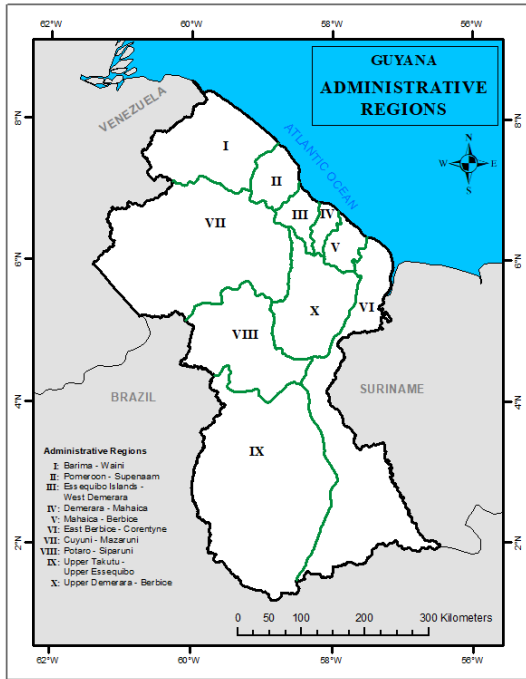


Figure 1. Guyana's Administrative Regions

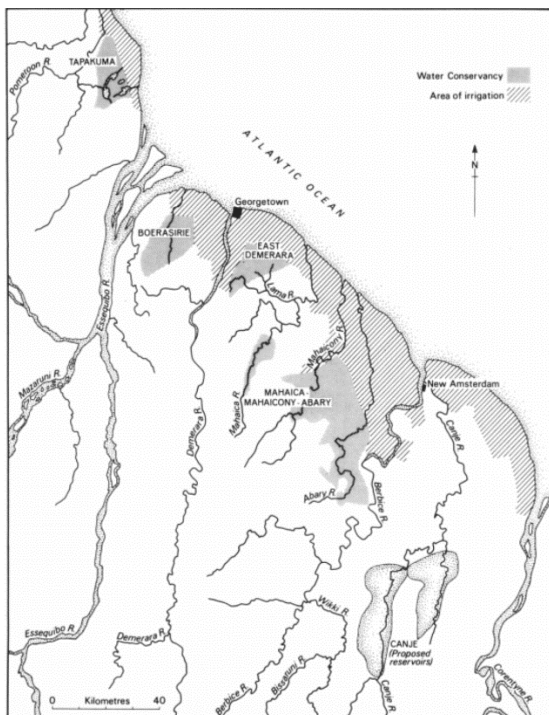


Figure 2. Guyana: Water Conservancy & Irrigation Areas (Strachan, 1980)

Mr. De Mendonca explained the current needs of Guyana's agriculture infrastructure to be improvements in salt water intrusion. The empoldering of farmlands as spring tides are even higher than normal tides. The need for farmland to have a wall or dam and more mechanization of farming. In order to be more in line with developed nations being able to use advanced technology such as drones and other software to assist in layout planning. There is also a need for better access for farms to market as the roads are not fully functional roads especially during the rainy season. Besides roads the waterways to be used for transportation can be choked with weeds. Livestock farmers have dealt with the introduction of mounds to deal with being in flooding zones. He lastly mentioned that extreme flooding and extreme dry season are also circumstances that need to be addressed as many citizens experienced traumatic floods that have cost millions in damages.

Discussion

In the case of Dr. Budhu he saw policy as the reason as to why there was no innovation. The political environment caused many to leave resulting in the brain drain as key evidence of there not being people to update and maintain systems nor add conservative or radical inventions. The colonial system design was not updated and maintained and since they were built so long ago, they do not have the capabilities to sustain the growing demands and needs.

Political system influenced design and that system did not support the agriculture infrastructure with momentum needed to continually make progress and technological advancements.

In terms of recent events regarding agriculture infrastructure Minister of Agriculture, Hon. Zulfikar Mustapha has said that 95 percent of dams in regions two, five and six are completed. This work is critical in the rice production of Guyana as the farmers need access to

transport their paddy from the fields to the mills. Other regions are planned to also be rehabilitated but due to weather conditions they are currently on hold. Rice production is expected to surpass last year's figures for the same period. Comparing values from April 2021 to April 2020, there has been an increase of 6 percent in weight and 12 percent in value of rice exported.

Contact with members of Guyana's Agriculture Department was non-existent. These members would be instrumental in the research as they are directly involved in the policy and operation of infrastructure. The interviews provide exceptional information there is bias in each interaction and those interviewed did not have an incentive to be objective. To expand on the paper more, research of historical documents such as reviewing President Burnham speeches on agriculture infrastructure would be key political evidence of how managers influenced the system. Lastly, if there was more use of historical op-ed pieces for the research, it would portray the sentiments of citizens toward the political actions taken place.

The research could be expanded by adding other sectors of infrastructure. This additional research would display the severity of political influence on the infrastructure and support the large socio-technical systems framework as the infrastructure would reflect political ideologies. Additional research could be done on the influence of the U.S. on the politics of Guyana. There was reference in some interviews of how the U.S. might have an involvement with the Guyanese government.

Political views of what is being done in the country is key, as in the interviews it was clear that some political figures did things that did not align with what their political affiliation preferred or wanted while others see those same actions of the same political figure as good works. As referenced in the interviews the removal of the Railway System for the interior was a

controversial project. Systems are influenced by the organization of management who is able to select components in said system.

Conclusion

Guyana's agriculture infrastructure challenges are a composition of multiple factors, some of which were explored in this research such as politics, economics, and colonialism. These are the reasons as to why agriculture infrastructure is lagging behind in Guyana and in similar developing nations in Latin America.

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