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Greening a Drug-Addicted Economy: Can Puerto Rico Ease Away from the Toxic Pharmaceutical Industry to a Sustainably Diverse Economy?

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Greening a Drug-Addicted Economy: Can Puerto Rico Ease Away from the Toxic Pharmaceutical Industry to a Sustainably Diverse Economy?

Natalie Galarza

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Abstract

Puerto Rico is not the most well known place to most Americans. The small island in the Caribbean is neither an independent nation nor a state, but rather a commonwealth of the U.S. Life filled coral reefs surround the coasts, rainforests and lush vegetation cover the land, and an underground cave system and glowing bioluminescent bay fascinate all those that venture to them. These natural wonders as well as the vibrant culture are the primary aspects most people who are familiar with Puerto Rico think of. However, the main sector of Puerto Rico’s economy has nothing to do with any of these assets, but rather a pharmaceutical industry that was instilled within the island by U.S. federal policies not long after America’s acquisition of Puerto Rico. As a result of this industrial dominance on such a small island, the environment, people and economy have suffered. Disease of the people and the environment is quite evident as a result of toxic waste from factories. Focusing on history, economy, and sustainable business, this thesis explores the environmental, social and economic issues caused by pharmaceutical dominance as well as the interconnectedness between the three. Regulation on manufacturing must become a key priority within the government, the use of the abundant ecological services as the main energy source, the revival of agriculture, and the continued generosity of the people to share their love for the natural beauty of the island through sustainable tourism are a few recommendations to help Puerto Rico kick its “drug habit.”
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Introduction: The Secret Business

The U.S. is known for having a “pill” to cure any minor ache or chronic disease. These medications generate billions in profit for the pharmaceutical industry, which is one the most profitable industries in the world.¹ The industry’s greed for profit as well as negative side effects of pharmaceutical drugs has received negative press in recent years. However, it has remained fairly hidden that America has outsourced much of its pharmaceutical drug manufacturing to Puerto Rico over fifty years ago. Puerto Rico ranks second after New Jersey for the U.S. states and territories with the most pharmaceutical facilities. Forty-nine FDA-approved pharmaceutical plants speckle the island including the top multinational companies like Pfizer, Abbott Laboratories and Merck & Company.²

One of the main reasons pharmaceutical companies took over the island was because Puerto Rico had “the one natural resource vital for drug production: untouched aquifers of extremely high-quality water.”³ This thesis will focus on a case-study municipality of Puerto Rico called Barceloneta, which is within the North Coast Province aquifer area that represents more than 63 percent of the island’s groundwater.⁴ Barceloneta is also the municipality on the island with the highest per-capita concentration of drug production with more than a dozen drug factories.⁵ The pharmaceutical industry has undoubtedly contaminated the environment in Puerto Rico and continues to emit chemicals into the air, land and water. Many of the island’s

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⁴ Ibid.
⁵ Ibid., 3.
superfund sites are former pharmaceutical plants and the U.S. EPA continues to monitor current plants for hazardous chemicals. Respiratory problems and cancer rates are high in pharmaceutical-concentrated areas like Barceloneta. While there is limited data on the correlation between pharmaceutical contamination and public health concerns, this thesis will explore such connections.

The ushering in of the pharmaceutical industry represents a preconception that Puerto Rico is devoid of natural resources necessary to develop an economy. However, defining natural resources is quite subjective and during the time of industrializing Puerto Rico, natural resources were seen as those that would contribute directly to the manufacturing economy. From the opposite perspective, Puerto Rico is actually quite rich in natural resources. There are 500 native species, 52 nationally recognized protected areas, 248 beaches with coral reefs filling the waters, 350 types of soils, and abundant sun and rainfall year round. Such discrepancies in natural resource definitions and how Puerto Rico has been converted to a manufacturing economy raises questions about whether a small tropical island with delicate ecosystems should be used for manufacturing. These questions can also apply to any country or ecosystem around the world that is at risk of environmental degradation due to industrialization and manufacturing outsourcing.

Pharmaceutical pollution is not a problem unique to Puerto Rico as factories exist around the world. Furthermore, the problem does not only belong to those places where drugs are produced. The companies that outsource their drug manufacturing are directly responsible for such issues and consumers who use medication are a part of the cycle as

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well. One major consequence from the discharges of antibiotics from manufacturing plants into the environment is microorganism drug resistance, which is listed by the World-Watch Health Organization as one of the top three risks to public health.\textsuperscript{7}

Economic development and policies in Puerto Rico are also significant because of the island’s place between the U.S. and Latin America. For example, will its industrialization and economic dependence on the U.S. influence other Latin American countries?\textsuperscript{8}

Because the pharmaceutical industry is the main sector of Puerto Rico’s economy, this thesis will analyze the problems it has caused and take an environmental approach in solving such issues. In Chapter One, the quantitative data on pharmaceutical contamination, public health, and economic indicators will be assessed. Chapter Two will use the history of how Puerto Rico was used for its resources or “lack” of them to help explain Puerto Rico’s current environmental and economic situation. Chapter Three will delve further into Puerto Rico’s economy accessing the pharmaceutical sectors current state as well as emerging sustainable industries. In Chapter Four, a look at Puerto Rico’s small but growing entrepreneurial ventures and sustainable businesses will show how such business works with and for the environment and people. And lastly, the Conclusion will offer policies and recommendations specifically for the pharmaceutical industry, sustainable tourism, renewable energy and agriculture.


Chapter 1: False Hope in a Toxic Industry

While Operation Bootstrap and the arrival of pharmaceutical companies promised to develop Puerto Rico’s economy, pollution affecting both the environment and the people were inevitable without proper precaution within an inherently polluting industry. Furthermore, the profitable industry has not proved to create long-term prosperity for the economic status of many Puerto Rican people nor the economy overall as economic statistics show. As stated in the introduction, pharmaceutical companies were especially attracted to the island for its extensive aquifer system, and thus, this natural resource was one of the first to be exploited. In 2000, “pharmaceutical and other related chemical manufacturing processes accounted for 7.38 million gallons per day (Mg/d) of self-supplied groundwater withdrawals” from the largest aquifer along the Northern coast.9

While industries are receiving 100 percent of their water from the groundwater,10 water for human consumption is clearly not prioritized. The drug companies of the case study town of Barceloneta accounted for the largest percentage of the total withdrawal at 37 percent.11 Prior to the arrival of industry, the aquifer did not require much treatment, and companies were permitted to drill their own wells to “extract tens of millions of gallons, daily, cost-free.”12

Pollution

Not only do the pharmaceutical companies remove a very important resource from the environment, but the industry also uses the ground, air and water as its waste

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12 Ibid., 25.
sink. In Puerto Rico, twenty-four different kinds of drugs are manufactured including antihypertensive drugs, tranquilizers, laxatives, anti-diabetic drugs, vasodilators, antibiotics, erectile dysfunction drugs and contraceptives. The production of these drugs creates wastes from toxic by-products resulting from chemical synthesis, biological compounds such a fermentation wastes, extraction solvents, and cleaning agents and disinfectants used to sterilize equipment. In the beginning, it was not uncommon for pharmaceutical companies to dispose of such wastes into unlined wells or landfills, nearby rivers, natural sinkholes, or the ocean. The wells consisted of wells drilled especially for liquid waste disposal or wells previously emptied of groundwater by the industry. Wastewater treatment plants would soon accept such waste; however, these plants were not equipped with the technology to treat the large list of hazardous chemicals. In 1982, the US Geological Survey sampled 57 wells in highly populated industrialized areas and found that most of them were contaminated. By 1994, pharmaceuticals accounted for half of the worst toxic polluters in Puerto Rico and in the decade overall, the island was among the states/territories with the highest releases to the environment.

Since the 1990s the situation has improved due to regulation and the island’s top five polluters are now electric facilities. Furthermore, Puerto Rico currently ranks the 27th worst out of the 57 states/territories (rank 1= highest releases) according to the EPA’s

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16 Ibid., 30.
Toxic Release Inventory Analysis.\textsuperscript{19} However, it is still pertinent to research past toxic release occurrences due to long-term effects as well as areas that are still heavily concentrated with pharmaceutical factories, such as Barceloneta. According to the EPA’s list of cleanup sites in Puerto Rico, Barceloneta has four listed sites, the highest concentration on the island. These sites include both Superfund NPL (National Priorities List) sites and RCRA (Resource Conservation and Recovery Act) Corrective Action Program sites.\textsuperscript{20} Superfund NPL sites contain either known or possible “releases of hazardous substances, pollutants, or contaminants” to the environment,\textsuperscript{21} while RCRA sites “have treated, stored or disposed of hazardous wastes to protect public health and the environment.”\textsuperscript{22} Barceloneta has three Superfund NPL sites listed as remediated: Upjohn Company, Barceloneta Landfill and RCA del Caribe, which is unrelated to the pharmaceutical industry. The RCRA site is Merck, Sharp & Dohme Quimica de Puerto Rico Limited pharmaceutical plant.\textsuperscript{23}

The first Superfund NPL site was a former Upjohn Company pharmaceutical facility added in 1984 as a result of a spill in 1982. Approximately 15,300 gallons of waste material, including carbon tetrachloride and acetonitrile, leaked from an underground tank, directly above the North Coast aquifer, which supplied drinking water to 12,000 people at the time.\textsuperscript{24} The groundwater also discharged into wetland areas that supported large aquatic bird populations.\textsuperscript{25} As a result, Upjohn pumped, treated and monitored the contaminated groundwater, and alternative water supplies were given. It

was not until 1995 when a new public waster supply well was constructed to replace the contaminated well. According to the EPA, potential or actual human exposure to hazardous substances is under control.26

The second Superfund NPL site in Barceloneta is the Barceloneta Landfill added in 1983 as a result of the continuous dumping of hazardous wastes, especially from pharmaceuticals. 300 tons of hazardous waste have been place into three naturally occurring yet unlined sinkholes, which make up the landfill. Some are as deep as 100 feet and no barrier exists to keep wastes from leaching into the groundwater and surrounding environment. As a result, on-site groundwater contains various heavy metals and VOCs that can be easily evaporated into the air. Furthermore, people swim and fish in Quebrada Cimarrona, a stream located on site. The clean up process initially involved capping the sinkholes to prevent exposure to waste. In 2000, the wastes as well as contaminated clays were excavated and relocated. Since then there has been a 30-year long monitoring program initiated to ensure clean up is effective.27

Currently, the Merck, Sharp & Dohme Quimica de Puerto Rico Limited pharmaceutical plant is classified as a RCRA, running under the authorization of a hazardous waste permit renewed in 2006 to be updated again in 2016. The manufacturing plant has existed since 1971 and produced human and animal health products such as anti-hypertensives, beta-blockers, diuretics and anti-parasitic drugs. It generates hazardous wastes including chlorinated and non-chlorinated solvents, solid and sludge wastes containing heavy metals, and residues from waste incineration operations. Toluene contamination in soil is the main potential environmental threat. Permits from

both RCRA and the Clean Air Act manage two hazardous waste container storage areas,
seven aboveground hazardous waste storage tanks, and two hazardous waste incinerators
used by the plant.28

As a result of such hazardous waste sites, reported accidents as well as unreported
everyday leaks, and faulty water treatment regulations in the early years, 29 percent of
drinking water wells had been closed by 1987 due to contamination.29 In 1977, a new
water treatment plant became operational, “receiving permission from the EPA to accept
domestic waste, industrial waste from food processing factories, and some “weak wastes”
from one of the pharmaceutical factories. By the early 1980s, this treatment plant would
accept even more pharmaceutical waste including hazardous wastes.30 Issues with the
treatment plant including how it was constructed as well as how well it treated the
wastewater quickly arose. The plant’s ocean outfall pipe was only constructed to end
about a half mile offshore,31 and studies on biological pathogens in the same area as well
as closer to shore showed that the treatment plant failed to treat domestic waste.32
Chemical concentrations were not studied at the time; however, if the plant could not
even handle domestic waste it is very unlikely that it could handle hazardous
pharmaceutical waste.

Currently, Barceloneta is still plagued by polluting pharmaceutical companies and
while regulations have improved, manufacturing plants are still releasing hazardous
chemicals. The top polluters are the following pharmaceutical companies: Pfizer
Pharmaceuticals LLC, Abbott Healthcare LTD, MSD International GMBH and Abbvie

28 “Merck, Sharp & Dohme Quimica de Puerto Rico Limited,” US EPA, accessed March 30, 2015,
University, 2013), 26.
30 Ibid., 27.
31 Ibid., 28.
32 Ibid., 30.
Pfizer contributed almost half of the toxic release at 24,998 pounds out of the total 54,177 pounds in 2013. 44 percent of Pfizer’s release is toluene. The breakdown of the total chemicals released in Barceloneta include, acetonitrile (26 percent), toluene (20 percent), and dichloromethane (18 percent), among others in smaller amounts. In the following section on Public Health Effects, these chemicals will be explored further.

Public Health Effects

It is quite the paradox that an industry that strives to fight disease and save lives may actually be contributing negatively to public health in the communities in which its manufacturing plants are located. While there is currently not extensive epidemiological research on the health consequences of pharmaceutical pollution on residents and drug factory workers, there does exist significant data on current asthma and cancer rates in the towns with the highest pharmaceutical concentration. Furthermore, industrial pollution and groundwater contamination has historically proved adverse effects on the surrounding community. Therefore, the information outlined in this section provides numbers and possible connections to pollution to encourage further research in this area.

33 See Appendix, Table 1.
In Barceloneta residents are aware that respiratory problems and other obvious symptoms are directly related to the noxious fumes released from the plants. Complaints, especially when fumes enter the home, include severe eye, nose and throat irritation, trouble breathing, nausea, dizziness, headaches, and extreme trouble sleeping.\textsuperscript{35} Out of a US Census survey of 353 households within the urbanized areas of Barceloneta 37.7 percent of the households reported one or more members with asthma, 46.7 percent with non-asthma chronic respiratory infections, and a total of 75.1 percent with either asthma or undiagnosed chronic “difficulty breathing”.\textsuperscript{36} According to a Behavioral Risk Factor Surveillance Survey, cases did not differ among age groups, people smoking at least 100 cigarettes in their entire life, or physical activity—some of the usual suspects of asthma. Asthma cases are also not likely related to indoor mold and dust since homes in Puerto Rico very well ventilated.\textsuperscript{37} Furthermore, Barceloneta public schools have been ranked in the 11\textsuperscript{th} percentile of the nations worst schools for local air quality.\textsuperscript{38}

\begin{table}
\centering
\caption{Households Reporting One or More Member(s) with Respiratory Complaints}
\begin{tabular}{|l|c|}
\hline
Condition & Percent \\
\hline
Asthma or chronic “difficulty breathing” (undiagnosed) & 75.1 \\
Asthma alone & 37.7 \\
Non-asthma chronic respiratory infections (including chronic cold) & 46.7 \\
Total asthma and/or other chronic respiratory infection (defined separately from “difficulty breathing”) & 84.4 \\
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\end{table}

Unlike respiratory problems, cancer is much more difficult to trace back to pharmaceutical pollution; however, high cancer rates in Barceloneta compared to other

\textsuperscript{36} Ibid., 40.
\textsuperscript{37} Ibid., 41.
\textsuperscript{38} Ibid., 3.
towns deserve some investigation. On the entire island, the Puerto Rico Central Cancer Registry indicates that cancer is the second leading cause of death resulting in 5,000 deaths annually. Breast cancer is the most commonly diagnosed cancer in Puerto Rico, accounts for 30.3 percent of all female cancers, and has the highest mortality rates of all cancers in the population. It has been found that only 15 percent of the cases can be attributed to familial and genetic influences, while most cases can be linked to hazardous effects of hormonal exposures. Barceloneta falls within the highest incidence rates for breast cancer as well as liver and oral cancers. For all cancers as well as lung and bronchial cancers, Barceloneta falls within the second highest incidence rate.

Unfortunately, the US Centers for Disease Control and Prevention state that even after a cancer cluster is confirmed, “follow-up investigations can be done, but can take years to complete and the results are generally inconclusive.”

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40 Ibid., 44.
41 Ibid., 21-46.
serious health effects such as asthma and other respiratory problems, local government
and health officials who are largely in favor of the industry are indifferent to health
complaints. Despite surveys that showed no difference between residents with different
personal behaviors like diet, exercise and smoking habits, officials attribute health issues
to such behaviors that could easily lead to respiratory problems.\textsuperscript{43}

However, the top pollutants currently being released into the air in Barceloneta as
well as chemicals released in spills formerly mentioned are known to cause the same
health consequences residents experience and lead to certain cancers. Acetonitrile, which
makes up 26 percent of the current air pollution and was released in large quantities in the
Upjohn spill, is used as a solvent in pharmaceutical facilities. Under 500 ppm, inhalation
causes irritation to mucous membranes. Higher concentrations can lead to weakness and
nausea from its effects on the central nervous system.\textsuperscript{44} Toluene, which makes up 20
percent of the current air pollution and contaminates the soil surrounding the Merck,
Sharp and Dohme Quimica facility, is also used as a solvent. It affects the central nervous
system causing symptoms such as fatigue, headaches and nausea. Chronic inhalation
exposure results in inflammation and degeneration of the nasal and respiratory tract.\textsuperscript{45}
Dichloromethane, which makes up 18 percent of the current air pollution, is used as a
solvent and cleaning agent. Like the other pollutants, it affects the central nervous
system, but it is also a probable human carcinogen. Animal studies have resulted in liver
and lung cancer, although several studies on workers exposed to the chemical were not

\textsuperscript{43} Ibid., 41.
statistically significant. Yet the EPA sets a limit of 5 ppm for drinking water with a goal of zero.

Two other chemicals used in pharmaceutical production, carbon tetrachloride and ethinylestradiol have also been found to be carcinogenic. Carbon tetrachloride is a solvent and cleaning fluid that was leaked in the Upjohn spill and has the potential to evaporate into the air and leach into groundwater when disposed of in landfills. In animal studies liver tumors have developed in rats and mice, and “occasional reports have noted the occurrence of liver cancer in workers who had been exposed to carbon tetrachloride.” Ethinylestradiol is a synthetic steroid used as an estrogen component to produce oral contraceptives and post-menopausal estrogen therapy drugs, which are widely produced in Puerto Rico. Several studies have shown a correlation between these medications and breast cancer in women as well as both breast and liver cancer in animal studies. While most studies on the effects of ethinylestradiol have been carried out on women receiving these medications, causes of breast cancer in Puerto Rico and towns like Barceloneta are worth further epidemiological investigation given the high breast cancer rates caused by hormonal exposures. Overall, these connections are offered in order to spark studies on populations affected by pharmaceutical pollution rather than to claim proven results.

Economic Effects

Not only has the pharmaceutical industry not been kind to the environment or public health, but it has also not proven to bolster Puerto Rico’s economy in the long term as promised by Operation Bootstrap. While Operation Bootstrap and the pharmaceutical industry did help create a middle class population, current economic statistics do not show overall success. Manufacturing, which includes pharmaceuticals, chemicals, durable goods as well as other products, is the major sector responsible for 46.5 percent of Puerto Rico’s GDP. The pharmaceutical industry, specifically, accounts for 25.7 percent of the GDP.50

However, these percentages do not translate to the benefit of the people. The manufacturing sector does not serve as one of the major employers and the number of people it does employ has been dropping over the years. The top three employers in Puerto Rico include government (255.9 thousand), trade, transportation and utilities (173.1 thousand), and education and health services (117.9 thousand). Manufacturing employed 85.6 thousand people in 2011, 83.5 thousand people in 2012, and 77.5 thousand people in 2013.51 Since 2000 the share of the manufacturing sector in total employment fell from 14.1 percent in 2000 to 8.4 percent in 2013.52 Additionally, Puerto Rico offers the lowest labor costs in the U.S. with hourly earnings in manufacturing averaging 65 to 80 percent of the U.S. average.53 According to the U.S. Department of Labor, the manufacturing worker in Puerto Rico earns an average of $11 per hour while a

52 Ibid., 13.
consumer in the U.S. mainland earns $16.14 per hour.\(^{54}\) While the worker in Puerto Rico is subject to modest wages, CEOs of pharmaceutical multinationals are criticized for being outrageously overpaid, collecting millions in compensation each year.\(^{55}\)

In terms of the overall economy in Puerto Rico, the poverty, unemployment and public debt rates remain high. Almost half of families are below the poverty level at 41.2 percent and 14.1 percent of the population is unemployed.\(^{56}\) The public debt is growing much faster than the economy at a rate of 9 percent, while the GNP real growth rate is 0.3 percent.\(^{57}\) In Barceloneta, specifically, the unemployment rate is 17 percent, higher than the island’s average.\(^{58}\) Half of the jobs available are in manufacturing and nearly half the population works in other municipalities.\(^{59}\) While these economic statistics do not paint a full picture of progress in Puerto Rico, this data combined with environmental and public health statistics show a great need for sustainable development and a restructuring of the economy on the island.

Conclusion

A dominating industry that has negatively affected the environment and the people is the result of a combination of factors including Puerto Rico’s historical ties with the US, a faulty regulatory system in favor of economic development, and a preconception of the industry’s dedication to public health. In the following chapter on the history of Puerto Rico it will become clearer that the colonial relationship between

Puerto Rico and the U.S. has put the island at risk of exploitation. The environment and the people of Puerto Rico have been primarily used to produce goods and profits for consumption in the U.S. as well as other countries. Policies and regulations for the pharmaceutical industry have been purposely weakened or ignored for the ease of development projects. When the Environmental Quality Board (EQB) was established shortly after the creation of the federal EPA in 1971, its main goal was to initiate “socioeconomic development of [the] island, in accord with optimal environmental quality,” clearly prioritizing economic goals over environmental health. For example, the EBQ has replaced Environmental Impact Statement requirements with weaker Environmental Assessments, which eliminate the need for public participation in development projects. Ultimately, the industry on the island is not overly criticized by the majority due to its association with health care and perception of economic benefits. However, the data outlined in this chapter show that the dominating pharmaceutical industry represents a wide range of issues including ecological health, public health, environmental justice, and government transparency. For the focus of this thesis, the remainder will offer an environmental history and economic perspective of the issue as well as a sustainable business approach in order to offer realistic solutions aligned with the current hopes and goals of the Puerto Rican government and people.

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60 Ibid., 58.
61 Ibid.
62 Ibid., 5.
Chapter 2: A Not So Natural History

The first people who inhabited Puerto Rico were the indigenous people known as the Taínos who had migrated from South America. They were dispersed throughout the Caribbean Islands from the Bahamas to the Lesser Antilles. As the first indigenous people to be met and colonized by Christopher Columbus, their culture, language, and adaptations to the natural environment influenced the Spanish settling in the Caribbean to a certain extent. For example, many words in both the Spanish and English language such as hurricane, canoe, iguana and hammock come from the Taínos. To this day, Puerto Rico is referred to as Borinquén derived from Borikén, the Taíno’s name for their island. In terms of the relation and adaptations to the natural environment, however, the Taínos way of living was not completely embraced by the Spanish as is the case in most colonies.

While the land and sea were utilized for human consumption, nature was appreciated and represented in Taíno spiritual and mythical culture. For example, the fish, which represented life and nourishment, was one of their main symbols. The Taínos were maritime people who depended on the creatures of the ocean as their main source of protein. The large array of animals included fish like grouper, snapper, parrotfish, and bonefish; mollusks like conch, urchins and clams; and larger animals like marine turtles and monk seals. While most species could be found in grass flats, patch reef habitats between coral reefs and the shore, boats were also used to fish farther out. Dugout boats called canoa were made from a single log using fire to burn the wood and

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65 Lisbeth Carlson and William F. Keegan, Talking Taíno (Tuscaloosa: The University of Alabama Press, 2008), 47.
66 Ibid., 4.
67 Ibid.
stone or shell tools to hollow the log. They could hold up to ninety men and be paddled almost as fast as a Spanish caravel could sail.\textsuperscript{68} There is also much evidence that these boats were used to travel and trade with neighboring islands.\textsuperscript{69}

On land, Taños also captured crabs, iguanas, and hutia (cat-sized rodents) for protein as well as cultivated a variety of different crops. Swidden, or slash-and-burn agriculture, followed by a horticulture style rather than a one-crop row style of planting was the main method of growing crops.\textsuperscript{70} Spanish records indicate that as many as fifty different plants were grown for food plus another thirty for medicine, and fibers for nets, hammocks and rope.\textsuperscript{71} A few include sweet and bitter yucca (cassava), sweet potatoes, taro (cocoyams), corn, guava, papaya, beans, gourds, groundnuts, chili peppers, cotton, and tobacco.\textsuperscript{72} As a result of such a varied and nutritionally dense diet, it is suspected that Taños enjoyed remarkably good health, which was confirmed by examination of human skeletal remains.\textsuperscript{73} Overall, the indigenous people of Puerto Rico managed to be self-sufficient from the richness of their natural environment.

**Spanish Rule**

In 1492, Christopher Columbus arrived to the Caribbean (the exact island is still debated) and began the transformation of Puerto Rico and the rest of Latin America. Columbus and the Spanish were mesmerized by the natural beauty of the Caribbean but also immediately sought ways to profit from it. Columbus wrote in his journals, “Here the fishes are so unlike ours that it is amazing; there are some like dorados of the brightest colors in the world – blue, yellow, red, multi-colored, colored in a thousand ways; and

\textsuperscript{68} Ibid., 13.
\textsuperscript{69} Ibid., 85.
\textsuperscript{70} Ibid., 2-3.
\textsuperscript{71} Ibid., 71.
\textsuperscript{72} Ibid., 3-4.
\textsuperscript{73} Ibid., 5.
the colors so bright that anyone would marvel and take a great delight in seeing them” – Christopher Columbus, October 17, 1492.74 However, Columbus and the Spanish were more interested in the precious metals and eventually profits from sugarcane. In Puerto Rico, Taínos were used as slaves to extract the minerals but it was soon found that these deposits were quite limited in Puerto Rico. Vast quantities were then found in Mexico and Peru, making Puerto Rico a port for both trade and defense.75 Puerto Rico’s name meaning “Rich Port” most likely comes from this economic usage of the island as it served as a port for merchants and travelers between Europe and Latin America. Columbus had originally called the island San Juan Bautista which remained the name of the capital San Juan.76

Looking for new economic uses in Puerto Rico when mining was in decline, sugarcane was brought in from the Canary Islands off the coast of Africa in order to launch a new industry based on a nonnative resource.77 Because the Taínos were not accustomed to labor-intensive agriculture and reduced in number due to disease and mistreatment, enslaved Africans were brought in to work on the sugar plantations. By the early seventeenth century, sugar was one of Puerto Rico’s main exports; however, sugarcane on its own could not generate enough funds to make the colony economically self-sufficient.78 The Spanish conquest and its economic development attempts for Puerto Rico represent the first time a distant authority inserted a foreign industry in hopes of reaping profits back home. The idea that Puerto Rico was void of “natural resources” is not uncommon to other colonized lands either. For example, breadfruit from the Pacific

74 Ibid., 36.
76 Ibid., 2.
77 Ibid., 68.
78 Ibid.
islands was brought to Jamaica as a cheap food staple for slaves, despite the fact that these Caribbean islands were rich in their own food sources. 79 Not only was traditional Taíno agriculture ignored when sugarcane production was forced on the land but Spanish peasants who adopted their horticultural way of farming were also pressured to work for the sugar industry. 80 The exploitation of land and people for the deficient sugar industry as well as the strategy of bringing in outside resources to boost the economy in Puerto Rico would continue under U.S. control.

U.S. Control - The Sugar Industry

The Spanish-American War sparked by the Cuban War of Independence resulted in the Treaty of Paris of 1898, which gave the U.S. direct control over Puerto Rico as well as Cuba, Guam and the Philippines. 81 Two years later, Congress passed the Foraker Act, which declared Puerto Rico a U.S. Territory. The law gave Puerto Rico its own House of Delegates but gave Congress the right to annul any laws those delegates passed. It also assigned American trade, treaty, sanitary and military posts for the island. Under Spain, Puerto Rico had sixteen voting delegates in the Spanish Cortes (the Spanish Legislature) and almost received sovereignty in the proposal of the Charter of Autonomy in 1987. 82 Instead the island was taken over by the U.S. a year later so Puerto Rico never enjoyed full democratic rights and liberties. 83 It would not be until 1917 that Puerto Ricans received American citizenship under the Jones Act, suspected to ensure loyalty in World War I in which 17,885 Puerto Ricans served. 84 In response to the growing

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79 Ibid.  
82 Ibid., 60.  
nationalist movement in 1948, Congress allowed Puerto Ricans to elect their own
governor. In 1952, the island officially became the Commonwealth of Puerto Rico,
which translates to “limited self-rule”.

Not only did the U.S. limit Puerto Rico politically in the early years of possession,
but it also immediately imposed economic restrictions and plans reflecting American
self-interest. The Foraker Act forbade the island from making commercial treaties with
other countries and it replaced the Puerto Rican Peso with the American dollar, thus
devaluing the peso and making it easier to take over Puerto Rican owned land. Trade
restrictions have affected Puerto Rico’s economy to present day and replacing the peso
immediately affected independent farmers due to America’s further development of the
sugarcane industry. Coastal areas were transformed into highly commercialized
sugarcane plantations and by 1930, sugar represented 70 percent of the island’s exports
and 44 percent of all cultivated land (up from 15 percent during Spanish Rule).
Not only did sugarcane plantations take the best agricultural land, but it also halted native
coffee production in the mountain regions, displacing independent coffee farmers.
The combination of devaluing the peso and industrializing sugarcane forced traditional
farmers to work for wage-labor cultivating and processing sugar.

As a result, Puerto Rican farmers were dependent on the American industry for a
salary and could no longer grow their own food. From an island that had once been self-
sufficient in food became a place that could not feed itself. To compensate for this loss,
canned and packaged foods were imported from the U.S. Former self-sufficient farmers

85 Ibid.
86 Ibid.
87 Ibid., 60-61.
88 Deborah Berman Santana. Kicking off the Bootstraps: Environment, Development, and Community Power in Puerto Rico, (Arizona:
89 Ibid.
90 Ibid., 43.
formed worker villages and spent their money on nutritionally deficient imported food.\footnote{Ibid.}

This newly created state of Puerto Rico influenced the prevailing ideas that Puerto Rico was “the poorhouse of the Caribbean,” too overpopulated and lacking natural resources to survive as an independent country.\footnote{Juan Gonzalez, \textit{Harvest of Empire}, (New York: Penguin Books, 2000), 62.} Overall, the sugarcane industry took advantage of the climate, fertile soils, abundant water, natural harbors, and the people of Puerto Rico, while giving little in return.

However, these circumstances did not go without resistance. Puerto Rico’s own economic suffering as well as political instability in surrounding islands, especially the revolution in Cuba, sparked a pro-independence sentiment in Puerto Rico. A Nationalist Party formed, headed by Pedro Abizu Campos, a Puerto Rican born and Harvard graduate. The movement did not last long as nationalists were imprisoned and massacred.\footnote{Ángel Collado-Schwarz, \textit{Decolonization Models for America’s Last Colony: Puerto Rico}, (Syracuse: Syracuse University Press, 2012), 10.} The movement was also not supported by many Puerto Ricans such as big landowners who saw American statehood as a bridge to the U.S. markets for their products.\footnote{Juan Gonzalez, \textit{Harvest of Empire}, (New York: Penguin Books, 2000), 61.} However, the sugarcane industry was suffering and mill after mill began to close.\footnote{Alexa Dietrich, \textit{The Drug Company Next Door: Pollution, Jobs, and Community Health in Puerto Rico} (New York: New York University, 2013), 63.} Each closing directly affected people as they lost their jobs, and with no alternative Puerto Rico was at a point that was even more economically and politically dependent on the U.S. than when the U.S. first entered.

\textbf{U.S. Control- Operation Bootstrap}

In 1948, it was considered time to move away from an agricultural-based economy to an industrial one. In order to develop Puerto Rico’s economy as well as bring modern infrastructure to the island, the U.S. in collaboration with the newly elected
Puerto Rican government began Operation Bootstrap, an export-led industrialization program. The main strategies of attracting U.S. capital to Puerto Rico were tax-incentives, cheap labor and duty-free exports that would make it much more cost-effective to produce goods outside of the mainland. The first industry to come in was petroleum refining, despite the fact that Puerto Rico did not have any petroleum to be extracted. It was hoped however, that factories for oil-related products would be attracted to the island, resulting in a “diversified” economy. Although the petroleum industry was capital-intensive, it was also labor-intensive, which ended up causing this industry to move to even cheaper labor markets.

In terms of the pharmaceutical industry, several sources date the first factory back to 1957. However, it was not until 1976 that the industry really began to take off with the introduction of the Federal Tax Law Section 936 that exempted federal corporate income taxes for firms located in Puerto Rico. Puerto Ricans viewed the industry as modern, high technology, non-labor intensive and well-paying. This perception of the industry as well as the social programs and developments created an overall acceptance of the industrial transition. A sister program called, Operation Serenity, that was created along side Operation Bootstrap set out to promote Puerto Rican culture, identity and traditions. Public health and housing were also improved through the eradication of
parasitic diseases resulting from extreme poverty, such as malaria and dysentery, and stronger concrete homes that could withstand hurricanes.  

While the overall development programs were carried out in collaboration with the Puerto Rican government and did provide social programs, the prolonged industrial nature of Puerto Rico’s economy is outdated. Such industrialization methods were also of their time period, so it is difficult to place full blame on the U.S. government or Operation Bootstrap. However, as evidence of environmental degradation as well as social and economic shortcoming began to accumulate, little was done to prevent such issues. Looking back at Puerto Rico’s history, it is now clear that the industries used to boost the economy and help the people were imperfect fits that exploited the environment and used outside resources, mainly to meet foreign needs rather than those of the local communities.

104 Ibid., 55-57.
105 Ibid., 57.
Chapter 3: Will a Service Economy Suffice?

By analyzing Operation Bootstrap’s short- and long-term effects on the Puerto Rican economy as well as the pharmaceutical sector’s current state in the economy, this chapter discusses the shortcomings of basic economic theories and introduces environmentally sustainable industries that use the island’s own resources.

Economic Analysis of Operation Bootstrap

Initially Operation Bootstrap did create a boom in the economy and did create jobs; however, the economy itself benefited to a much lesser degree than the industries benefited and the jobs created were limited to only a portion of the population. By the 1950s, Puerto Rico had the highest average income in Latin America that lasted until the early 1970s.106 Social mobility and power were increased for some, meaning that the gap between the rich and the poor majority was also increased.107 In order to alleviate poverty, the federal government spent nearly $6 billion in federal welfare annually.108 At the same time, there were massive migrations of Puerto Ricans to the U.S. in search of jobs, representing the largest migration of Latin Americans to the U.S. at the time.109 More than 40,000 Puerto Ricans migrated to New York City in 1946 alone and by 1960, more than one million were in the states.110 Ironically, many young people went to the U.S. for agricultural work via the government-sponsored migration program, while agriculture was being phased out of the economy in Puerto Rico.111 Overall, there were more people abandoning the island than there were new jobs being created.

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107 Ibid., 250.
108 Ibid.
109 Ibid., 63.
110 Ibid., 81.
The perception of an influx of well-paying manufacturing jobs in cities as well as the move away from agriculture, created urban shantytowns filled with unemployed rural poor. Unemployment among Puerto Ricans ages sixteen and over increased steeply after a 5.5 percent low to a 15 percent high in 1980 and then to 20 percent in 1990.\textsuperscript{112} The combination of limited jobs and federal welfare encouraged this environment of unemployment.\textsuperscript{113} Today these impoverished urban areas still exist, where rising crime rates and illegal drug trade have accounted for much of the publicity surrounding Puerto Rico.

In terms of the pharmaceutical industry, many of the jobs created required higher educational levels than the local people had, especially in towns like Barceloneta. As a result, the factories hired people from more developed cities rather than the local communities.\textsuperscript{114} The companies were also making massive profits while the workers were making modest wages. In 1985, for every $30,300 drug companies paid in salary and benefits to a Puerto Rican worker, they received $85,600 in federal tax benefits.\textsuperscript{115} Between 1980 and 1999, Johnson & Johnson saved $1 billion in federal taxes for its 4,000 workers in Puerto Rico, Smith-Kline Beecham saved $987 million, and Merck & Company saved $749 million.\textsuperscript{116} Overall, four out of every ten dollars made on the island ended up in U.S. firms.\textsuperscript{117} When more money is flowing to outside companies rather than to the hands of the people or the government through taxes, the economy will surely

\textsuperscript{113} Alexa Dietrich, \textit{The Drug Company Next Door: Pollution, Jobs, and Community Health in Puerto Rico} (New York: New York University, 2013), 52.
\textsuperscript{114} Alexa Dietrich, \textit{The Drug Company Next Door: Pollution, Jobs, and Community Health in Puerto Rico} (New York: New York University, 2013), 72.
\textsuperscript{116} Ibid.
\textsuperscript{117} Ibid.
suffer. Restoring the economy and closing the budget deficit remain the central concerns of the Puerto Rican government today.\textsuperscript{118}

**Current State of the Pharmaceutical Sector**

Although the pharmaceutical industry continues to lead the manufacturing sector, it has faced several challenges in recent years and certain indicators suggest that it might be on its way out of Puerto Rico. In 2005, Section 936 tax incentives completely expired for firms in Puerto Rico.\textsuperscript{119} While the expiration affected some pharmaceutical companies, many were able to apply for a new tax code for foreign countries in 2008. Since Puerto Rico is categorized as a foreign country for federal corporate tax purposes, new or old companies on the island are able to enjoy no federal tax and 2 to 7 percent of the local corporate income tax by applying as a Controlled Foreign Company (CFC).\textsuperscript{120} While these maintained tax incentives have definitely helped the industry remain strong in Puerto Rico, it is questionable if these tax incentives will continue to apply to the island in the future. If not, will pharmaceuticals remain a dedicated partner?

Another issue has to do with the duration of drug patents. Once patents expire, any pharmaceutical company can manufacture the medication as a generic drug anywhere in the world.\textsuperscript{121} Since labor and other costs are now cheaper in other countries like India and China, patent expirations threaten the viability of the companies.\textsuperscript{122} It is estimated that the pharmaceutical industry in Puerto Rico will lose billions in sales due to the


\textsuperscript{120} Ibid., 149.

\textsuperscript{121} Ángel Collado-Schwarz, *Decolonization Models for America’s Last Colony: Puerto Rico*, (Syracuse: Syracuse University Press, 2012), 225.

expiration of patents on medicines. Furthermore, 31,000 manufacturing jobs have been lost since the beginning of 2006. Given that the pharmaceutical industry has been declining in recent years and represents a negative industry for the environment and public health, it would be in Puerto Rico’s best interest to diversify its economy especially with more sustainable industries.

Beyond Services

In order to revive the economy, move away from a manufacturing-based economy, and most importantly, create an economy that generates self-sufficiency both monetarily and ecologically, economic strategies must go beyond the typical shift to a service economy. Puerto Rico has been slowly moving towards a service economy with prospering banking, financial, consulting, legal, accounting, marketing, insurance and tourism services. According to economic growth and development theories, the most commonly observed shift in developing economies throughout the world has been from an initial agricultural economy to a manufacturing economy to a final service economy. According to this theory, environmental degradation is the highest during the manufacturing phase but is halted when a service economy is achieved since pollution and environmental destruction is not associated with service industries. Incorporating the environmental Kutznets curve into this theory enforces that when average income reaches a certain point, which service-based jobs are suppose to facilitate, environmental quality will improve because wealthier people have a greater demand for it. This demand can

translate to the basic economic term of “willingness to pay” but also overall standards and concerns for environmental quality.

These economic theories help explain general trends when looking at the economic histories of individual nations as well as when comparing developed nations to developing ones, but there are also many factors that are left out that cannot explain all environmental issues. Such theories are easily applied to pollution from manufacturing plants since pollutants decrease as a service economy takes over a manufacturing one. People with higher education and income will also demand that remaining factories develop pollution abatement measures. However, as income rises so does consumption, displacing manufacturing consequences to other developing nations. These theories also are quite difficult to apply to the overall sustainability, ecological health and self-sufficiency of a nation.

Green Industries Fit Puerto Rico

While it is beneficial that Puerto Rico is moving towards a service economy, specific industries that directly serve the people and preserve the environment should be incorporated into the island’s shifting economy. Industries that Puerto Rico is currently
turning to that encompass such goals include sustainable tourism, renewable energy, and agriculture. There is growing effort to boost Puerto Rico’s tourism industry, especially eco-, agro-, and community-based tourism. Renewable energy, primarily solar energy, has been realized, although economic and political factors still prevent it from fully expanding. And an agricultural movement has been taking off as people are trying to revive their agricultural past.

The amount tourism has been contributing to the economy and the efforts Puerto Rico’s tourism company has been making towards sustainable tourism have been growing in recent years. Technically, tourism counts as a service industry but its connection to both the natural and built environment as well as local communities sets it apart from other service industries. Its direct contribution to the GDP is modest at 2.3 percent and its total contribution is 7 percent.\textsuperscript{127} The total contribution accounts for direct economic flows to hotels, travel agents, airlines, restaurants and leisure industries directly supported by tourists as well as indirect contributions such as investment spending, and government spending on marketing or resort area security and sanitation.\textsuperscript{128} The number of jobs tourism has been creating is even more praise-worthy. In 2013, direct employment amounted to 19,000 jobs and total employment reached 80,000 jobs in 2014, up from 65,000 in 2000.\textsuperscript{129} These numbers surpass current manufacturing jobs, which have dropped from 143,000 jobs in 2000 to 74,000 jobs in 2014.\textsuperscript{130}

While travel and tourism is often viewed as an excessive and wasteful industry that destroys habitats through resort construction and outdoor activities, it can be an


\textsuperscript{128} Ibid.


\textsuperscript{130} Ibid.
industry that helps preserve and educate about the environment. The Puerto Rico Tourism Company, which is a government-owned corporation in charge of tourism matters and regulations in Puerto Rico is currently working towards sustainable tourism, which they define as making a “low impact on the environment and local culture, while helping to generate income, employment, and the conservation of local ecosystems.” They are currently working to create an Office of Sustainable Tourism of Puerto Rico with a clear Environmental Tourism Policy that would outline strict ecological guidelines to conserve natural resources and biological diversity. The tourism company has already adopted a few certificate and standard systems including the Green Globe 21 International Ecotourism Society Course and the Blue Flag International Recognition of Excellence for beaches. Green Globe 21 is a benchmark system that the company offers to tourism industries like hotels to reach sustainability goals and Blue Flag offers a system that the tourism company can use to work with beaches to reach certain standards like water quality, and environmental management and education.

Overall, Puerto Rico has been making positive strides in their tourism industry. The industry is naturally fit for a tropical island and gives Puerto Rico the opportunity to celebrate and share its ecological and cultural wonders. While there are many mega-resorts in Puerto Rico that do not contribute to sustainability goals, the following chapter on sustainable business will focus on small-scale eco-hotels and entrepreneurial tourism ventures.

Another industry that is naturally fit for Puerto Rico and has been gaining some advancements in recent years, is solar energy. Puerto Rico is sunny year round and has

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132 Ibid.
133 Ibid.
short nights, while the sun provides a clean, renewable, and inexhaustible source of energy. However, instead of taking advantage of this natural resource, Puerto Rico pays astronomical rates for imported fossil fuels, which make up 98 percent of the energy used. Residential, commercial and industrial electric costs are roughly double electric rates in the states. Currently 68 percent of the total energy comes from oil, 15 percent from natural gas, 15 percent from coal, and 2 percent from hydroelectric power. Therefore, solar power is not even ranking in the total energy used.

Nevertheless, there has been legislation for renewable energy, solar power projects, and studies for projects in many other areas. In 2010, the Puerto Rican government enacted Act 82-Puerto Rico Energy Diversification Policy through Sustainable and Alternative Renewable Energy Act, which created a $290 million Green Energy Fund, tax benefits, renewable energy credits, and a renewable portfolio standard. The latter requires energy providers to meet certain percentages of renewable energy every few years. Currently there are two large-scale photovoltaic (PV) projects on the island that began in 2010 as well. One is in Guayama in the Southeastern Coast of the island and the other is in Salinas, the municipality directly west of Guayama. They both use a power purchase agreement (PPA), which allows them to sell the energy produced to Puerto Rico’s Electric Power Authority (PREPA).


Ibid.

The National Renewable Energy Laboratory (NREL), under the U.S. Department of Energy, also carried out a solar power study in various locations in Puerto Rico. The study tested the feasibility of the economics and performance of solar photovoltaics on several landfill sites awaiting closure under the Resource Conservation Recovery Act (RCRA). \(^\text{141}\) Closed landfills would be ideal for PV installation since they cannot be reused for many other purposes due to contamination. There is also very little shade cover on these landfills so new vegetation and habitats would not have to be cleared. The only concern is that they must be capped properly so that contaminants would not threaten workers on the sites. Eight landfills were included in this study and there are 30 landfills in total on the island, all of adequate solar availability but not all scheduled to close soon. \(^\text{142}\) Furthermore, since landfills are owned by municipalities and a PPA would be set up with PREPA, revenue would flow directly back to the municipality. \(^\text{143}\)

Although solar power seems promising in Puerto Rico, economic concerns and a maintained dependence on fossil fuels prevents solar power from reaching full potential. The NREL feasibility study estimated that it would take between 6 to 31 years, depending on many factors, for the projects to pay for themselves. \(^\text{144}\) Pressure from the fossil fuel industry as well as preconceived notions that fossil fuels are more economically efficient also perpetuate its use in Puerto Rico. In 2011, a natural gas pipeline was planned to be constructed along forested mountain regions on the island, although Puerto Rico does not have any reserves of the fuel. Not only was it ecologically

\(^{141}\) Ibid., 1.
\(^{142}\) Ibid., 8-9.
\(^{143}\) Ibid., 1.
\(^{144}\) Ibid., 15-36.

The last sustainable industry to be discussed goes back to a reoccurring topic throughout this thesis: agriculture. As formerly mentioned, an island that was once self-sufficient in its food supply has become a place that imports 80 percent of its food mainly from the U.S., China, the Dominican Republic and Costa Rica.\footnote{Héctor Monclova Vázquez, “Can Puerto Rico Revive Agriculture?,” Caribbean Business, May 1, 2014, http://www.caribbeanbusinesspr.com/prnt_ed/can-puerto-rico-revive-agriculture-9833.html.} Agriculture only makes up 1 percent of the GDP and the main contributors are livestock and dairy farms.\footnote{Agency, C. Fund, W., & International, C, “Puerto Rico,” The Encyclopedia of Earth, 2012, http://www.eoearth.org/view/article/51cbebf7896bb431f699fc3.} One problem is the lack of a labor force that can be partly attributed to the widespread welfare availability. Another problem goes back to U.S. shipping restrictions that require Puerto Rico to use U.S. maritime transport, which makes it very expensive to export foodstuff, including some of the most reputable coffee and mangoes in the world.\footnote{Ángel Collado-Schwarz, Decolonization Models for America’s Last Colony: Puerto Rico, (Syracuse: Syracuse University Press, 2012), 189.} Puerto Rican coffee was once served in fine-dining restaurants in Europe but because of its history alongside sugarcane dominance as well as trade issues, the supply out of the island has been minimal. A large portion of the 32.5 billion pounds of coffee consumed in Puerto Rico per year is even imported from other countries since only around half of that amount is being grown in Puerto Rico.\footnote{Ibid., 196.}

Puerto Rico’s Department of Agriculture and other experts in agriculture predict that with the right policy the island is capable of producing 90 percent of food in the long-term, and 40 to 50 percent in the short-term because of favorable agricultural
With programs initiated by the Agriculture Secretary Myrna Comas Pagán as well as a local food movement, Puerto Rico is finally reviving its agriculture sector. A few of the initiatives include an investment program in technology such as aquaponics and the adoption of a high-tech geospatial information systems program that analyzes geographical data like soil types and climate in different regions of the island to pinpoint ideal growing locations for different crops from fruits to tomatoes to plantains. The programs then work directly with farmers to make use of such technology. If Puerto Rico can achieve a prosperous agriculture sector, it is estimated that 85,000 new jobs could be created, the $3.5 billion currently spent on imports could stay in the economy, and $7 billion could be generated for the economy from growing and selling local food. A local food movement among the people has also been growing in recent years and individual initiatives and businesses will be explored in the next chapter on sustainable business.

Conclusion

These three industries – sustainable tourism, solar power and agriculture – offer key examples of what Puerto Rico will need to protect the environment, boost the economy, become self-sufficient, and directly serve the people. One of the main issues with the objectives of manufacturing or service economies, and economic goals in general, it that they aim to raise economic indicators like GDP before anything else. However, raising the GDP often does not translate to overall social welfare. As a result, economies with high unemployment and degraded environments are created. Therefore, these three industries provide examples of broadening the common ideas of economic

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151 Ibid.
152 Ibid.
growth. By analyzing the root causes of problems, the needs of the people and the
environment, and the resources that are naturally abundant to a country, economic
development could be much more sustainable and successful.

Chapter 4: Bottom-Up: Sustainable Business in Puerto Rico

The economic development strategies in Puerto Rico spearheaded by the U.S.
federal government provided little support for the makings a strong entrepreneurial class. Therefore, Puerto Rico has been slow to develop “native intellectual capital related to Puerto Rican-owned business and ownership of innovation.” Furthermore, many college graduates and educated people leave the island for better opportunities in the states or other countries. The need for entrepreneurs to stay on the island to create businesses that are owned by the local people rather than multinational corporations is great and has not gone unrecognized in recent years. The Puerto Rican Economic Development Bank has made strides to finance small- and medium-sized businesses and the Department of Economic Development and Commerce offers a wide array of entrepreneurial tools such as incentives and business education to help people start their own businesses. This chapter will specifically explore entrepreneurial ventures in sustainable business, focusing on sustainable tourism and agriculture.

First, sustainable business must be defined and distinguished from business strategies like greening or corporate social responsibility. The latter two strategies often seek to make incremental changes that benefit society in minuscule ways while

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publicizing their efforts as much more. Basic greening efforts include recycling, end-of-the-pipe pollution control, or going paperless. Corporate social responsibility schemes often involve carrying out business as usual with separate philanthropy initiatives that usually have nothing to do with the company itself. For example, the pharmaceutical companies of Barceloneta have organized beach cleanups for their employees to pick up tangible trash on beaches and walks to raise money for the American Cancer Society.\footnote{Alexa Dietrich, \textit{The Drug Company Next Door: Pollution, Jobs, and Community Health in Puerto Rico} (New York: New York University, 2013), 96-98.} However, in no way do these kinds of beach cleanups solve the pharmaceutical pollution problem. And proceeds for cancer research, or simply drug-industry medications, are often collected from regular community members.\footnote{Stuart L. Hart, \textit{Capitalism at Crossroads: Next Generation Business Strategies for a Post-Crisis World} (Upper Saddle River, NJ: Wharton School Publishing, 2010).} Overall, the goals of these community-based initiatives are to disguise the true pollution that the pharmaceutical companies are causing rather than to serve the true needs of the community.

Authentic sustainable business differs dramatically and the core of the business is often aimed towards transformative benefits for society. It is often defined as business that strives to meet the triple bottom line, which is comprised of people, planet and profit. In terms of people, a sustainable business might create new markets that perhaps do not currently benefit from the global economy by utilizing skills of local people. In this way, new industries are created with formerly marginalized people as the core of the business. The poor are viewed as innovative partners rather than workers or consumers that can be exploited.\footnote{By involving input from the local community, local needs such as environmental quality, health, employment or education can be more easily incorporated into the business core. Business will also become more permanent and successful in a
specific location if they are wholeheartedly supported by the community. These strategies of directly involving people represent a bottom-up approach rather than a top-bottom approach because the people are a part of making the business a success. Top-bottom approaches such as bringing multinational corporations into impoverished areas in hopes of creating a monetary trickle-down effect, pursue the opposite goals and often will not spread wealth throughout a community.

In terms of planet, true sustainable businesses should work harmoniously with the surrounding environment, being sure not to pollute it, to preserve it, to make it healthier than when the business first arrived, and to educate the community and customers about it. The business should use renewable energy to power its buildings and processes, prevent waste, and use materials from reused or ecologically sound sources.

A few small-scale hotels in Puerto Rico have been striving for such standards. For example, Casa Sol in San Juan is a restored colonial style eighteenth century building that was restored from reused materials salvaged from other properties in Old San Juan. It employs waste reduction, recycling, electric and water conservation methods, and also supports local growers and businesses. Another hotel called the Hix Island House located in Vieques, one of Puerto Rico’s smaller islands, is located on a 13-acre natural refuge and its swimming pools, fountains and pumps are directly powered by solar energy. Solar energy also supplements electricity for the building and hot water. Water used inside is recycled for fruit-bearing plants on the property. Hotels also provide jobs for the local community. Unemployed people who may not have qualifications for other industries may do well in the hospitality industry and thus be introduced to an industry

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159 Ibid.
they can gain experience from. In terms of ecotourism sites that are protected and offered as a place for tourists to enjoy include Humacao’s Natural Reserve, Guayama’s Las Limas Butterfly Ranch, El Yunque Rainforest, and Bioluminescent Bay Tours that are mainly carried out by canoe except for a few electric pontoon boats in order to prevent polluting the ecosystem.\textsuperscript{160}

In terms of agriculture, a combination of farmers, chefs and food suppliers are coming together for the local food movement in Puerto Rico. A family-owned coffee farm and company in the mountain valley of Juyua has been working Hacienda San Pedro Coffee Company for four generations and is finally in the works of introducing their coffee to the tourist hub of San Juan. Rebecca Atienza, a member of the family, is currently in the works of creating two Hacienda San Pedro cafes in the city and introducing their brand to local restaurants that may have only served imported coffee.\textsuperscript{161}

El Departamento de La Comida is a pioneering “farm-to-tote bag” market in San Juan that sells extremely fresh produce and prepared food made from the produce. It started out four and a half years ago just as a produce-selling van with the two entrepreneurs, Tara Rodríguez Besosa and Olga Casellas Badillo. When demand exploded, they bought out a warehouse space to create their market that is supplied completely by privately owned gardens and small farms. It provides a wide array of fruits and vegetables like zucchini, broccoli, carrots, okra and fresh herbs, offering people very fresh and healthy food that goes beyond the typical plantain, rice and beans diet.\textsuperscript{162} Restaurants and chefs have also been trying to get their hands on fresh produce. San Juan restaurants like Parcela


\textsuperscript{162} Ibid.
Gastropub, La Jaquita Baya, Santealla, Marmalade and Jose Enrique all represent farm-to-table dining. Rather than having a fixed menu with fixed ingredients that would most likely be imported, the menus in these restaurants change everyday depending on what produce, herbs, fish and meat are available that day. One Puerto Rican farm-to-table chef had even ranked among the top chefs of the Food & Wine magazine’s 2013 ranking.\textsuperscript{163} Agriculture and the food industry in Puerto Rico represent a perfect fit for the island as people are willing to make use of crops that grow in abundance. The local food movement will also result in tremendous benefits such as reducing the huge ecological footprint from importing food and food security for the people of Puerto Rico.

**Conclusion: Policy Recommendations for a Sustainable Puerto Rico**

This thesis has touched upon various problems, many interconnected in some way and many stemming from Puerto Rico’s history. It is clear that the environment, people and economy are still struggling with many issues but many projects and initiatives offer hope. Taking into account the direction Puerto Rico is headed in terms of sustainable industries and self-sufficiency, this concluding chapter offers a few additional policies and recommendations that can be implemented to assist in Puerto Rico’s sustainable future.

**Pharmaceutical Industry**

First, the pharmaceutical industry is in need of much regulation and change. Addressing the problem of pharmaceutical pollution should primarily be based on the design and production of drugs. Green chemistry and personalized medicine are two

\textsuperscript{163} Ibid.
strategies pharmaceuticals could adopt. New advancements and research in green chemistry could design drugs to be biodegradable or at least reduced in environmental persistence. Personalized medicine, known as “pharmacogenetics,” customizes drugs and dosage to the individual patient. Since not all medications are suitable for everyone, prescription trials often take place, contributing to the over prescription and overconsumption of drugs. Creating custom drugs would help reduce the overproduction of drugs, which is a factor in pharmaceutical pollution. Not only would this lessen environmental issues, but it would also create better medications for individuals. FDA approval processes could better consider environmental impacts and encourage or require certain green chemistry and pharmacogenetics methods.

Secondly, more frequent and advanced tests need to be carried out in groundwater, coastal waters, land, air and wildlife in suspected polluted areas in Puerto Rico. Little data on specific chemicals in the environment is currently available to the public. Field studies that investigate the impacts of discharges as well as comprehensive chemical characterization would initiate change and cleanup to occur. Once this necessary information is known, effective treatment technology can be developed. Since the treatment plants are most likely not treating such hazardous wastes, it is vital that this technology is improved. However, as stated above, it would be more ideal for hazardous chemicals to be prevented or lessened in the first place.

Tourism

In terms of sustainable tourism, Puerto Rico’s Tourism Company has been making great efforts. However, large-scale resorts that clear land and destroy habitats are still being constructed. Perhaps when the company does come up with their
environmental policy, restrictions on new hotels can be implemented. For example, new land should not be cleared for hotels and other tourism industries like golf ranges, there should be an adequate distance between hotels and coasts, and incentives should be given for implementing green design features. Perhaps the company could partner with a green architecture firm to further development in energy and water usage in hotels. Overall, continuing to boost this industry would create long-term green jobs, help the economy, and raise awareness about what Puerto Rico has to offer and protect both environmentally and culturally.

Solar Energy

While two utility-scale solar plants have been constructed, feasibility studies carried out, and legislation for solar incentives passed, solar energy still remains a grossly underused resource. The main challenge that prevents renewable energy from expanding is cost. The government has a huge debt right now and holds back from spending on renewable energy. However, the government is also paying astronomical rates to import fossil fuels. By partnering with solar companies and insurance providers, the immediate cost of solar projects for the government can be cut. For example, the completed utility-scale plant in Guayama was financed by MetLife through construction loans, term loans, and tax equity non-resource financing facilities. The solar company AES Ilumina that partnered with Puerto Rico’s Department of Economic Development and Commerce helped make the financing possible but also benefitted from the economic incentives under the Energy Diversification Act. Therefore, by continuing to work with quality solar companies, Puerto Rico can expand large-scale solar plants.
On the smaller-scale, such as on residential and commercial properties, incentives by the new act also apply. While funding is a problem on the smaller-scale as well, awareness of the incentives is also an issue. If home and business owners do not know about the benefits they can receive from installing solar panels, they will shy away from the expensive investment. Not only can owners receive tax exemptions and credits, but they can also sell excess energy back to the grid for a profit. Partnering with solar panel installment companies, and creating a marketing and sales team to educate home and business owners about the benefits should become a key priority for the Department of Economic Development and Commerce in moving forward with small-scale solar power.

Solar energy in Puerto Rico not only makes sense, but it is necessary for the health of the island’s environment, economy, energy security and the planet overall. Switching to solar energy from fossil fuels would protect the local environment from the burning and transporting of fossil fuels in Puerto Rico. It would reduce electricity costs for the people as well as importation costs of fossil fuels for the government, while generating profits. Green and long-term jobs would be created through research, installment and maintenance, creating a new economic sector. Engineers often flocking to pharmaceuticals or even out of the country would have a new local field to work in. Advancement of solar energy in Puerto Rico would also contribute to global climate change initiatives. Being a small island that is more sensitive to the consequences of climate change such as rising sea levels and increased severity and frequency of hurricanes, Puerto Rico should act in its own interest to move towards a solar power-based island as soon as possible.

Agriculture
As mentioned in chapters three and four, Puerto Rico is aware that they are in need of a major agricultural revival. So far legislation to incentivize farmers has been passed and technology such as aquaponics is being encouraged. Farmers receive full tax exemption on property taxes and agricultural equipment, 90 percent exemption on earning contribution, and annual bonuses. These policies will help farmers to be more profitable as well as attract more people to work in agriculture. Other helpful policies could incentivize property conversion, sustainable technology, and local food in markets, restaurants and hotels. Landowners with enough acreage can be encouraged to convert open land into farmland through tax credits. Tax exemption on equipment should include sustainable technologies like hydroponics and drip irrigation. And markets, both large supermarkets and small outdoor markets, restaurants and hotels should be subsidized per pound of local food purchased. According to basic economics, the supply of local food should increase when the demand is increased. Apart from incentives, a governmental program focused on education and youth can be developed to teach children about growing their own food through the curriculum as well as through afterschool programs. Much of the youth leaving high school without college or career plans would benefit greatly from a program like this.

Developing agriculture is extremely important in Puerto Rico, especially with current global food security issues. Depending on other countries for food is risky since supply could be cut if the particular country faces drought, crop failure, social instability, etc. Importing food is also unsustainable due to the huge carbon footprint created by transporting food over long distances as well as industrial farming practices in the top two exporting countries, the U.S. and China. Puerto Rico needs to be able to feed its own
population now to prepare for any future instability as well as to be environmentally sustainable.

Overall, Puerto Rico’s economy dominated by the pharmaceutical industry is unhealthy for both the people and the environment, and is in need of green industries that will provide for the people and conserve the rich biodiversity. While boosting the economy and lessening the public debt are currently the government’s main priorities, focusing on self-sufficiency and sustainable local industries can achieve such goals and more. Regulating the pharmaceutical industry and restoring the polluted environment due to pharmaceuticals as well as other industries should be tended to in order to move on to new industries. Next, looking to inherent industries such as tourism, solar power and agriculture will create self-sufficiency, boost the economy and work harmoniously with the environment to conserve it.
Bibliography


http://www.prepa.com/AEEES2_ENG.ASP.


