

How to Feed Brazil

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The world's population has grown larger and at a faster rate in the last century than it has in all of human history. In fact, the global population is projected to reach 9 billion people by 2050 ("Growing at a Slower Pace"). While this is a global issue, this paper focuses on specifics of how to feed Brazil. By focusing on the efforts of the largest country in South America, these efforts can have tremendous impacts on the rest of the continent, including potential resources and ideas. In order to feed Brazil's growing population, issues in their infrastructure, their government, and overall food waste must be addressed.

BACKGROUND

BRAZILIAN DEMOGRAPHICS AND SETTING

Demographics

Brazil occupies over half of South America and is the 5th largest country in the world by area. As of 2020, its population exceeded 211,817,000 people, making it the fifth most populous country on Earth. Brazil has a growing population, meaning that the majority of its population is young (**Figure 1**). In fact, it is projected to have its population grow until at least 2050 due to a number of factors including immigration ("South"). Additionally, in recent years Brazil has become more modernized, this has resulted in the population living longer. This modernization

and prolonged life have also contributed to a slight decline in the birth rate, specifically because women now have access to education, contraception, and better healthcare.

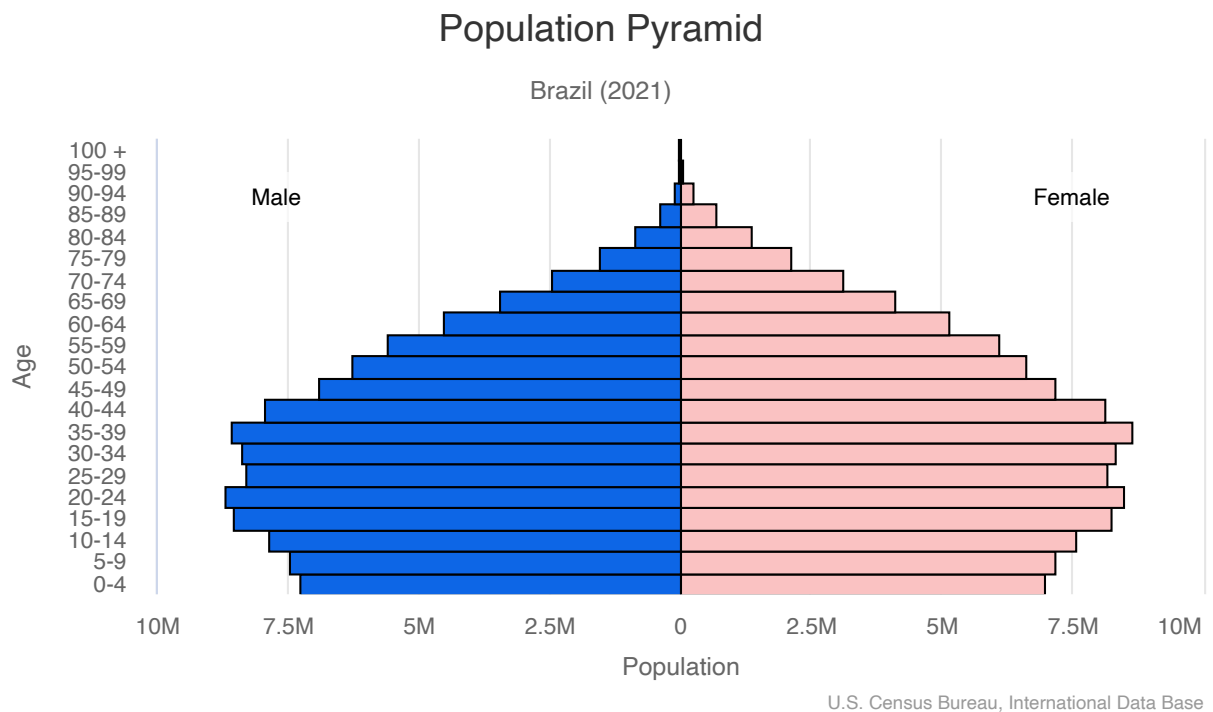


Figure 1. Population Pyramid of Brazil for 2021. (“South”)

Geography

Geographically, it contains a wide variety of landscapes from tropical wetlands, mountains, savannahs, and the rain forest (Poppino). It also experiences a wide range of climates. In fact, Brazil has five climactic regions including: equatorial, tropical, semiarid, subtropical, and highland tropical (Hudson 98). Its diverse climates and geographic regions, booming cities, hydroelectric and industrial complexes, and mining industry makes Brazil one of the world’s largest economies (Poppino). However, poverty and food insecurity still affect a large percentage of the population.

Where people live

As of July 2020, 85% of Brazilians lived in cities. The largest of these cities, by far, is São Paulo with over 12.3 million inhabitants (“São Paulo”). São Paulo, as well as the next four largest cities Rio de Janeiro, Brasília, Salvador and Fortaleza, all contain numerous *favelas* where many of the food insecure people live. These cities are highlighted on the map below (Figure 2).



Figure 2. Map of Brazil with five largest cities. Geology.com

Brazil contains around 60% of the Amazon Rainforest. Today there are approximately 24 million people living in this region of Brazil, hundreds of thousands of which are indigenous (“Brazil and the Amazon”). This is one of the most biodiverse regions of the world and is home to 10% of all plant and animal species on Earth (“Brazil and the Amazon”). One of the major cities in the Amazon is Manaus and contains over 1.6 million people (Figure 3). In recent years,

there has been oil discovered which has led to the expansion of the Amazon highway network (“Manaus”). The rest of the country consists of a semi-arid region and temperate regions, typically referred to as the “interior”. Since 85% of Brazilians live in cities, the rest of country is fairly sparsely populated. The interior region is home to many of the poorest, and most food insecure people in Brazil. The term “interior” mainly refers to places away from the coast.



Figure 3. Map of Amazon. Brazil Travel Guide.

HOW MUCH FOOD BRAZIL NEEDS

In order to feed Brazil’s current population of nearly 213 million people there has to be an analysis of how many total calories are needed daily per person and this number of calories must then be multiplied by the amount of people. The USDA recommends that a healthy adult consume about 2,000 calories per day (“U.S. Department of Agriculture”) which directly correlates with the average number of calories a healthy adult already consumes in Brazil which is 1,929-2,334 cal/day (Duffrey). This number of course varies with a person’s gender and level of daily activity. Children at 12 months are recommended to have 800, at 15 months they are to have 900 (for males), and they will need 1,000 calories from 18 months until age 4. After progressively increasing their caloric intake each year, by 13 a child has the same caloric needs

as an adult. **Table 1** and **Table 2** shows the breakdown of each age, gender, and their necessary caloric intake.

Table 1. Average recommended caloric intake in children under 2 years old

Age in Months	Males	Females
12	800	800
15	900	800
18	1000	900
21-23	1000	1000

Table 2. Average recommended caloric intake in people over 2 years old

Age	Males (Sedentary)	Males (Moderately Active)	Males (Active)	Females (Sedentary)	Females (Moderately Active)	Females (Active)
2	1000	1000	1000	1000	1000	1000
3	1000	1400	1400	1000	1200	1400
4	1200	1400	1600	1200	1400	1400
5	1200	1400	1600	1200	1400	1600
6	1400	1600	1800	1200	1400	1600
7	1400	1600	1800	1200	1600	1800
8	1400	1600	2000	1400	1600	1800
9	1600	1800	2000	1400	1600	1800

10	1600	1800	2200	1400	1800	2000
11	1800	2000	2200	1600	1800	2000
12	1800	2200	2400	1600	2000	2000
13	2000	2200	2600	1600	2000	2200
14	2000	2400	2800	1800	2000	2400
15	2200	2600	3000	1800	2000	2400
16	2400	2800	3200	1800	2000	2400
17	2400	2800	3200	1800	2000	2400
18	2400	2800	3200	1800	2000	2400
19-20	2600	2800	3000	2000	2200	2400
21-25	2400	2800	3000	2000	2000	2400
26-30	2400	2600	3000	1800	2000	2400
31-35	2400	2600	3000	1800	2000	2200
36-40	2400	2600	2800	1800	2000	2200
41-45	2200	2600	2800	1800	2000	2200
46-50	2200	2400	2800	1800	2000	2200
51-55	2200	2400	2800	1600	1800	2200
56-60	2200	2400	2600	1600	1800	2200
61-65	2000	2400	2600	1600	1800	2000
66-70	2000	2200	2600	1600	1800	2000
71-75	2000	2200	2600	1600	1800	2000

76	2000	2200	2400	1600	1800	2000
and						
up						

There is a major difference between getting enough calories and getting sufficient nutrients. This distinction plays a significant role in feeding the world. Brazil is the world's largest producer of sugarcane. About 9.1 million hectares were cultivated in 2016 and 2017, used primarily for bioethanol (Bordonal). If the solution were just a matter of getting enough calories, Brazilians could just live on 2,000 calories of sugarcane. This solution is not sustainable from a human health perspective. Therefore, Brazil's plan for feeding its population has to guarantee proper nutrition. According to the USDA's most recent dietary guidelines, a healthy adult's diet should consist of vegetables including dark-green vegetables, red and orange vegetables, beans, peas, and lentils, and starchy vegetables. It should also consist of fruits and grains, including mostly whole grains and some (or no) refined grains. Finally, there should be dairy and fortified soy alternatives, as well as proteins, including meats, poultry, eggs, seafoods, nuts, seeds, and soy products. Oils are also a part of the recommended dietary guidelines; however, it is recommended not to eat saturated fats. Oils are naturally present in foods like nuts and avocados. The recommended daily amounts of each food group per calorie intake can be seen in **Table 3**.

	1,000	1,200	1,400	1,600	1,800	2,000	2,200	2,400	2,600	2,800	3,000	3,200
	cals	cals	cals	cals	cals	cals	cals	cals	cals	cals	cals	cals
Vegetables												
(cup/day)	1	1.5	1.5	2	2.5	2.5	3	3	3.5	3.5	4	4

Fruits												
(cup/day)	1	1	1.5	1.5	1.5	2	2	2	2	2.5	2.5	2.5
Grains												
(ounce/day)	3	4	5	5	6	6	7	8	9	10	10	10
Dairy												
(cup/day)	2	2.5	2.5	3	3	3	3	3	3	3	3	3
Protein												
Foods												
(ounce/day)	2	3	4	5	5	5.5	6	6.5	6.5	7	7	7
Oils												
(grams/day)	15	17	17	22	24	27	29	31	34	36	44	51

Table 3. Recommended daily amounts of foods per caloric intake by food group

WHAT BRAZIL CURRENTLY PRODUCES

Brazil has a large agricultural sector due in part because the country spans a wide range of ecosystems that are favorable for agricultural productions. While it excels in the production of grains, beans, and oilseeds, the number one agricultural product is soybeans, which in 2020/2021 reached nearly 134 million metric tons produced. Brazil uses these soybeans primarily for alternative protein sources for humans, and soybean meal is used for livestock feed (Alves). It also produces over 665 million metric tons of sugarcane, primarily in the State of São Paulo, over 98 million metric tons of corn, over 61 million 60-kg bags of coffee, 12 million 218-kg bales of cotton, and over 17 million metric tons of oranges (Alves). It is important to note that while half of the main agricultural products are non-essential foods or non-food items, the money

that is made from the production and exportation of these products is used to import foods such as wheat, fresh and processed vegetables, and dairy products (“U.S Agriculture Export Opportunities in Brazil”). Brazil also has a strong livestock agricultural segment. While it has a fairly large cattle market, with 32 million cows slaughtered in 2019, the largest livestock segment is poultry. In 2019, Brazil slaughtered almost six billion broiler chickens (Alves). With this information, it is clear that Brazil has the potential to feed its population, or at least to provide residents with more than enough protein since beef and chicken provide about 7 grams of protein per ounce and soybeans provide about 3 grams per ounce (“Protein Content of Common Foods”). However, the capability to do so and to actually do so are far from the same thing.

ACTIONS BRAZIL IS ALREADY TAKING

In recent years, Brazil has made significant progress in reducing food insecurity in the country through a variety of social programs. These programs are working to tackle the United Nation’s Sustainable Development goal of Zero Hunger (“Transforming our World”). The most notable is the *Fome Zero* program that focuses on the interconnectedness of poverty reduction, food security, and small-scale agriculture that began in 2003 (Silva). There are five main components to this program. The first one is the *Bolsa Familia* which is a family grant program. It provides monthly cash transfers to families that vary based on the ages of family members. This program requires that pregnant women seek prenatal care, children are enrolled in school, and families comply with a basic health agenda. In 2010, this program reached over 12 million families and it is the largest income-based social service in Latin America (Silva). The second program is called *Programa de Aquisição de Alimentos*. The goal of this program is to stimulate

the production of food surpluses and generate income for farmers. This program was designed to focus on the community level to acquire local produce and promote food donations for families suffering from food insecurity. The program bought the produce at fair market prices and then donated it to food insecure, urban households (Silva). The next program is the *Programa Nacional de Alimentação Escolar*. This program partners with local farmers to provide food for schools. This creates a cycle of income and employment in rural communities. As a result of this program, a law was passed in 2009 that required that 30% of the food purchased for school lunches be purchased from local farmers. In 2010, this program served food to over 45 million students daily (Silva). The fourth major program is *Programa Nacional de Fortalecimento da Agricultura Familiar*. This program offers federal subsidies with below market interest rate to family farmers. Initially this program focused on farmers in the south, but it soon expanded throughout the whole country. There were even special lines of credit created such as credit for young adults, women, agribusiness, agroecology, agrarian reform settlers, and poor farmers. Additionally, this program expanded again to offer farmers protection in the event of crop failure from natural disasters, financial aid and insurance protection for price variations (Silva). This program had a major impact and by 2014, there were just under 2 million contracts between farmers and the government (Grossi). The fifth program is *Programa Cisternas*. This segment of *Fome Zero* refers to the government's initiative to supply one million cisterns in Brazil's semi-arid region. This program works to build devices that captures rainwater to use for human and small animal consumption. It sees water as a fundamental part of food and nutrition security and therefore sees it as an integral part of combatting hunger in Brazil (Silva).

THREE OVERARCHING ISSUES

According to the most recent data from the World Bank in 2018, Brazil's rate of undernourishment, which is having access to enough nutritious foods, is 2.5%, or 5,295,425 people ("Prevalence of Undernourishment"). While this number is drastically lower than the 2001 rate of 10.1%, and lower than many neighboring countries' rates including Argentina's 3.8% and Chile's 3.5%, the rate has not decreased since 2008 ("Prevalence of Undernourishment"). It is also important to note that this number is currently the same as that of the US, Canada, and the UK ("Prevalence of Undernourishment"). This does not mean *Fome Zero* has been unsuccessful, merely that there is still room for growth. While it has made significant strides in its poverty and hunger levels, in order to continue the work that Brazil has done, and to progress beyond where it is, there are many areas that need to be addressed. In order to achieve food security, Brazilians need to have reliable access to affordable sufficient food. This looks different in different parts of the country, as each state has various GDPs and levels of poverty and nutrition (**Figure 4**). Specifically, to feed Brazil's population and achieve 99% food security (accounting for the people who would rather be isolated), issues in their infrastructure, the government, and the overall food waste and loss must be addressed.

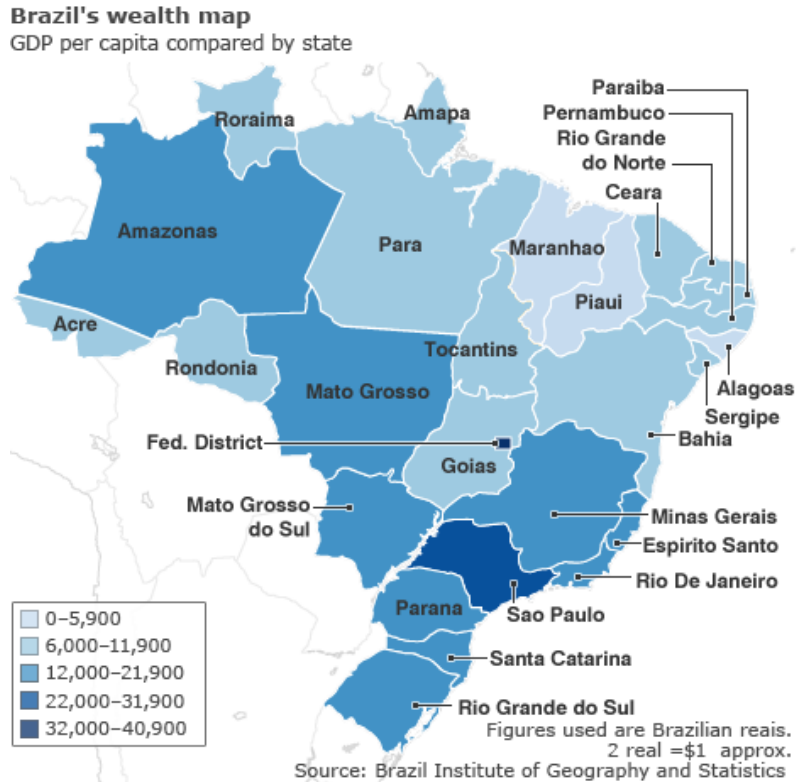


Figure 4. GDP per capita of Brazilian States. (“Brazil. Key”).

INFRASTRUCTURE

Infrastructure issues refer to roads and transportation systems, communication networks, sewage, water, and electricity. These infrastructure issues lead to supply chain issues, which in turn results in less access to food for people. Many communities throughout Brazil do not have appropriate roads, especially in the interior where 13% of the population lives (“Brazil”), see **Figure 5**. This affects farmers’ ability to get to a place where they can sell their food, and results in spoilage and crop loss. If sufficient food is being produced, and it is not getting to market, then the efforts are futile. Studies have shown that the commercialization of these agricultural products are deficient because transport from the interior, specifically the north, and to the commercial centers are slow and inefficient (Adilson 315). Because of this, the Brazilian

government has made improving the country's infrastructure a top priority because it recognizes the relationship infrastructural investment and economic growth.



Figure 5. Map of Brazilian Road Network. Agência Nacional de Transportes Terrestres

GOVERNMENT

The next improvement needs to be governmental. While the government has created many beneficial organizations and social programs to reduce food insecurity, there has been a history of mistrust of the the Brazilian government. In fact, it was the major theme for the last few presidential elections and even led to the impeachment of President Fernando Collor de Mello in 1992. The executive branch holds significant discretionary power over decisions about spending and has the power to shift the budget (Blake 153). Additionally, although the Brazilian government contains all the individual bureaucracies necessary for the accountability at the

federal level, there are problems when the gaps and overlaps of these individual bureaucracies leave room for corrupt activities (Blake 154). These corruption scandals do not just stop at presidential elections, they even affect the agriculture industry. One recent example from 2017 concerns the meatpacking industry. The global meatpacking companies JBS SA and BRF SA were charged with bribing health officials to approve over \$12 billion worth of beef that was exported to Europe, China, and the Middle East (Haynes). This demonstrates, it is important to address the issues of corruption at the governmental level in order to feed the Brazilian people. By reconfiguring the way the governmental programs work and are organized (by including local people in their creation and management and assessing them annually for effectiveness) and by creating new programs to help the people, new trust can be generated in the government.

FOOD WASTE AND LOSS

Finally, the last area to address is food waste and food loss. The Food and Agriculture Organization (FAO) of the United Nations defines food waste as the “decrease in the quantity or quality of food resulting from decisions and actions by retailers, food service providers and consumers” (“Technical Platform”). For example, Brazil sends 40 tons of food to landfills every day (Camargo). This is distinct from FAO’s definition of food loss, which is “the decrease in the quantity or quality of food resulting from decisions and actions by food suppliers in the chain, excluding retailers, food service providers and consumers” (“Technical Platform”). In simpler terms, food waste is a subcomponent of food loss. It occurs when food fit for consumption is thrown out primarily at the retail and consumer level. Food loss and food waste occur in different areas of the supply chain and in different regions/cities of the country. In fact, it is estimated that in Latin American countries, Brazil included, 30-45% of food is lost due to postharvest losses

(Henz) and 28% of food that reaches the end of the food production stage is wasted by consumers (Henz & Porpino). By identifying areas most vulnerable to loss in the supply chain, people are able to create strategies to combat food loss. The graph (**Figure 6**), shows how interconnected the issues at the supply chain are and how solving one (or all) of these problems can lead to massive change.

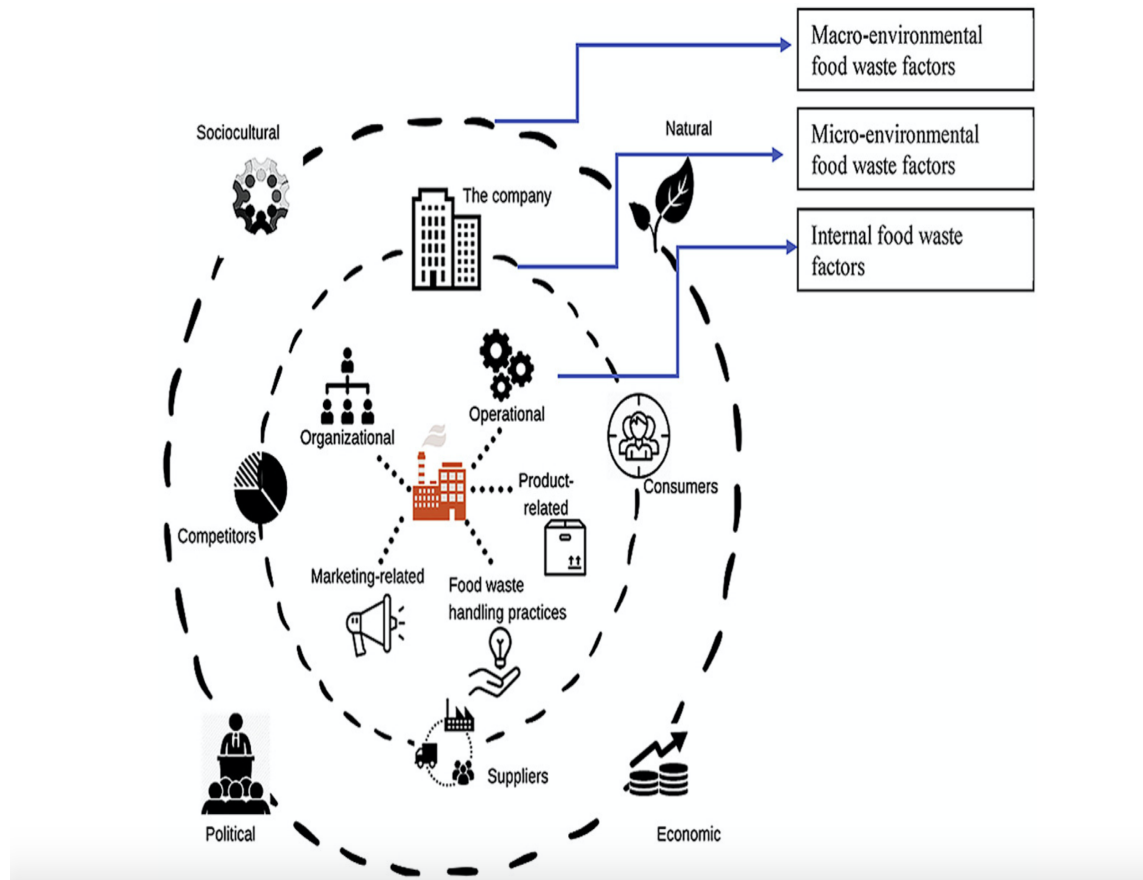


Figure 6. Factors affecting supply chain (Özbük et al.)

Ultimately, the factor affecting the Brazilian food supply chain is efficiency, or rather the lack thereof. Brazil has most or all of the food supply chain inefficiencies, leading to food loss and food waste, emblematic of many countries. There is inefficiency at virtually every level of production. It begins at the production stage (farming) with various natural forces such as loss from pests and climate (water, temperature). However, there are other areas that are essentially

preventable. One example is overproduction due to the perception of a greater demand than actually exists. By eliminating overproduction, many environmental drawbacks, including soil pollution and damage to water supply, can be reduced. Additionally, there is the process of selective harvesting, where people gathering produce do not pick the fruit that does not look appealing (“The Gross and Growing Problem of Food Waste”). Selective harvesting does not only leave food that may be rotting or contaminated by insects, but also any food that is not as aesthetically appealing. After harvesting, culling begins. In this stage, produce is examined again for blemishes and “unwanted” features. Some estimates indicate that less than half of the vegetables grown end up leaving the farm, and 75% of produce that has been culled is in fact edible (Bloom). In the process stage, lots of the waste comes from the trimming process. Edible pieces of the produce are trimmed off in this stage, and a high amount of food is lost during processing.

In the distribution phase, food is often damaged in transit and storage due to improper preservation methods, poor infrastructure and overall inattentiveness from people (“The Gross and Growing Problem of Food Waste”). Eliminating some of this regrettable discarding of food (discounting food that is rotten or damaged beyond repair) will contribute to shrinking the food gap because not throwing out food obviously increases the supply. The demand is already there, so the only “consequence” of increasing the supply will be a decrease in the price of food. This, of course, makes food more accessible to people with a lower socioeconomic status.

The next two supply chain stages are at the retail and the consumer level. At the retail level, food shipments can be rejected by the retailer because of surplus or a number of other factors. Additionally, decisions made to move products out of the store, such as discounting and promotions, encourage bulk shopping and ultimately food waste. The final stage of the supply

chain is the consumer level. The majority of food waste at this stage is a result of misinformation on the food itself, such as what the “best by” dates mean, and the hypo-awareness of food waste globally.

To get an idea of where Brazil stands in their inefficiency in the food chain, it is beneficial to look at their main agricultural product. The chart below (**Figure 7**) shows the percentage of food lost at each production stage of the soybean crop.

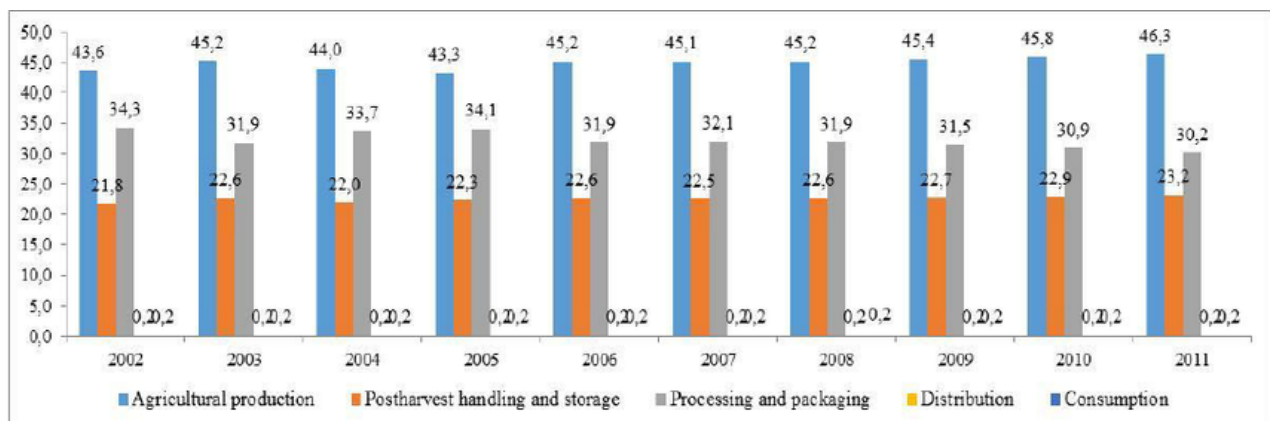


Figure 7. Soybean crop loss in Brazil from 2002 and 2011. (Mores et al.)

SOLUTIONS

In order to best address these three areas, it appears to be necessary to split up the solutions for how to feed Brazil in solutions for urban areas, and for the jungle/interior regions. Brazil is a large country and has a fairly uneven population distribution. While most people do live in the major cities, primarily in the Southeast, most undernourished people live in the Northeast (Indio). Although the projections are to continue urbanization, there will always be people living outside of the cities for cultural, familial, and personal preferences. Therefore, it is important to examine all areas of the country and not just where the “most people” are. This

paper provides solutions to many of the issues in the previously identified problem areas, but not all of them. Some of the issues are too complex to be sufficiently addressed in this section alone.

INFRASTRUCTURE SOLUTIONS

Cities and Interior

In order to see improvements in the infrastructure of Brazilian cities (specifically in the slums or *favelas*) and interior (the semiarid regions of the country, outside of cities), and to ultimately achieve food security, there is a need for drastic improvements in the connectivity both within and between urban areas. This refers to improved transportation systems, access to water and even better telecommunications networks. All of these areas in particular have tremendous need for improvement.

According to a recent interview with Venilton Tadini, the President of the Brazilian Association of Infrastructure and Basic Industry, Brazil has over 1.7 million kilometers of roads, but only about 18% are actually paved (Vardy). Unpaved roads can lead to excess of dust that impacts produce. They are also prone to flooding since they lack proper drainage systems. The roads built need to connect the rural parts of the country to the urban areas, the urban areas to other urban areas, and even within urban areas. One strategy that has proven to be success is to create an environment for private, long-term investments. Essentially, what Brazil needs is access to private financing through companies like the petroleum giant Petrobras or private banks like Itaú and Bradesco. By offering things like tax relief in exchange for infrastructure, these private corporations are incentivized to construct in the country, specifically in the cities and the interior (Biedermann et al.). A successful example of this is Boeing. Boeing was offered an incentives package to move its manufacturing site to South Carolina, and in exchange it

provided over 3,800 jobs and \$750 million local investment (Wise). Another potential strategy to bring roads to Brazil through the partnership with private sector is the implementation of toll roads. These roads are owned either by the government or by private companies and a fee is charged to pass through them, the money made from this fee is used to improve roadways, build more roads, and maintain the roads. With improved roads in cities and the interior, farmers can have better access to sell their product, not just in farmer's markets, but potentially to larger wholesalers. The greatest need for roads can be seen in the map below (**Figure. 8 5**).

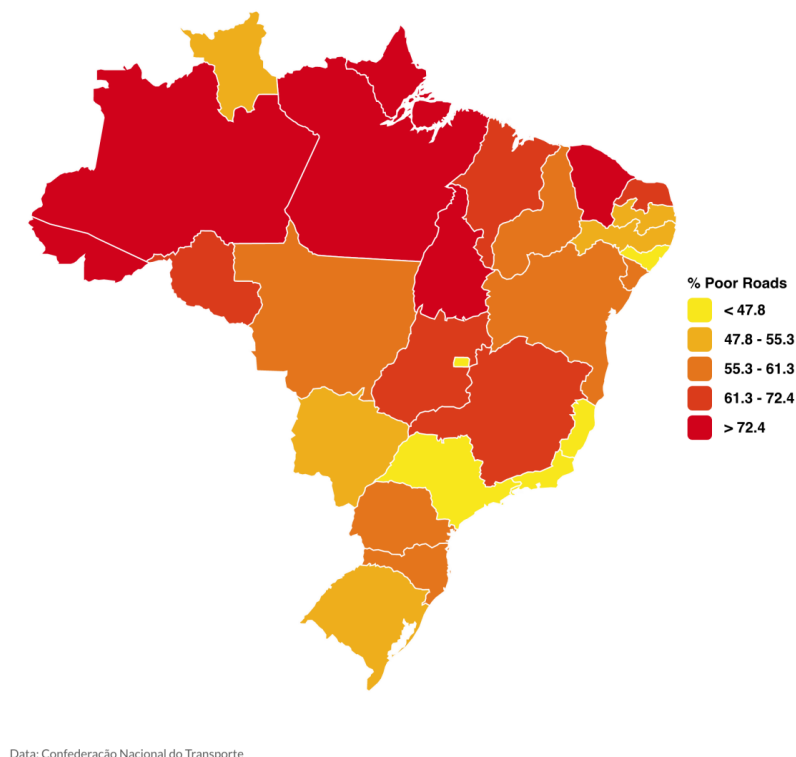


Figure 8. Map of Brazilian road quality. Confederação Nacional do Transporte.

Over 8.4% of the rural population does not have access to clean drinking water (“Brazil”). Through better water systems, people have access to safe drinking water. Many parts

of Brazil have access to water; however, there are still areas like the favelas and the rural regions that do not have piped access to water. Those that do have access face another set of challenges that make the available water unsafe, like lack of maintenance of existing infrastructure, mismanagement, and bacteria due to these other issues. Water not only is a necessary part of people's bodies, but it makes cleaning and storing produce that much safer and longer lasting. Contaminated water leads to contaminated food, which results in the promotion of food loss and waste and ultimately hinders the nourishment of the Brazilian population. Improved water access can be accomplished, like the roads, through partnerships with private entities. One example where this worked successfully is in Senegal. The country clustered the 1,500 rural piped schemes into five sections and then turned them over to private entities. This has resulted in Aquanet providing safe water to over 400,000 people (Ndaw).

Finally, while 98% of the population has access to a mobile phone, only 67.47% has access to the internet ("Brazil"). With better telecommunication networks, specifically in urban and agricultural areas, come improved market functions. This allows people to have better access to information about food prices, nutrients, and even introduces the possibility of mobile money and quick banking which reduces overall transaction costs. One example of a company who sought to improve better telecommunications worldwide is Google. The division, Station, provided free WIFI to over 400 railway stations in India (ET Bureau). It soon expanded into other countries like Brazil in 2019 where it partnered with America Net and Linktel sponsored by the bank Itaú (Coelho). This program no longer exists for Google in any country; however, many other companies including RailTel in India have begun the process of creating its own free WIFI initiatives (Kulkarni).

Amazon

In order to improve the infrastructure of the Amazon jungle region, there are a lot more things to consider. First, there are parts of the jungle protected by the government which not only makes it illegal, but also in many ways immoral to develop. Additionally, it would not be environmentally beneficial to overdevelop the region because this would result in the destruction of many valuable species as well as adversely affecting climates around the world as well as the hydrologic cycle of South America. Finally, while there are 24 million people living in the Brazilian Amazon region, many of which live in Manaus, but there are still over 20 million people who are outside of this urbanized area ("Brazil and the Amazon"). Many of these people are indigenous. Others choose to live isolated from the rest of the country. This presents a number of problems on how to best improve the infrastructure in this region. For example, in order to get sustainable power, one solution would be hydroelectric power and use the power of the Amazon river. However, in order to get this power, usually the river has to be dammed. This creates large flooded areas and destroys wildlife. Another example includes the need for more farmland; however, this results in deforestation and the loss of some of the biodiversity. These are just two examples of the numerous challenges present when developing in the Amazon. However, it is not impossible. A large part of the problem with past infrastructure projects pertains to lack of planning. There are not enough studies and analyses of the long-term impacts of these projects, which results in poor execution and needless Amazonian destruction (Bandura). Therefore, in order to build sustainable infrastructure, the projects have to be on much smaller scales. Instead of focusing on clearing large plots of land for farmland, work with the areas and the people that are already present. Instead of using large dams to create hydroelectric power, options like small canals to channel the river water should be created. This

has been successfully done before, an example being the Cangpinghe Hydropower Facility in China (Ma). The facility generates 9.1 megawatts of power, as opposed to a larger dam like Three Gorges Dam that generate 22,500 megawatts (“Three”). This creates localized power and greater opportunities for people. Furthermore, by partnering with organizations like FUNAI (The National Foundation of Indians), this will educate project leaders on how to develop in an ethical and environmentally friendly way for all people.

GOVERNMENT SOLUTIONS

The next area that needs to be addressed is government intervention. While the government is already doing many things to achieve food security in Brazil, there is still a great more that can be done. For example, in all schools, no matter the location, the government should expand the school lunch program to include breakfast. It is estimated that at least seven million students only receive one meal a day, and that is the one provided by the school (Saraiva). Without access to these meals, students are unable to learn. By including breakfast in schools, all students are guaranteed significantly more calories and nutrients and are less likely to be malnourished.

Furthermore, there needs to be coordinated actions between the government and nonprofits. There are multiple nonprofit agencies working in Brazil to provide humanitarian aid and food for people of all ages. However, a problem arises when there is disorganization. Some areas may be receiving an overabundance of aid, while other areas are not receiving any. Therefore, something as simple as a government database where NGOs are required to register where they are working, who they are working with, and what they are doing can create systemic, purpose-driven aid.

Cities

Specifically, in cities, there can be an increase in local government run food banks that provide food to impoverished areas and food deserts. Similarly, the *Programa Nacional de Alimentação Escolar* partners with local farmers to provide food for schools. The government can extend this program to provide food for these food banks and shelters. Also, something as simple as community gardens can bring agricultural awareness and education, as well as healthy foods for communities. Communities can apply for grants that give them funding to start gardens. This would benefit the government because it could reduce the number of people who go to the aforementioned food banks. One example of a successful private/public partnership is Foot Print Farms in Jackson Mississippi. This is a 68-acre urban farm that does community-supported agriculture. Since around 70% of children in Mississippi rely on free or reduced lunches at school, they also have a partnership with the local schools where they provide produce for the school lunches (Ayres).

Amazon and Interior

In the jungle and interior region where people are more spread apart, a different approach is required. Although the concept of “food deserts” has mostly been studied in developed nations, it applies to Brazil, especially in these remote regions. Food deserts are defined as, “areas characterized by relatively poor access to healthy and affordable food, that may contribute to social disparities in diet and diet-related health outcomes, such as cardiovascular disease and obesity” (Santiago). The key to achieving food security and eliminating food deserts in this area is actually not to introduce more “big-box” supermarkets. In fact, in areas with widespread poverty, like many areas in the interior and the jungle, small local grocery stores offer

advantages like the ability to buy smaller quantities and offer credit (Davies). However, the most important thing for food security in these regions is nonretail food acquisition. If the government were to offer federal land for subsistence farming, specifically to individuals and families, this would give people in seemingly inaccessible people groups the opportunity for access to food, if they want to participate. This has the potential to impact over 4 million people who are considered subsistence farmers (Gross).

FOOD LOSS/WASTE SOLUTIONS

Finally, the last areas to be addressed is food loss and food waste. As was previously mentioned, the greatest cause of food loss and waste in both cities and the interior/jungle region are inefficiencies in the supply chain. However, the inefficiencies come from different areas of the supply chain depending on where the food is; i.e. cities or interior and jungle.

Cities

In urban areas, a lot of food waste occurs at the retail/consumer level and can be attributed to factors like the stigma against damaged foods in grocery stores and other cultural factors. As far as damaged foods are concerned, too many fruits and vegetables are thrown out due to their looks, whether there is an issue with quality of the product itself. A study from the FAO estimates that nearly 30% of the food that reaches the end of the supply chain and into grocery stores is wasted at the consumer level due to consumer choices (Henz). One solution could be to increase the sale of “damaged foods.” While there are companies that sell these “ugly” products, it is not common, and they have not expanded to Brazil. These companies operate exclusively online currently outside of Brazil and therefore miss a huge consumer base.

One such proposal could be to introduce stand-alone grocery stores that feature these products or to incorporate specific sections in already established supermarkets. This gives consumers the option to buy these products, with the incentive being at a reduced price. It also makes them more commonplace and ultimately contributes to eliminating the stigma towards these foods.

As far as cultural factors contributing to food waste, it is common for Brazilian households to cook more than necessary and serve large portions. Stockpiling food is a symbol of wealth, whether families have financial means to do so or not (Henz). While culture may not changed completely, educating people as to the consequences of their actions can lead incrementally to huge impacts in reducing food waste.

Amazon and Interior

In the interior/jungle region, much of the food is lost in the processing phase due to insufficient food storage and transportation methods (Lee). This food loss not only reduces the income for the producer but also negatively affects the environment. People produce food that is ultimately going to be thrown away thus harming the environment in the process.

Most experts believe that in order to bring electricity, and ultimately refrigeration, to developing countries, the best solution is mini-grids (“Access”). A mini-grid is essentially a set of electric generators that are interconnected and provide energy to a localized group of people. These decentralized systems are the cheapest way to provide power for people in some of the most remote areas of the world. As a result of these mini-grids, less food goes to waste, which means people can make more money, which will stimulate the economy. One way that mini-grids could be installed is through a partnership with USAID, the Howard G. Buffett Foundation, or other agencies working in humanitarian aid. These agencies cannot be expected to simply

finance these in every country around the world, so partnerships have to include in-country energy companies. For example, if a mini-grid were to be installed in a community in Pernambuco (in the state of Piauí in the northeast), then the community should partner with the Companhia Energética de Pernambuco. A major cost is actually installing these grids. If this partnership existed, it would provide energy to more people, create future business for the energy company, and decrease food insecurity in the areas involved.

CONCLUSION

In order to combat food insecurity, and ultimately feed Brazil's growing population, there needs to be improvements made in the infrastructure, government intervention, and food waste. Brazil has an abundance of potential resources; however, it lacks the means of efficiently distributing these resources. Not only does it have tremendous agricultural resources and potential, but it has the most valuable resource of all: the Brazilian people. They are known for being a hardworking, warm, and very social people. If given the opportunity, the Brazilian people can create greatness and feed their own.

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