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Towards a Sustainable and Equitable Economic Development in Brazil: Applying the Doughnut Economics Model

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2018

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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
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Abstract

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Kate Raworth's Doughnut Economics model offers a fresh perspective on economic development that prioritizes human prosperity within ecological boundaries. However, its application has been limited to the Global North, and this paper aims to explore its potential in the context of economic development in Brazil, specifically the beef industry. The expansion of cattle ranching in Brazil has led to significant environmental and social costs despite recent efforts to reduce deforestation rates.

This thesis presents a white paper that draws conclusions from publicly available data, using inductive reasoning to identify research and application gaps in the Doughnut Economics model. The goal is to stimulate thinking on how economics can be improved in the global development sector. The thesis examined data for a Doughnut Brazil and found that while some targets, such as access to energy and social support, have been exceeded, others, such as land-use change and nitrogen and phosphorus usage, have not been met. The thesis argues that adopting the Doughnut Economics approach can lead to a more balanced and sustainable model of international development that benefits everyone, especially the most vulnerable to the negative impacts of climate change and inequality.

Overall, the thesis highlights the potential of the Doughnut Economics model in guiding economic development in Brazil and beyond. By considering ecological boundaries and human well-being, it offers a more comprehensive and sustainable approach to economic policy that can lead to a fairer and more equitable future.

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I. Introduction

The global community has witnessed a persistent trend of favoring the interests of powerful elites over the welfare of marginalized communities and humanity as a whole. This trend is reflected in the lack of priority given by governments to solving poverty and inequality on both domestic and international levels. Additionally, the detrimental impact of natural resource overuse has not been fully recognized, further exacerbating global inequalities.

Despite ongoing efforts, mainstream economic policies have yet to achieve truly inclusive and sustainable economic growth. Instead, such policies often perpetuate existing disparities by disproportionately benefiting those in positions of power and reinforcing systemic inequalities. As a result, many individuals and communities continue to face significant barriers to achieving basic needs such as access to healthcare, education, and employment opportunities.

Addressing these challenges requires a fundamental shift in societal priorities and economic policies. This includes acknowledging and prioritizing the needs of marginalized communities and ensuring that economic growth is inclusive and sustainable. Governments must take action to address the root causes of poverty and inequality, such as systemic discrimination and inadequate social safety nets. Additionally, a greater emphasis on sustainable resource management and conservation is necessary to mitigate the negative impacts of natural resource overuse and protect the environment for future generations.

Climate Change

The rate of climate change and natural resource scarcity have increased exponentially over the last few decades. Human activities are the main cause of these unprecedented climate changes, now called the Anthropocene era. Since the Industrial Revolution, the global concentration of greenhouse gases and mean global temperatures have steadily risen. In 2021, the global mean temperature was about 1.1°C above pre-industrial levels (measured from 1850-1900). The seven warmest years on record were the years from 2015 – 2021 (United Nations, (n.d.)a).

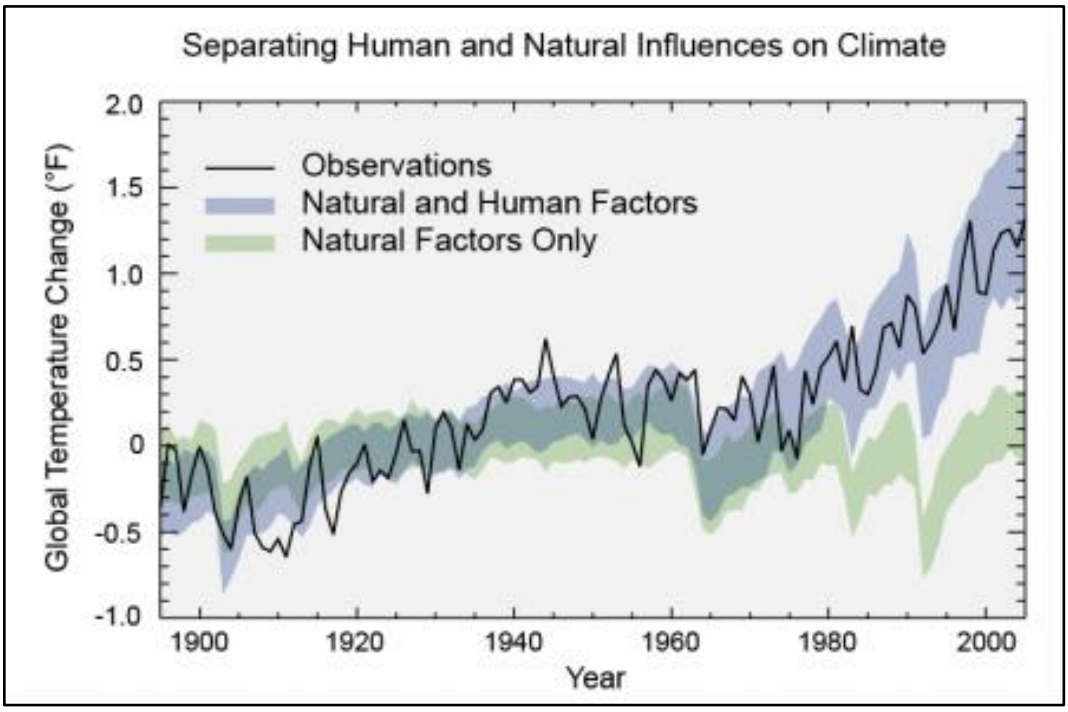

Figure 1. Impact of Anthropogenic Climate Change (Environmental Protection Agency, (n.d.))

As seen in Figure 1 above, global temperature change models that account only for the effects of natural processes are not able to explain the unprecedented warming observed over the past century. In contrast, models that account for increased greenhouse gas emissions from humans does explain the increase in warming (EPA, (n.d.)). The graph shows the results of a comparison between observed temperature data and modeled temperature data from natural and human-caused factors from 1860 to 2015. The black line represents observed temperature data, which is based on direct temperature measurements from weather stations and other sources. The blue line represents modeled temperature data that takes into account both natural factors, such as volcanic activity and solar radiation, and human-caused factors, such as greenhouse gas emissions and land use changes. The green line represents modeled temperature data that estimates global temperature changed due to only natural factors.

The graph shows that the observed temperatures have been rising steadily since the late 1800s, with some fluctuations from year to year. The difference between the blue and green lines on the graph represents the contribution of natural factors alone to the increase in temperature, as opposed to the contribution of both natural and human factors. The graph shows that natural factors alone cannot explain the observed increase in temperature, and that human factors are necessary to account for the magnitude of the observed warming. Overall, this graph provides evidence for the conclusion that human activities, such as the burning of fossil fuels and deforestation, are contributing significantly to global warming and climate change.

Human factors contributing to global temperature rise have increased over time. One of the primary factors is the increase in greenhouse gas emissions, including carbon dioxide and methane, which are emitted when humans burn fossil fuels, use transportation, and engage in

other industrial activities. As economies grow and populations increase, the demand for energy and resources also increases, leading to higher emissions of greenhouse gases. This has led to an increase in the concentration of these gases in the atmosphere, trapping heat and leading to a rise in global temperatures.

The resulting climate impacts include more frequent and severe heat waves, droughts, wildfires, storms, and floods, among others. These events can have devastating effects on people's lives, property, and livelihoods, and disproportionately affect vulnerable populations, such as those living in poverty, women, and children, and people in marginalized communities. For example, people living in coastal areas are more susceptible to the impacts of sea-level rise and extreme weather events, while those in rural areas may be affected by changes in agricultural productivity due to changes in temperature and rainfall patterns.

It is estimated that 3.6 billion people live in contexts that are highly vulnerable to climate change (United Nations, (n.d.)a). This highlights the urgent need for immediate and sustained global action to mitigate greenhouse gas emissions and adapt to the impacts of climate change, with a focus on protecting and empowering vulnerable populations.

In addition to the impacts of climate change on human society, there are serious consequences for the sustainability of the planet and the survival of many other species. If these issues continue to be ignored, the changes in the climate and environment will be irreversible by 2030, making it crucial to take immediate action to mitigate the effects of climate change. The longer society waits to take action, the harder it will be to reverse the damage already done, and the more expensive and difficult it will be to reduce global emissions in the future (United Nations Environment Programme, 2019).

One key strategy for addressing climate change is the conservation and restoration of natural spaces, both on land and in the water. These natural spaces serve as critical carbon sinks and help to mitigate greenhouse gas emissions. Additionally, they provide habitat for countless species and support the health and well-being of humans and the planet (United Nations Environment Programme, 2021).

However, addressing climate change requires a holistic approach that takes into account the systemic nature of historical intersections of the global economy, social injustices, and human-caused ecological imbalances. This approach must address the underlying root causes of climate change, including unsustainable consumption patterns and systemic inequalities. This requires a collective effort by individuals, businesses, and governments around the world to promote sustainability, reduce emissions, and create a more equitable and just future for all.

Income as a Development Indicator

The World Bank classifies countries as low-, middle-, or high-income based on their gross domestic product (GDP) or gross national income (GNI), both of which measure the monetary value of goods and services produced within a country. GDP is a measure of the value of goods and services generated within the borders of a country, while GNI measures the value of goods and services generated by residents of a country, whether earned domestically or abroad. The World Bank's classification of countries by income level has important implications for development policy, as it determines a country's eligibility for financial assistance and loans from the bank.

While the goal of many countries is to move up to a higher World Bank income status by growing their GDP, this focus on economic growth as the primary measure of development success has its limitations. The emphasis on GDP growth can result in environmental degradation and social injustice, which are not accounted for in these economic indicators. For example, a country may achieve high GDP growth by exploiting natural resources, leading to environmental degradation and harm to indigenous communities. Moreover, GDP growth does not necessarily translate to improved living standards for all people within a country, and may exacerbate income inequality. Therefore, it is important to take into account a broader range of factors when evaluating development success, such as social equity and environmental sustainability.

In conclusion, while GDP and GNI are important measures of a country's economic activity, they do not holistically reflect the well-being of a population or the health of the planet. There has been increasing recognition of the limitations of GDP as a measure of development progress, and a growing call for alternative metrics that take into account broader social and environmental considerations. By using alternative measures, policymakers can better evaluate the true progress of a country, rather than relying solely on economic indicators that may not accurately reflect the well-being of a population or the health of the planet. Alternative metrics should be considered in evaluating development progress, to ensure that the goal of economic growth is balanced with the goal of improving the well-being of people and the planet.

Current State of the World

The state of health in the world is a complex issue that is influenced by a range of factors, including access to healthcare, lifestyle choices, environmental conditions, and socioeconomic status. Despite significant progress in global health over the past few decades, there are still significant disparities in health outcomes between different regions and populations.

Life expectancy has been steadily increasing around the world over the past few decades, with the global average now at approximately 73 years (WHO, 2021). However, life expectancy varies significantly by country and region, with some countries reporting much higher or lower life expectancies due to factors such as access to healthcare, nutrition, and lifestyle habits. For example, in sub-Saharan Africa, the average life expectancy is just 62 years, compared to 77 years in high-income countries (WHO, 2021). It is also worth noting that life expectancy can change over time due to various factors such as advancements in medical technology, changes in lifestyle habits, and global events like pandemics or wars.

Hunger and malnutrition remain major global health challenges, with an estimated 811 million people experiencing chronic hunger in 2020 (FAO et al., 2021). While the prevalence of hunger has declined in some regions, such as East and Southeast Asia, it remains high in sub-Saharan Africa, where 21% of the population is undernourished (FAO et al., 2021).

Extreme poverty, defined as living on less than $1.90 per day, has also declined globally over the past few decades, with the number of people in extreme poverty falling from 1.9 billion in 1990 to 689 million in 2017 (World Bank, 2020). However, progress in reducing extreme poverty has been uneven, with many low- and middle-income countries still struggling to provide basic services and opportunities for their citizens. It is also important to note that the

COVID-19 pandemic has had a significant impact on poverty rates, with many people falling back into extreme poverty due to economic disruptions caused by the pandemic.

Access to safe drinking water is another important factor in global health. While significant progress has been made in expanding access to safe drinking water, with 91% of the global population now having access to improved water sources, many people still lack access to this basic necessity (WHO/UNICEF, 2019). In sub-Saharan Africa, for example, 29% of the population does not have access to safe drinking water (WHO/UNICEF, 2019).

Overall, the state of health in the world is characterized by significant progress in some areas, such as increasing life expectancy and reducing extreme poverty, but persistent challenges in others, such as hunger and access to safe drinking water. The state of health in the world is a complex and multifaceted issue that requires a comprehensive and coordinated response. Addressing these challenges requires a comprehensive approach that includes not only healthcare interventions, but also efforts to address social, economic, and environmental factors that influence health.

The current state of the planet's health is concerning due to several significant shortcomings. Firstly, the local average temperature has already increased by 0.8 degrees Celsius, and it is projected to rise by almost four degrees by the end of the century (Global Agriculture, (n.d.)). This level of temperature increase can cause catastrophic consequences such as intensified floods, droughts, storms, and sea-level rise, which could have far-reaching impacts on humanity. The severity and scale of these events would surpass anything humanity has ever experienced before.

Additionally, over 40% of the world's agricultural land is already severely degraded, which indicates that society is struggling to maintain the quality and productivity of our food systems. Furthermore, by 2025, over 75% of the global population will live in water-stressed regions, meaning that the world is facing a critical water shortage (Global Agriculture, (n.d.)). This shortage can lead to social, political, and economic unrest as well as conflicts over access to water resources.

The oceans are also facing several serious challenges as over 80% of the world's fisheries are over-exploited. Humans are over-extracting from the ocean, which is leading to the depletion of fish populations. Moreover, the increasing amount of plastic pollution in the ocean is replacing the fish populations, and it is estimated that by 2050, there will be more plastic than fish in the oceans (Food and Agriculture Organization, 2010). This pollution is causing severe harm to marine life, which could lead to ecological imbalances and devastating consequences for the planet's biodiversity.

Overall, these shortcomings are a cause for concern as they threaten the planet's health and the well-being of its inhabitants. Urgent and decisive action is needed to address these issues and prevent further harm to the planet's ecosystems.

Looking Forward

The human population is projected to continue to grow in the coming decades, albeit at a slower pace than in the past. According to United Nations projections, the global population is expected to reach 9.7 billion by 2050 and 10.9 billion by 2100 (UNDESA, 2019). The majority of this growth is expected to occur in low- and middle-income countries, particularly in Africa

and Asia. This population growth presents a number of challenges, including increased demand for resources and services, strain on infrastructure and natural systems, and potential impacts on global health and security.

Climate change projections suggest that global temperatures will continue to rise in the coming decades, with potentially significant impacts on ecosystems, human health, and economic activity. According to the Intergovernmental Panel on Climate Change (IPCC), global temperatures are likely to rise by 1.5°C above pre-industrial levels by the 2030s and 2°C by the middle of the century, even if aggressive emissions reduction measures are implemented (IPCC, 2018). These temperature increases are expected to lead to more frequent and severe weather events, such as heat waves, droughts, and floods, as well as sea level rise and ocean acidification.

Projections in global economic development suggest that low- and middle-income countries will continue to experience growth in the coming decades, but at varying rates. According to World Bank projections, the global economy is expected to grow at an average annual rate of 4% between 2021 and 2023, with low-income countries growing at a faster rate than high-income countries (World Bank, 2021). However, there are significant disparities in economic growth within and between countries, with many low- and middle-income countries facing significant challenges in areas such as infrastructure, education, and healthcare. These disparities can contribute to social and economic inequality, which in turn can have impacts on health, security, and social cohesion.

Both eradicating poverty and consideration of humanity’s use of natural resources are crucial to sustainable development. All people need to have their essential needs met and be empowered with needed rights and resources in order to lead lives with dignity, opportunity, and

fulfillment. In addition, many of earth's systems have critical natural thresholds or gradients of increasing risk that cannot be crossed for the earth to remain in a stable state that will support human life. Sustainable development can only succeed if poverty eradication and environmental sustainability are pursued together. The world needs a solution to sustainably support the growing global human population while emphasizing and supporting the right to human thriving and planetary health.

Doughnut[1] Economics

Shifting away from solely relying on GDP as a measure of development is crucial in the pursuit of a more equitable and sustainable economic system. Instead, it is essential to consider indicators that take into account the interconnectedness of the economy, society, and the environment. In this regard, Kate Raworth's Doughnut Economics offers a new perspective on how to approach economic development. The Doughnut model aims to create a regenerative and distributive economy that promotes human well-being while staying within the ecological boundaries of the planet.

To achieve this goal, the Doughnut model proposes a new economic paradigm that is distributive, collaborative, and regenerative. This means designing economic systems that promote fair distribution of resources, encourage collaboration between individuals and organizations, and prioritize the regeneration and conservation of natural resources. By shifting

[1] Due to language translations and specific project names, "Doughnut" and "Donut" will be used interchangeably throughout the thesis.

from a model of endless growth to one of sustainable development, the Doughnut model offers a path towards creating an economy that is inclusive, equitable, and sustainable.

The Doughnut model has gained popularity in recent years as a viable alternative to traditional economic thinking. It provides a new framework that is relevant to today's global challenges, such as climate change, economic inequality, and social injustice. By focusing on human prosperity and the need to live within the means of the planet, Doughnut Economics offers a vision of economic development that is both ambitious and achievable. It is a call to action for individuals, governments, and organizations to embrace a new way of thinking and working together to create a better world for all.

As seen in Figure 2 below, two concentric rings form the shape of a doughnut. The inner ring is the social foundation, made up of indicators that represent the essentials of human life. The outer ring is the ecological ceiling, made up of indicators that represent planetary boundaries. The space in between the two rings, the safe and just space for humanity, ensures that no one is falling short of life’s essentials and maintaining earth’s life supporting systems. Keeping within the Doughnut emphasizes not crossing boundaries thus creating a world where humanity can thrive.

The first aspect of Doughnut Economics is the focus on meeting the basic needs of all individuals. This includes access to food, water, healthcare, and education. These needs are represented in the inner ring of the Doughnut. The idea is that every person should have access to these basic needs, regardless of their economic status or location. The second aspect of Doughnut Economics is the recognition of planetary boundaries. The outer ring of the Doughnut represents the ecological limits of the planet.

The goal of Doughnut Economics is to operate within these limits while still providing for human needs. This requires a shift away from traditional economic practices that prioritize unlimited growth and resource extraction. Instead, Doughnut Economics emphasizes sustainable resource management and the use of renewable energy sources.

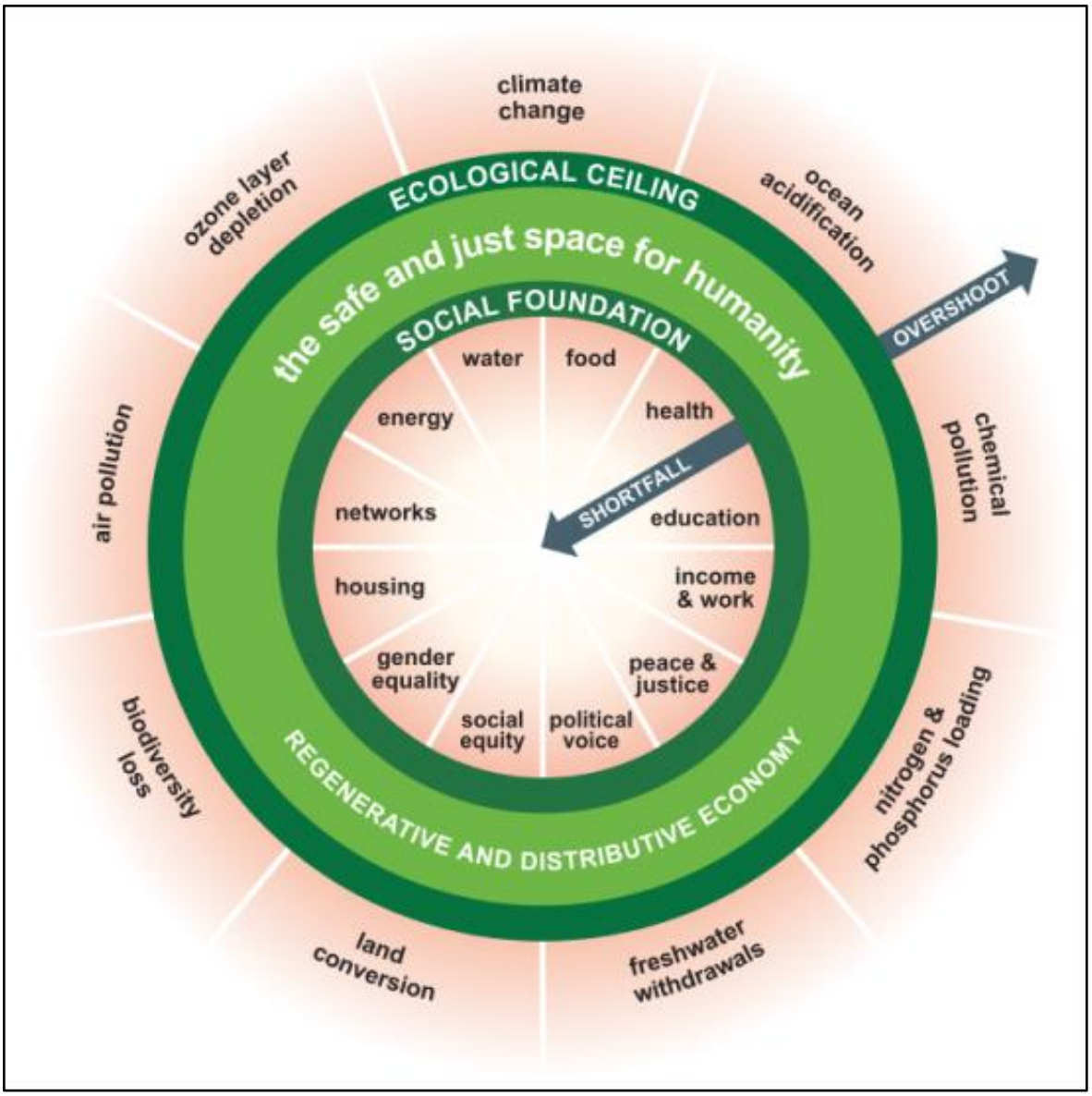

Figure 2. The Doughnut of Social and Planetary Boundaries, (Raworth, 2017).

Social Foundation

International human rights norms have asserted the fundamental moral claim that each person has to life's essentials, food, water, health care, education, freedom of expression, political participation, and personal security regardless of how much power or money an individual has (Raworth, 2012). However, true sustainable development pushes for human prosperity beyond these standards.

The dimensions of human deprivation, the indicators under the social foundation, or in the Doughnut hole, are based on governments' priorities set out for the United Nation's Rio+20 Conference which culminated in the development of the Sustainable Development Goals (SDGs) (Sustainable Development Knowledge Platform, (n.d.)). These dimensions reflect internationally agreed minimum social standards identified by the world's governments. The 12 social priorities in the Doughnut model can be grouped into three clusters:

1. Enabling people to be well – through food security, adequate income, improved water and sanitation, and health care;
2. Enabling people to be productive – through education, decent work, modern energy services, and resilience to shocks;
3. Enabling people to be empowered – through gender equality, social equity, and having political voice.

Ecological Ceiling

The dimensions of environmental degradation, the indicators over the ecological ceiling, are based on the nine planetary boundaries set out by Rockström et. al., (2009). Crossing over any of the nine boundaries set out in the Doughnut model could lead to irreversible environmental change. Crossing these tipping points causes unacceptable environmental degradation and is potentially devastating to humanity. Impacts from crossing these thresholds hit vulnerable populations, especially people living in poverty who depend on natural resources for their livelihoods, first and hardest.

Safe and Just Space for Humanity

The space in between the social foundation and the ecological ceiling that Raworth defines as the “safe and just space for humanity" represents the ideal state for economic development that is both inclusive and sustainable (Raworth, 2017). It places equal importance on both the social and ecological dimensions of development as economic development should not come at the expense of the environment or social well-being. Instead, economic growth must be achieved within the boundaries of the planet's resources and should be designed to promote human well-being.

This Doughnut Economics model emphasizes the need for systems thinking in sustainable development, recognizing the interconnectedness of different indicators. Environmental stress, for instance, can exacerbate poverty and vice versa. This highlights the need for a holistic approach to policy development that considers multiple dimensions

simultaneously. For example, a policy aimed at alleviating poverty may increase natural resource stress if it relies on unsustainable extraction or production methods. Conversely, a policy aimed at increasing sustainability may negatively impact poverty if it does not consider the social and economic implications of its implementation.

The Doughnut Economics model provides a new way of thinking about economic development, one that is centered around human prosperity and flourishing within planetary boundaries. By considering social and ecological dimensions together and recognizing their interconnectedness, the model provides a roadmap for policy development that aims to address the complex challenges facing society today.

In 2017, Kate Raworth drew up the first global Doughnut, depicted in Figure 3 below. Figure 3 represents the current state of the world by illustrating the extent to which humanity has overshot or fallen short of the Doughnut's ecological and social boundaries. The current state of the world is depicted by the position of the various indicators in relation to these boundaries. Actual, observed data is represented by the shaded area inside or outside the Doughnut. It is colored red if the data has overshot or fallen short of the ecological or social boundary targets.

Figure 3 shows that humanity has exceeded the ecological ceiling in several areas, such as climate change, nitrogen and phosphorus loading, land conversion, and biodiversity loss. At the same time, a large portion of the global population remains below the social foundation, as indicated by the large number of people who lack access to basic needs such as food, water, electricity, sanitation, education, and health care. Overall, the Doughnut model provides a

powerful visual for understanding the challenges facing humanity and the need to shift towards a more sustainable and equitable future.

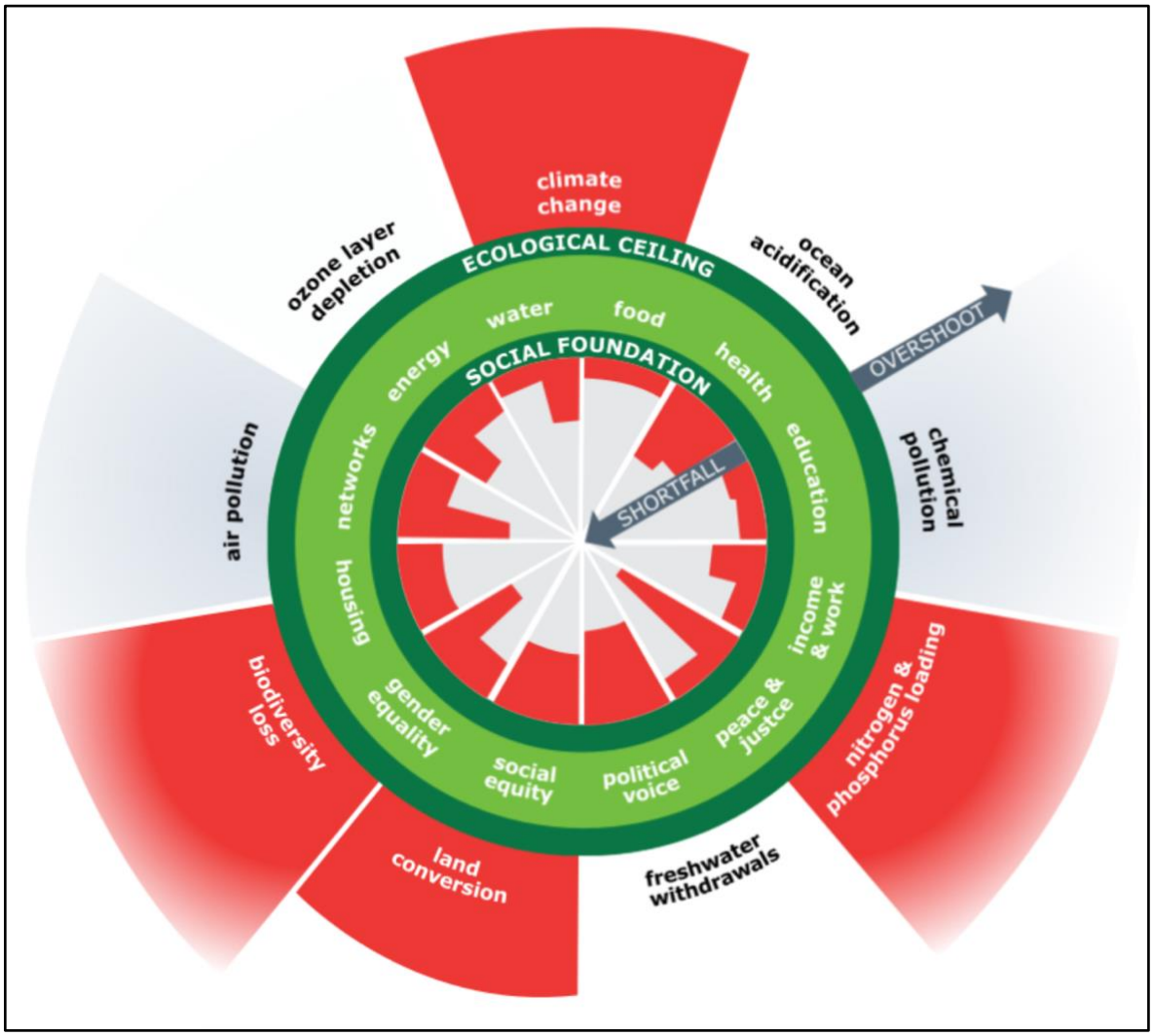

Figure 3. The Doughnut of Social and Planetary Boundaries (Raworth, 2017)

Table 1 shows the same data from Raworth's 2017 Global Doughnut. It also includes information on the defined control variables and targets for each dimension of the Doughnut.

Table 1. Global State of The Doughnut of Social and Planetary Boundaries (Raworth, 2017)

Doughnut Dimension	**Defined Control Variable**	**Target**	**Actual**
Climate Change	Atmospheric carbon dioxide concentration in parts per million (ppm)	At most 350ppm	400 ppm and rising
Nitrogen & Phosphorus Loading	Phosphorus and reactive nitrogen applied to land as fertilizer in millions of tons per year	Phosphorus = 6.2 million tons Nitrogen = 62 million tons	Phosphorus = 14 million tons and rising Nitrogen = 150 million tons and rising
Land Conversion	Area of forested land as a proportion of forest-covered land prior to human alteration	At least 75%	62% and falling
Biodiversity Loss	Rate of species extinction per million species per year	At most 10	Estimated between 100-100,000 and rising
Chemical Pollution	Not yet identified	N/A	N/A
Air Pollution	Not yet identified	N/A	N/A
Ozone Layer Depletion	Concentration of ozone in the stratosphere, in Dobson Units (DU)	At least 275	283 and rising (improving)
Ocean Acidification	Average saturation of aragonite (calcium carbonate) at the ocean surface, as a percentage of pre-industrial levels	At least 80% of pre-industrial levels	Around 84% and falling (intensifying)
Freshwater Withdrawals	Blue water consumption, cubic kilometers per year	At most 4,000km^3 per year	Around 2,600km^3 per year and rising (intensifying)
Health	Population in countries with an under 5 mortality rate exceeding 25 per 1,000 live births	0% of the global population	46% of the global population

Doughnut Dimension	Defined Control Variable	Target	Actual
	Population in countries with life expectancy at birth of less than 70 years	0% of the global population	39% of the global population
Education	Adult population (aged 15+) who are illiterate	0% of the global population	15% of the global population
	Children aged 12-15 who are out of school	0% of the global population	17% of the global population
Income & Work	Population living on less than the international poverty limit of $3.10 a day	0% of the global population	29% of the global population
	Proportion of young people (aged 15-24) seeking but not able to find work	0% of the global population	13% of the global population
Peace & Justice	Population in countries scoring 50 or less in the Corruption Perceptions Index[2]	0% of the global population	85% of the global population
	Populations in countries with a homicide rate of 10 or more per 10,000	0% of the global population	13% of the global population
Political Voice	Population in countries scoring 0.5 or less (out of 1.0) in the Voice and Accountability Index[3]	0% of the global population	52% of the global population
Social Equity	Population living in countries with a Palma ratio[4] of 2 or more	0% of the global population	39% of the global population
Gender Equality	Representation gap between women and men in national parliaments	0% of the global population	56% of the global population
	Worldwide earnings gap between women and men	0% of the global population	23% of the global population

[2] The CPI uses a scale from 0 to 100, 100 is very clean and 0 is highly corrupt (Transparency International, 2022).
[3] Voice and Accountability captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. It is measured on a scale of 0-1 (Kaufmann, D, 2016).
[4] The Palma ratio is the ratio of the income share of the top 10% of people to that of the bottom 40% (Roser et. al., 2019).

Doughnut Dimension	Defined Control Variable	Target	Actual
Housing	Global urban population living in slum housing in developing countries	0% of the global population	24% of the global population
Networks	Population stating that they are without someone to count on for help in times of trouble	0% of the global population	24% of the global population
	Population without access to the internet	0% of the global population	57% of the global population
Energy	Population lacking access to electricity	0% of the global population	17% of the global population
	Population lacking access to cooking facilities	0% of the global population	38% of the global population
Water	Population without access to electricity	0% of the global population	9% of the global population
	Population without access to improved sanitation	0% of the global population	32% of the global population
Food	Population undernourished	0% of the global population	11% of the global population

Key: Table 1. Global State of the Doughnut of Social and Planetary Boundaries

	Ecological Ceiling Doughnut Dimension
	Social Foundation Doughnut Dimension
	Not meeting Doughnut target
	Meeting Doughnut target

Table 1 provides a summary of the state of the world's progress towards various sustainability goals, highlighting both defined control variables and their corresponding targets, as well as the actual figures for each dimension. The data in the table reveals that most of the defined targets have not been met, and in fact, many have worsened over time.

For planetary health, the world is overshooting the planetary health boundaries in climate change, nitrogen and phosphorus loading, land conversion, and biodiversity loss. In all of those categories, data show that not only is the world overshooting the boundary, but the overshoot will continue to get worse if action is not taken. For example, in the case of climate change, the defined control variable is atmospheric carbon dioxide concentration in parts per million (ppm), and the target is at most 350 ppm. However, the actual figure is 400 ppm and rising. Similarly, the land conversion dimension indicates that the defined target of at least 75% of forested land has not been met, with actual figures showing that only 62% of forest-covered land prior to human alteration remains, and this is falling.

There are not yet identified ways to measure chemical and air pollution. The world is not overshooting the planetary boundaries for ozone layer depletion, ocean acidification, and freshwater withdrawals. For ozone layer depletion, the world is below the boundary and is trending in the direction of improvement, moving further within the Doughnut and expanding the distance between the target and the actual measurements. In contrast, the trends in actual measurements for ocean acidification and freshwater withdrawals, while below the planetary boundary, are trending towards the boundary and in danger of crossing the threshold if action is not taken to prevent it.

In contrast to the planetary boundaries, Raworth does not explicitly list target values for the social foundation dimensions. When discussing the model, Raworth says that the social foundation is critical to ensuring that no one is left falling short on life's essentials. Based on this, the assumed target values for the social foundation are zero. Based on that, the global state of the Doughnut data in Table 1 show humanity falling short in every category of the Doughnut threshold.

The data in Table 1 underscore the need for continued efforts to address sustainability challenges across the board, including in the areas of climate change, biodiversity loss, energy, and access to basic needs like water, food, and housing.

This thesis summarizes the ways that Doughnut Economics is currently being utilized around the world and discusses how to carry the framework forward for utilization in economic development using a case study in Brazil, highlighting the beef cow industry.

II. **Literature Review**

Traditional Economic Thinking

Economics is both the language of public policy and a driver in the international policy arena. Organizations such as the World Bank and the World Trade Organization influence international policy by utilizing an economic framework and in turn reinforcing that same framework. Traditional economics, also known as neoclassical economics, has been the dominant economic theory since the 20th century.

In the *Principles of Economics* by Gregory Mankiw, he writes that "economics is the study of how society manages its scarce resources (Mankiw, 2018)." This definition mentions that resources are scarce, which ascribes them value, and highlights the fundamental concept that the scarce resources must be allocated in a way that maximizes their value to society. However, there is no notion of correction if a society is mismanaging its scarce resources. Furthermore, there is no mention of an overall end goal of economics.

In the 1930s, the United States Congress commissioned Simon Kuznets, an American economist, to find a way to measure the country's national income. This resulted in Gross National Product, which was based on the income generated worldwide by the nation's residents. This new measurement made it possible to put a dollar value on the U.S.'s annual output and therefore enable comparison to previous years. This ability to track growth caught on quickly and by the end of the 1950s, output growth became one of the most important policy objectives in industrialized countries across the globe. However, Kuznets himself warned about the limitations in applying his findings, stating that it is dangerous to reduce a complex situation, like the state of a nation, with quantitative measurements that give an often misleading precise and overly simple answer (Moulton, 2007).

In the 1960s, Arthur Okun found a correlation between an increase in national output and a decrease in unemployment, which he called Okun's Law. This correlation states that a country must grow its GDP by 2% to achieve a 1% decrease in the unemployment rate (Amadeo, 2020). This correlation portrayed economic output growth as a solution for a social, economic, and political problem. In practice, as global GDP has increased over the last 60 years, millions of people have been lifted out of poverty in the developing world (Bernhardt, 2017). However, this provides too narrow of a definition of economic growth. GDP measures the value of all goods and services produced within a country's borders, but it fails to account for environmental degradation, income inequality, and other social costs associated with economic growth (Stiglitz, Sen, & Fitoussi, 2009). This narrow focus on GDP can lead to policies that prioritize short-term economic gains over long-term sustainability and societal welfare.

Traditional economics is limited in accurately capturing the complexity of the real world. One major limitation is its assumption of rational behavior. Rational behavior assumes that

individuals make decisions based on their preferences and beliefs, and will always choose the option that maximizes their utility. This assumption fails to account for the fact that humans are not always rational and often make decisions that are influenced by emotions and social norms (Thaler & Sunstein, 2008).

Another limitation of traditional economics is its focus on markets and prices as the primary mechanism for resource allocation. While markets have proven to be efficient in some contexts, they are not always the best mechanism for allocation. For instance, markets may fail to account for negative externalities, such as pollution or public goods, which leads to underproduction or overconsumption (Stiglitz, 2019). Moreover, markets may also fail to account for power imbalances, such as monopoly power or information asymmetries, which can result in inefficient outcomes and reduce societal welfare.

GDP only captures the market value of goods and services produced and does not capture externalities, when prices do not capture the full cost of a good. Investment, production, and consumption decisions often affect people and things not directly involved in the transaction. There is also a difference between private costs and returns and the costs and returns to society as a whole. The most obvious way to think about negative externalities is in the context of climate change. A business decision that will cause pollution and contribute to global temperature rise if carried out is considered a good investment based on direct cost and profit to the business. The indirect cost to people or environment harmed by that pollution is not factored into the financial cost of the decision (International Monetary Fund, 2010). If, however, there was a way to include a financial cost associated with the externality the cost of carrying out that business decision would be much higher which could deter action.

These inefficiencies and differences between actual cost and true cost are deemed a market failure. Traditional economics itself labels these discrepancies as failures. To make up the difference, traditional economics argues that it is the government's role to intervene and correct the situation. In 1920, in *The Economics of Welfare*, Arthur Pigou proposed that governments should tax polluters an amount that is equivalent to the cost of the harm done to others and should subsidize those who generate positive externalities an amount that is equivalent to the amount that others benefit (Pigou, 2013). While this is a logical approach to correct market failure, this does not always happen as there is no regulatory structure to enforce it.

Much of the current global environmental degradation is the result of degenerative industrial design. This correlation is described in the Environmental Kuznets Curve (EKC) based on previous research by Simon Kuznets in the 1950s on the relationship between income inequality and economic growth (Kuznets, 1955). The EKC describes a relationship between environmental quality and economic growth. As seen in Figure 4 below, the inverted u-shape of the trend line demonstrates that as a society's income and development increases, its negative impact on the environment will also increase. But, eventually, at a certain level of economic activity, the negative impact on the environment will level off and decline (Grossman & Krueger, 1995).

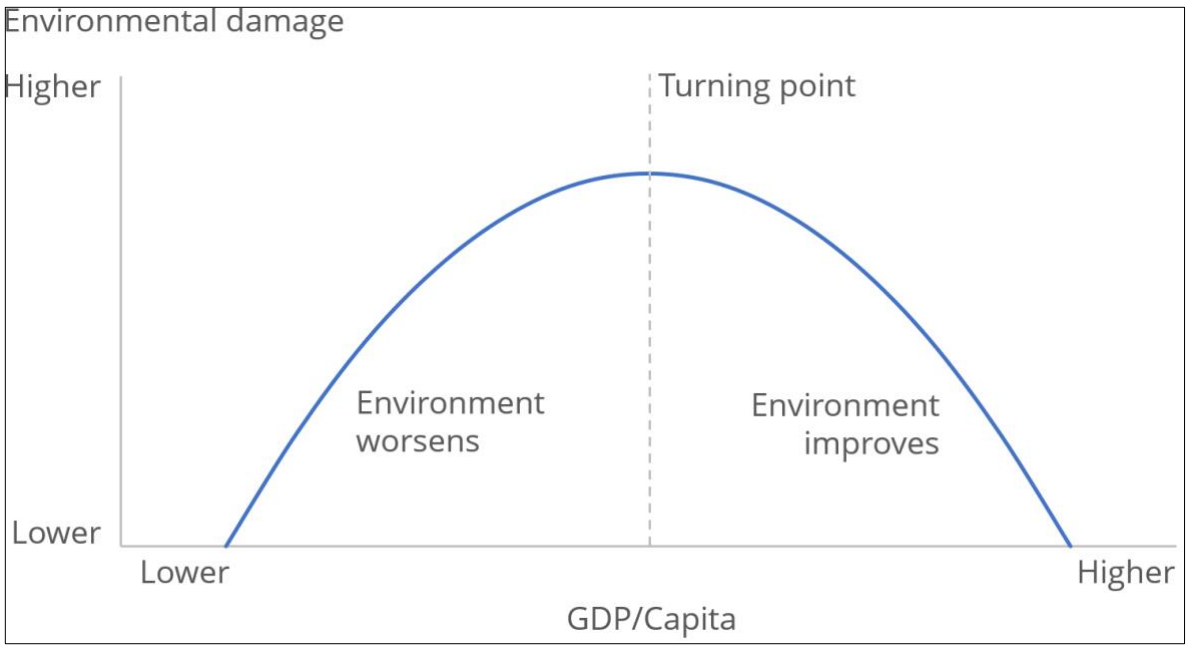

Figure 4. Environmental Kuznets Curve (Office for National Statistics, 2019)

However, current environmental and climate statistics prove this to be untrue, the negative impact on the environment has continued to get worse over time. EKC does not consider the systematic nature of environmental pollution or degradation.

The most basic economic principles are the concepts of supply and demand, rooted in 19th century ideas of mechanical equilibrium. Similar to the Kuznets curve, the principles of supply and demand assume that left to its own devices, the market will eventually course correct if supply becomes less than or more than demand. The levers of supply and demand are over simplified and do not account for systems thinking or positive and negative feedback loops (Mankiw, 2018). This theory is based on assumptions that do not hold up over time like the assumption that consumers will always prefer more to less. Traditional economic theory is too quick to assume that the price people are willing to pay is a good enough representation for utility gained.

Lastly, traditional economics tends to disregard the role of institutions and social norms in shaping economic outcomes. Institutions, such as property rights, contracts, and regulations, are critical for shaping incentives and enabling economic exchange. Social norms, such as trust and reciprocity, also play a crucial role in facilitating economic interactions (Bowles, 2004). However, traditional economics largely ignores the role of institutions and social norms, leading to an incomplete understanding of how economic systems operate in the real world.

Today, the economists of 2050 are being taught an economic mindset rooted in the textbooks written in the 1950s, which are based on theories from 1850. Traditional economic theory makes awkward and inaccurate assumptions about how the world works and glosses over critical issues such as human welfare and planetary health. It would not be possible to completely divest from economics in total because it shapes the world. However, economics is due for a new way of thinking that emphasizes starting with humanity's long-term goals and then seeking out economic thinking that enables its achievement.

While traditional economics has been influential in shaping economic policy and institutions, it has limitations in accurately capturing the complexity of the real world. Its assumptions of rational behavior, reliance on markets as the primary mechanism for resource allocation, narrow definition of economic growth, and disregard for institutions and social norms are all areas where it falls short. To address these limitations, alternative economic frameworks, such as behavioral economics, ecological economics, and feminist economics, have emerged in recent years. These frameworks seek to expand our understanding of economic systems and provide a more comprehensive approach to economic policy and practice.

In conclusion, traditional economics promotes the viewpoint that economies need to grow, whether or not they support human thriving. However, in order to close the gap in equity issues and stop the damage to the natural world, economics needs to facilitate economies that promote human thriving, whether or not they grow. There is still much to be learned about how economies that are financially, politically, and socially dependent on GDP growth can function without relying on it.

The Doughnut Model Strengths and Weaknesses

Strengths

Doughnut Economics, developed by Kate Raworth, is a framework that aims to create an economic system that is sustainable and just for all. One of its strengths is that it promotes a holistic view of the economy, taking into account both the social and ecological factors that affect it. This is in contrast to traditional economic models that focus primarily on financial indicators such as Gross Domestic Product (GDP). By incorporating a broader range of indicators, Doughnut Economics can better capture the well-being of a society and the health of the environment.

Doughnut Economics draws on diverse and complex schools of thought such as ecological, feminist, institutional and behavioral economics. A strength of Raworth's approach is not leaving these siloed, but combining what each has to offer. In doing this, social and environmental issues are not left at the periphery. Doughnut Economics brings into focus the need for approaches that acknowledge the complexity of economics and the necessity of understanding systems dynamics (Bernhardt, 2017).

One of the most prominent strengths of the Doughnut Economics model is that in its ideas and goals, there is little to disagree about. In concept, most people would agree that human and planetary thriving are desirable goals for humanity to aspire to.

Emphasis on ecological limits and social well-being: Doughnut Economics provides a framework that prioritizes the need to operate within ecological limits and meet social needs. This approach aligns with ecological economics, which emphasizes the importance of considering social and ecological factors in economic decision-making (Costanza et al., 2016). Additionally, Doughnut Economics provides a clear visualization of these ecological and social limits, which can help policymakers and individuals better understand the need to balance economic growth with sustainability (Raworth, 2017).

Another strength of Doughnut Economics is its emphasis on distributive justice. Doughnut Economics highlights the need for a more equitable distribution of resources and wealth. This focus aligns with theories of distributive justice, which emphasize the importance of fairness in the distribution of resources and opportunities (Roemer, 1998). By prioritizing distributive justice, Doughnut Economics can help reduce inequality and promote more sustainable and inclusive economic growth (Alvaredo et al., 2018).

The framework seeks to ensure that everyone has access to the resources they need to live a good life, while also respecting the ecological limits of the planet. It takes into account issues such as income inequality and access to basic needs such as food, water, and healthcare. By promoting a more equitable distribution of resources, Doughnut Economics can help to address some of the social and economic challenges facing many countries (Raworth, 2017).

Another strength of the Doughnut Model is that it is realistic. The Doughnut has been described as a "pragmatic utopia," presenting a model of a utopia that is meant to be achievable. The economics of the Doughnut model are based on realistic assumptions about human nature. The key aspect that makes the model achievable is that in order to realize the world living inside the Doughnut, there is no need to abolish the existing market system or private property rights. It is possible to use economic means that already exist to push beyond just providing equal opportunity but means to make the best of those opportunities (Nagase, 2022).

Global capitalism has been shaped by politico-economic forces to serve the needs of economic power. The Doughnut Model leverages economic science, which has enormous political relevance, as a place to start putting pressure to change the system. In redesigning the macroeconomy, the fixation with money as the only measure of wealth is replaced by a more realistic understanding of what makes economic activities work and what is their real cost (Barca, 2018). In addition to economic science, the model builds on existing research, using earth system science to establish the ecological ceiling and the United Nation's Sustainable Development Goals (SDGs) to establish humanity's deprivations.

Raworth clearly identifies a subject for her message. She challenges the next generation of economists to devise the best means by which the goals of the Doughnut Model can be achieved. The model does not lay out specific policies or institutional fixes nor does Raworth does not promise an immediate answer for what to do next. However, the principles and patterns of The Doughnut will equip new economic thinkers to start to create an economy that enables everyone in the world to prosper. The Doughnut Model is a tool that can be utilized to focus on outcomes that support human well-being and planetary health (Bernhardt, 2017).

Climate change and its impacts (and what to do about them) are one of the most prevalent global conversations happening in the 21st century. Due to the pace of climate change and global resource consumption, the Doughnut model is presented not as an option moving forwards, but as a necessity for humans to survive and thrive. Raworth successfully conveys the urgency of the current global situation and the necessity to realize the Doughnut (Nagase, 2022).

Weaknesses

While Doughnut Economics provides a useful framework for promoting sustainability and distributive justice, it is not without its limitations. The most widely discussed weakness of Doughnut Economics is that it is still a relatively new framework and has not yet been extensively adopted. There is limited empirical evidence to support its effectiveness in practice.

Another weakness of the model is its oversimplicity due to the universal context. The global focus allows for inapplicability in more localized contexts. There is no distinction to how different contexts can apply the model, for example industrialized versus developing country contexts. Nor does it address political and power differences that impact how a more localized context is able to adopt the goals set forth by the model (Krauss, 2017). Doughnut Economics may not fully account for the complexity of the global economy. While the framework is designed to be applicable to a wide range of contexts, it may not fully capture the nuances of individual economies and may not be able to provide specific solutions to address unique challenges (Turner, 2019). Therefore, it may be difficult to implement the model's recommendations at scale (Galbraith, 2018).

While Doughnut Economics provides a useful framework for understanding the need for sustainability and distributive justice, it does not provide specific policy recommendations for achieving these goals. This can make it difficult for policymakers and individuals to know how to apply Doughnut Economics in practice (Folke et al., 2019). A further criticism of the simplicity of the model is that the policy prescriptions put forth are based on beliefs and hopes rather than empirical analysis. Raworth proposes a new set of beliefs to counter an existing set of beliefs. To this end, Doughnut Economics contributes to the ideological struggle of what is a good economy and provides a competitor for traditional economics but is not helpful in building an empirically oriented Doughnut Economy (Schokkaert, 2019).

Some economists have criticized Doughnut Economics for promoting a growth-based economic model that may not be sustainable in the long term. These economists argue that Doughnut Economics does not go far enough in promoting alternative economic models that prioritize well-being and sustainability over economic growth (Jackson, 2017).

The Doughnut has also been described as being ambitious due to the necessity to formulate a new set of rules and insights to guide the global economy. It is important to note that the Doughnut Model moves so far away from using GDP that it does not include it at all. The only monetary indicator is related to money and work and the focus of it is not growth of monetary wealth, but focused on poverty alleviation, job access, and equity concerns. This pushes against preconceptions about growth as a necessary condition for a healthy economy, individual wealth creation, and positive investment results. Even the SDGs include overall economic growth as one of the explicit global development aims (Bernhardt, 2017).

The emphasis on sustainability reinforces the need for redistributive policies and regulations (Nagase, 2022). However, there is not acknowledgement of trade-offs. Between climate action and sustainable production and consumption there will be trade-offs. There is not discussion about what goals and/or boundaries should take precedence over others (Alcott, 2019).

While the ideas in the model may be easy to agree with, there is not critical thinking about how to deal with the current global desire to acquire wealth. Nor does it address other current issues like xenophobia, migration, populism, and terrorism.

There are remaining questions that the model does not answer like how to manage the commons? How should institutions and incentive structures that reinforce social reciprocity look? How to bring about more international coordination in the face of climate change? How to design and implement a global tax on extreme personal wealth? Future research will be needed to refine and develop the Doughnut Economics framework and to identify specific policy recommendations for achieving its goals.

Overall, while Doughnut Economics has its strengths and weaknesses, it represents a promising step towards a more sustainable and equitable economic system. With further research and experimentation, it has the potential to transform the way we think about economic development and create a more just and thriving world for all.

Applications in the Global North

While the Doughnut model was drawn at a global scale, it is being scaled and utilized in what are called "Doughnut Cities." Doughnut Cities are the most widely used method of implementing the ideas of the Doughnut Economics Model.

Amsterdam is the most famous city utilizing Doughnut Economics. In 2019, city officials in Amsterdam designed a strategy for the city to become 100% circular by 2050, called the Amsterdam Circular Strategy (Amsterdam Donut Coalition & Doughnut Economics Action Lab, 2020). Aligning with this approach, in April 2020, the city announced incorporation and utilization of the Doughnut Economics model in city plans. They were the first city in the world to present a city portrait approach to downscaling and applying the global Doughnut model. Amsterdam's Doughnut initiatives focus on local development and sustainability. Amsterdam's portrait focuses on four main areas: for people in the city to thrive, staying within the natural habitat, contributing to a healthy planet, and respecting wellbeing of people worldwide. The first area, people thriving, spotlights the creation of more green spaces throughout the city, fewer cars, accessibility to affordable housing for all, and enabling the involvement of community-based networks in decision-making all while ensuring a just transition that considers reducing social inequality. To stay within the boundaries of the natural habitat, the city is emphasizing biomimicry, driving innovation inspired by nature. Urban designers are incorporating nature's needs in the fabric of buildings by using products like boo-hotel bricks and designing retaining walls that include places for nesting birds. In addition, the Clean Air Action Plan aims to expand current low emissions zones and completely ban petrol and diesel vehicles by 2030. Beyond the city, to contribute to a healthy planet, Amsterdam has set goals to become a climate neutral and fully circular city by reducing CO_2 emissions by 95%, below 1990 levels (Doughnut Economics

Action Lab, 2020). The final area, respecting the wellbeing of people worldwide, is being addressed through focusing on procurement. One initiative in this area is by Fairphone, a smartphone manufacturer, who is responsibly sourcing raw materials by ensuring they are not connected with dangerous working conditions or child labor. Similarly, Moyee Coffee is promoting fair chain production by giving the countries of origin more of the financial value created. The Amsterdam Donut Coalitie is funded by the Amsterdam University of Applied Sciences in the short term but does not currently have a source of long-term funding. External funding sources provided by non-governmental entities provides neutrality and autonomy to explore Doughnut initiatives around the city.

Through presentations by Kate Raworth and inspired from neighboring cities and nations, the ideas of the Doughnut model are prolific throughout the rest of Europe. Many cities and counties in the United Kingdom have begun to utilize the Doughnut. In 2019, Cornwall declared a climate and ecological emergency and subsequently developed a plan to become carbon neutral and boost nature recovery. The Cornwall Plan 2020-2050 aims to achieve greater social and ecological sustainability and measure changes over time based on the categories of the Doughnut (Turner, 2022). Cornwall has developed a decision-making wheel based on the Doughnut that can be used to assess if specific policy decision or interventions align with the model. It takes each indicator in the model and based on the specific policy or intervention assigns it a category (long lasting positive impact, short term or limited positive impact, no known impact, short term or limited negative impact, and long-term negative impact) to assess its overall impacts (Turner, 2020). In the same report as the decision-making wheel, Cornwall defined each indicator in the Doughnut model, how it will be measured, and how collected data on the current state of each indicator serve as a baseline with which to compare future data. The London Doughnut Economy

Coalition (LDEC), inspired by the changes being implemented in Amsterdam, published a city portrait in June 2022 (Doughnut Economics Action Lab, (n.d.)). Currently, they are working to get London's City Hall to adopt new strategies and policies to build a new economic future for the city. In addition, they are currently working to build partnerships with local councilors at the borough level. The Leeds Doughnut Coalition, started in 2021, was created from the existing Climate Action Leeds program working towards the goals of zero carbon emissions and being nature friendly through the lens of socially just action by 2030 (Climate Action Leeds, (n.d.)). They published their city portrait in April 2022 and have been working towards creating a more detailed city plan to achieve the goals set out in the Doughnut (Climate Action Leeds, (n.d.)). In the cities that have published city portraits, there are varying levels of progress being made due to several being quite new and do not yet have much to report. Particularly the initiatives that were launched during the COVID-19 pandemic. There are differences in funding of the projects with some cities being fully funded and some having no funding at all. In addition, the bodies of support differ in that some cities have the support and partnership of governmental bodies, and some cities are working to lobby those bodies on the merits and necessity of utilizing the Doughnut. There is limited information published on cities that have started the process of incorporating the Doughnut, but do not have official city portraits published yet, like Liverpool, Cambridge, Cheltenham, Middlesbrough, Devon, Milton Keynes, and Pontypridd. A research institute in Liverpool has announced that its currently exploring the possible use of the Doughnut for the city but has not made any official moves towards creating a city portrait or official conversations with government officials (Brannigan, 2019). The Cambridge Doughnut Project is currently working to build relationships with their local government officials and other key organizations to create a group of important stakeholders before moving forward with a city

portrait or official plans (Cambridge Doughnut Economics Action Group, 2021). Planet Cheltenham, a climate action organization, has no plans to officially adopt the Doughnut, but has utilized ideas from the model to fit its goals of minimizing the carbon footprint and building a sustainable and resilient future for the town (Planet Cheltenham, 2022). Middlesbrough's community action groups, the Boro Doughnut Network, has utilized aspects from the model to support their One Planet Living strategy, but does not currently have a city portrait published or in the works (Boro Doughnut, 2022). The Devon Doughnut Collective, formed in October 2020, got its inspiration from neighboring Cornwall (Devon Doughnut Collective, 2023). The project is operating with no funding, utilizing volunteers, and is experimenting with various indicators in deciding what to measure and how to best incorporate input from its citizens. Currently, they are holding meetings with the Devon County Council to partner with government officials to adopt the Doughnut. The Milton Keynes Doughnut Economics project is currently creating a city portrait (Doughnut Economics Action Lab, (n.d.)f). Lastly, Pontypridd is utilizing the principles from the Doughnut model in their Pontypridd Place Plan but does not currently have an official city portrait (Pontypridd Open Network, 2022).

Four cities in Germany have begun adopting the ideas in the Doughnut Economics Model. Donut Berlin is currently unfunded and in the stages of gathering ideas about current systems, future possibilities for change, and the resources needed to achieve that change (Donut Berlin, 2022). They are in the process of lobbying the integration of the model to political parties, so they incorporate the ideas into their election programs (Donut Berlin, 2021). Hamburg and Frankfurt hosted a multi-city event where Kate Raworth presented the Doughnut Economics model. The Donut Coalition Hamburg was established in 2021 and is currently working to grow the local community around the project and to develop a set of indicators particular to the city

(Doughnut Coalition Hamburg, (n.d.)). The Frankfurt Doughnut Coalition was also established in 2021 and is still in the beginning stages of project development (Frankfurt Doughnut Coalition, (n.d.)). Donut Munich is the newest group and is still in the process of collecting together into a network for action (Doughnut Economics Action Lab, (n.d.)d).

Other cities across Europe have also begun utilizing the Doughnut Economics model. The West Cork Doughnut Economy Network in Ireland was started in April 2020. The team was created from members of the Green Economy Foundation, and they are currently working to widen their network (Doughnut Economics Action Lab, (n.d.)g). In Austria, the Doughnut Coalition Vienna is in the initial phases of creating the Doughnut4Wien downscaled model (Doughnut Economics Action Lab, (n.d.)c). The city of Barcelona, Spain took inspiration from the work happening in Amsterdam and Copenhagen and announced in July 2021 that it would embrace The Doughnut to guide the city's ecological transition to address the climate emergency (Doughnut Economics Action Lab, (n.d.)a). The city is collaborating with the Barcelona + Sostenible network and the University of Barcelona. Brussels Donut, created in 2020, is a consortium that is supported by and coordinating with the Brussels Regional Secretary of State for Economic Transition (Donut Berlin, 2021). Inspired by Amsterdam's city portrait, the group published a city portrait for Brussels focusing on the practical political measures that can be taken at the local and regional level (Brussels Donut, (n.d.)). Also inspired by the work in Amsterdam, the City Council of Copenhagen adopted use of the Doughnut in June of 2020 (Københavns Kommune, 2020). Lastly, Tonsburg, Norway has begun having conversations around the potential to adopt the Doughnut (Smultring Tønsberg, (n.d.)).

Nanaimo and Ottawa, Canada are also downscaling the global scale Doughnut and integrating the framework into city level plans. Nanaimo, a small city on Vancouver Island, has

incorporated Doughnut Economics in civic decision making. In December 2020, the city council voted to adopt the Doughnut framework to guide development to get through and beyond the COVID-19 pandemic (Beaudoin, 2021). The city has created environmental goals on greenhouse gas reduction, waste generation and diversion, and ecosystem protection and plans to measure progress. Goals and measurement related to social indicators such as housing and homelessness statistics, neighborhood walkability, and job market data have also been created (Sakaki, 2021). While the goals have been set, data are needed to measure the effectiveness of utilizing the Doughnut model does not currently exist. The city is balancing making progress with the long-term commitment it takes to fulfill and measure the transition. In Ottawa, the Doughnut Economics model was identified as a way to frame the solution to their declared climate and housing emergency. Ottawa's climate plan sets the goals of drastic cuts to emissions by 2030. To do this, the city is emphasizing better and more sustainable transit options, climate-proofing Ottawa's building stock, ensuring new neighborhoods meet the highest climate standards, and improving connectiveness and walkability in neighborhoods and between neighborhoods and hospitals, grocery stores, etc. In order to make these changes while promoting equity and equality, all plans and policies must consider reconciliation with the Algonquin-Anishinaabeg tribe and reflect indigenous views and leadership (The Ottawa Citizen, 2021).

In Australia, Sydney and Melbourne have begun integrating the concepts of The Doughnut. The project in Sydney does not currently have any funding and has just begun the process of building a coalition to explore practical applications of the Doughnut in the city (Donut Berlin, 2021). The city has set the goal of being inside the Doughnut within a generation with the entire project spotlighting the connection and wisdom of the native First Nations people (Regen Sydney, 2021). Regen Melbourne, formed in 2020, is a funded initiative but only on a

short-term basis (Regen Melbourne, (n.d.)). They are in the process of creating a Doughnut City Portrait focused on getting the city into the Doughnut through specific projects focused on social innovation.

In the United States, the state of California is working to partner with cities to start Doughnut city projects. No cities have adopted the project yet and they are working to increase awareness of the model and building relationships with a variety of stakeholders to create a state-wide network (California Doughnut Economics Coalition, (n.d.)). In Swannanoa, North Carolina, the Swannanoa Watershed Action Network (SWAN) is utilizing the Doughnut model to frame environmental change to protect the watershed area (Swannanoa Watershed Action Network, 2022).

In Southern Israel, near the unrecognized villages around Ramat Hovav are chemical evaporation ponds that contribute to high levels of air pollution. Investigation of this in 2017 and inspiration from the cities of Amsterdam and Brussels working with the Doughnut model sparked the facilitation of a forum to utilize the Doughnut Economics model in Israel. The new Israeli Doughnut community is lobbying the Tel Aviv-Jaffa Municipality to run a pilot program incorporating the principles outlined in the Doughnut Economics model (Surkes, 2022).

Both a strength and a limitation of the Doughnut model is that it provides general targets that can be adapted to specific locations and industries. While adaptability is crucial to the success and sustainability of the model, the lack of guidance on selecting more specific indicators or how to set targets at levels lower than global makes it difficult and potentially impossible to use in lower resource settings. Even though the Doughnut Economics Model was published in 2012, all the places mentioned began their journeys with the Doughnut in 2020 or

2021. Many of these projects were prompted by COVID-19 pandemic response efforts. Because these projects and programs are so new, there are no data yet on their success.

Some studies have utilized the Doughnut Economics model and applied it to industries or sectors. One study discussed how the European Union is attempting to speed up the transition to a low-carbon economy and to do this, the need to de-couple economic growth from environmental degradation. In order to achieve that goal, the Doughnut Economics model was presented as an optimal framework through which to develop policies to successfully direct that transition. However, the study points out a limitation of the model is that it does not provide concrete incentives or targets in this process and that each country in the European Union will have to decide what those will be (Grabbe, 2019).

The model has also been discussed in the creation of positive energy districts in urban residential areas in Europe to enable the energy transition to net zero balance and become climate neutral. Energy districts include all the buildings and neighborhoods in a given district meeting their energy demands from renewable resources that are low-cost, locally available, and environmentally friendly. The Doughnut was used because the model emphasizes a holistic approached needed to design a resilient system. Applying the Doughnut to the energy domain allows space for recognition of social impacts like access to energy in addition to the usually discussed environmental concerns like climate change and air pollution. Beyond the conclusions of needing to reduce energy consumption using fossil fuels and reducing CO_2 emissions to prevent environmental degradation, this paper includes the importance of being distributive and regenerative to create energy justice through access to clean energy for all (Derkenbaeva et. al., 2022).

Another similar study investigated the use of the Doughnut for regenerative urban planning in Europe. It argued the need for moving beyond the goal of sustainability in favor of more regenerative development frameworks, utilizing tenets of the Doughnut Model. All three of the neighborhoods discussed in the paper are located in Lisbon, Portugal and are used as an example of a contemporary city that could transition to become an ecocity if the Doughnut framework were utilized in urban development decision making (Crowley, 2021). Another study looked at the challenges that industrial small and mid-size enterprises in Europe are facing of balancing ecological and social issues while still needing to meet profitability and cost efficiency demands. The authors argue that due to the features of most European small and mid-size enterprises, they are highly suited for implementing strategic sustainability measures. However, they conclude that the framework is too comprehensive to be practically applied to the issue (Stopper et. al., 2016).

The Doughnut model has also been discussed as aligning with the latest Environment Action Programme of the European Union's explicit mention of the planetary boundaries and setting out the objective that people live well and within the planetary boundaries by 2050. The model can be used as the framework to create a common European approach of how to allocate the planetary boundaries. In this paper, the benefit of using the Doughnut is that is can be scaled easily from the planetary level down to specific products or services (Piciga, 2022). All of these papers provide evidence based on the context of the European Union and therefore the findings cannot be generalized and applied outside of that context. In addition, all the papers discuss potential uses of the Doughnut model to frame future action, but none mention specific action being taken to meet the tenets set out in the model.

Healthcare is another industry utilizing the Doughnut Model in the hopes of transitioning to a more sustainable way of working. Using the Doughnut allows for the change from a money centered approach to a people centered one. The key benefits to using the Doughnut Model in this context are that it highlights the wastefulness of the industry and demonstrates areas for innovation in reprocessing and recycling of medical instruments and other single-use devices (Silverthorne, 2021). However, the information is limited outside the context of the United Kingdom and a potentially broader western European context. The Doughnut model has also been used by the European Tourism Futures Institute to frame improvements in the tourism management industry to find a balance between quality of work for employees, quality of experience for visitors, quality of life for inhabitants, and quality of the physical space (Hartman & Heslinga, 2022). Applying the Doughnut model to a specific industry does change the limitations presented by the global scale of the model, however no specific thresholds were set because in this industry they are place and people dependent. The biggest benefit of this application of the Doughnut Model is that setting early warning signs, in addition to indicator thresholds can improve the specificity and usability of the model.

In Australia, the Doughnut Economics model was used as a framework to present a reform to the current economic system in favor of one that is growth agnostic and more circular. The pressure of bushfires, waste management, and COVID-19 on the Australian economy is generating discourse in the media and online about the possibilities of transition to a more circular economy. Despite these discussions, there have not been practical applications of the Doughnut. While being a useful framing mechanism, challenges arise with competing interests of businesses and politicians. The author argues that the biggest advantage of the model is that its

flexible to be molded to different situations and contexts and the biggest disadvantage is its limited measurability and lack of appeal to key agents of change, like businesses (Melles, 2021).

Lastly, Regenerate Barbados, which began in 2020 is utilizing themes identified in the Doughnut Economics model to support environmental and social action such as nationally monitoring pesticide and fertilizer use, working with women fisherfolk and vegetable vendors to manage multiple roles, and integrating construction waste mechanisms (Almerigi et. al., 2021).

Applications in the Global South

As seen by all the previous evidence presented, the Doughnut Economics Model has mostly been utilized and implemented in the context of the Global North. However, there are a few instances of utilizing the Doughnut Economics model in the Global South.

Although India has not explicitly mentioned the Doughnut model, one study argues that the model represents the issues the country is currently facing. Global South economies face unique challenges in achieving the goals set out in the Doughnut Economics model. Currently India's economic development agenda includes massive infrastructure projects like smart megacities and piped water and sanitation, delivering education and healthcare and new farming methods, improving agro-processing and increased farm incomes, and improving transportation. This paper identifies the biggest challenge as how to achieve these things while also decarbonizing (Mukherjee, 2022).

One study mentioned the Doughnut model in investigating the implications of sustainable development on human rights law in Africa. The arguments made in the paper align with the Doughnut model, that economic growth does not equal economic development, human development, and usually has a high environmental cost. While these ideas have been discussed

in other papers, this paper makes the distinction that it is critical in the global south context to directly focus on human well-being and ecological sustainability to avoid mirroring the development of the global north. Finally, this paper emphasizes the importance of shifting away from growth towards redistribution and the criticalness of that within African countries (Vandenhole, 2018).

The Tri-Color Coalition for Sustainable Transitions in Mexico City is currently working to promote the Doughnut model as a framework for sustainability transformation across the city (Coalición Tricolor, (n.d.)). Currently, they have not published a city portrait.

Doughnut Brazil was created in 2021. It began as a WhatsApp group and has expanded to more than 250 current members consisting of academics, consultants, NGOs, and entrepreneurs (Doughnut Economics Action Lab, (n.d.)b). Currently, the project has no funding source and volunteers host sporadic meetings on Doughnut-related themes. The largest stakeholder, the Brazilian Government, remains absent from the conversation. The current interest from other stakeholders in Brazil needs to be capitalized on in convincing the government of Brazil to officially incorporate the Doughnut into policy decision-making.

At this stage, there is an opportunity to expand beyond many of the Doughnut City approaches and emphasize human health and environmental health beyond urban planning and development.

Case Study: Brazil

Brazil is the fifth-largest country in the world by land area and has the largest economy in Latin America. According to the World Bank, it is classified as an upper-middle-income country

based on its gross national income (GNI). The expansion of cattle farming has been a significant contributor to Brazil's economic growth, making it the largest beef exporter globally (Osorio et. al., 2013). The increase in beef production was fueled by a shortage of beef in the 1980s, which led to the adoption of technological modernization and government subsidies that improved meat quality, productivity, and competitiveness in the global market (Faria, 2016; Malafaia, 2021).

Brazil's economic growth over the past few decades has had a positive impact on many of the country's development indicators. For example, between 2001 and 2015, the percentage of the population living in poverty fell from 24.7% to 8.9% (World Bank, 2022). This decline can be attributed in part to Brazil's strong economic growth during this period, which was driven by factors such as the expansion of the agricultural sector and increased access to credit.

In addition, Brazil's economic growth has also led to improvements in areas such as health and education. Between 1990 and 2015, the under-five mortality rate in Brazil declined from 53 deaths per 1,000 live births to 14 deaths per 1,000 live births (World Bank, 2022). This improvement can be linked to increased access to healthcare services, which has been facilitated by Brazil's economic growth.

Despite some positives of economic growth, the country faces environmental challenges. The country is the largest emitter of greenhouse gases in the Latin America and Caribbean region (USAID, 2022). Land-use change and the forestry sector are the main sources of emissions.

The expansion of cattle ranching has come at a significant cost to the environment, with vast areas of forest being cleared to make way for pastureland. Deforestation in the Amazon has not only contributed to greenhouse gas emissions but has also led to the loss of biodiversity, disrupted local ecosystems, and caused soil erosion and water pollution. Sixty percent of the

Amazon Basin, the world's largest land carbon sink, is within Brazil's borders. This is concerning because the Amazon rainforest plays a critical role in regulating the Earth's climate by storing vast amounts of carbon. As such, the destruction of the Amazon rainforest can have significant environmental consequences, including the acceleration of climate change.

Despite efforts to reduce deforestation rates in recent years, the beef industry continues to drive land use change in Brazil, and further action is needed to address the environmental and social impacts of this sector.

III. **Methods**

The aim of this thesis is to identify research and application gaps of the Doughnut Economics Model and highlight a potential opportunity to utilize the framework in the global development sector. This thesis is presented as a white paper that draws conclusions from a series of separate observations, thus inductive reasoning. All data utilized in the paper are publicly available. The goal is to present ideas to stimulate thinking on the ways to improve the way economics is utilized in the global development sector.

Information Sourcing on Traditional Economics

To provide a context for Doughnut Economics, I conducted a general Google search of traditional economic theories that Doughnut Economics seeks to challenge. The search included keywords such as "neoclassical economics," "Keynesian economics," and "Chicago School of

Economics." I reviewed various sources, including academic papers, news articles, and textbooks, to understand the key principles and assumptions of these economic theories. This information helped me to identify the gaps and limitations of traditional economic theories, which Doughnut Economics aims to address. I used this background information to inform my analysis of the literature on Doughnut Economics and to identify the unique contributions of this new economic paradigm.

Information Sourcing on Doughnut Economics and Its Applications

To identify relevant literature on Doughnut Economics, I conducted a search of the Emory University Library Database. I used the inclusion criteria of any literature that mentioned the phrase "Doughnut Economics" in the body of the text or title of the references. To exclude other publications by or about Kate Raworth that were not directly related to Doughnut Economics, I used the exclusion criteria of only including literature that specifically focused on the concept of Doughnut Economics. I used a combination of keywords such as "Doughnut Economics," "economic theory," "sustainable development," and "planetary boundaries" in my search to ensure that I captured a comprehensive range of literature. I reviewed the titles and abstracts of the search results to assess their relevance, and then I retrieved the full texts of the relevant literature for further analysis.

In addition, I sourced project information from the Doughnut Economics Action Lab (DEAL) website (https://doughnuteconomics.org/), an online platform that showcases innovative projects related to Doughnut Economics from around the world. I reviewed the website to

identify relevant projects and their associated information such as project descriptions, objectives, and outcomes.

Information Sourcing on Brazil Case Study

The case study country was selected based on general knowledge of Brazil's Gini index value, general knowledge of extreme wealth inequality, and general knowledge of the country's large contributions to environmental resource degradation and climate change. Actual data on these values was collected from the following sources.

Brazil country development data were gathered from The World Bank's DataBank that compiles data on a collection of development indicators from internationally recognized sources and presents the most current available global data.

Both global and Brazil climate change data were gathered from World Resource Institute's Climate Watch online platform. Climate Watch is a synthesis of dozens of datasets to create a single source to analyze historical emissions data, Nationally Determined Contributions (NDCs) under the Paris Agreement, and climate goals by country.

Brazil global health development data were gathered from the World Health Organization's Global Health Observatory. Data in the GHO repository are meant to be used to compare across countries and over time and therefore represent best estimates of the World Health Organization using specific methodologies depending on the indicator.

Information and Data on the Brazil Doughnut were sourced from The University of Leeds' A Good Life For All Within Planetary Boundaries project. This project collects and aggregates data on Doughnut Economics indicators at the country level.

Literature was grouped into three categories: review of traditional economic thinking, review of other economists' responses to the Doughnut Economics model, and finally a review of the current applications of the model.

Analysis

I conducted a qualitative analysis of the literature and project information using thematic analysis to identify common themes and patterns related to the concept of Doughnut Economics. My analysis included identifying key definitions, theories, and practical applications of Doughnut Economics in various contexts, including policymaking, business, and community development. I followed the guidelines of systematic literature review methodology to ensure the validity and reliability of my results. See Appendix 1 for the abstract table of sources.

IV. **Results**

Sustainable Development Goals Compared to Doughnut Economics

Doughnut Economics and the Sustainable Development Goals (SDGs) share many common goals and indicators, as they both aim to promote sustainable and equitable

development. For example, both frameworks prioritize access to clean water and sanitation, access to affordable and clean energy, and reduction of poverty and inequality. However, Doughnut Economics takes a broader approach by emphasizing the importance of planetary boundaries and social foundations, and by incorporating ecological and social indicators such as carbon emissions and gender equality. In contrast, the SDGs focus more on economic indicators such as GDP growth and employment rates, while also including social and environmental indicators. While both frameworks are valuable in their own right, the different indicators they use reflect different priorities and goals, and careful consideration should be given to which framework is most appropriate for a particular context or analysis.

Table 2. Comparing Social Foundation and SDG Indicators

Social Foundation Indicators	**Related Sustainable Development Goals (SDGs)**
Energy and materials	SDG 7: Affordable and Clean Energy SDG 8: Decent Work and Economic Growth SDG 9: Industry, Innovation and Infrastructure SDG 11: Sustainable Cities and Communities SDG 12: Responsible Consumption and Production
Water	SDG 6: Clean Water and Sanitation
Health	SDG 3: Good Health and Well-being
Education	SDG 4: Quality Education
Political voice	SDG 16: Peace, Justice and Strong Institutions
Social equity	SDG 5: Gender Equality SDG 10: Reduced Inequalities
Jobs and livelihoods	SDG 1: No Poverty SDG 8: Decent Work and Economic Growth
Infrastructure and housing	SDG 9: Industry, Innovation and Infrastructure SDG 11: Sustainable Cities and Communities

Networks and systems	SDG 17: Partnerships for the Goals
Community and participation	SDG 16: Peace, Justice and Strong Institutions SDG 17: Partnerships for the Goals
Wellbeing	SDG 3: Good Health and Well-being SDG 4: Quality Education SDG 8: Decent Work and Economic Growth SDG 11: Sustainable Cities and Communities
Cultural diversity	N/A (not directly related to a specific SDG)

Table 2 lists the social foundation indicators of the Doughnut Economics model and identifies which of the Sustainable Development Goals match up, or do not match up with them. Based on the indicators used in Doughnut Economics, it appears that SDG 14: Life Below Water, SDG 15: Life on Land, and SDG 16: Peace, Justice, and Strong Institutions are not explicitly included in the Doughnut framework. However, it is important to note that some of the indicators used in Doughnut Economics may indirectly touch upon aspects of these SDGs, particularly SDG 14 and SDG 15, which are focused on environmental sustainability.

Doughnut Economics and the Sustainable Development Goals (SDGs) both offer frameworks for building a more sustainable and just world, but they differ in their approach. The SDGs focus on specific measurable targets across 17 different areas. In contrast, Doughnut Economics offers a more holistic approach. The Doughnut model sees these indicators as interconnected, and emphasizes the importance of meeting all of them to achieve a thriving and sustainable society. In contrast, the Sustainable Development Goals are often separated from one another and each indicator is seen as an independent goal. While both frameworks are useful in guiding efforts toward a more equitable and sustainable future, Doughnut Economics offers a

more integrated and comprehensive approach that recognizes interdependence of social foundation indicators on each other.

Planetary Boundaries Compared to Doughnut Economics

The indicators in the ecological ceiling of Doughnut Economics and the indicators in the Planetary Boundaries share similarities, as they both aim to identify and measure the limits of the earth's natural resources and ecosystems. The ecological ceiling indicators of Doughnut Economics focus on measuring the use of materials, energy, and water, as well as the impact on land use and air pollution. The indicators in the Planetary Boundaries, on the other hand, measure the extent to which certain global environmental processes, such as climate change, ocean acidification, and nitrogen cycles, have been pushed beyond their safe limits (Rockström et. Al., 2009). Both sets of indicators are important for understanding the sustainability of human activities and identifying areas where action is needed to prevent further damage to the environment.

Table 3. Comparing Ecological Ceiling and Planetary Boundaries Indicators

Ecological Ceiling Indicators	**Planetary Boundaries**
Climate Change Mitigation	Climate Change
Ozone Layer Depletion	Stratospheric Ozone
Atmospheric Aerosol Loading	Atmospheric Aerosols
Ocean Acidification	Ocean Acidification
Biogeochemical Flows	Biogeochemical Cycles
Land-Use Change	Land System Change
Freshwater Withdrawals	Freshwater Use

As seen in Table 3 above, Doughnut Economics' ecological ceiling indicators and the planetary boundaries are almost identical. Both frameworks recognize the importance of addressing the interrelated and complex environmental challenges facing the planet, such as climate change, biodiversity loss, and pollution. However, while the planetary boundaries focus on identifying nine key Earth system processes that, if crossed, could result in irreversible and catastrophic environmental change, ecological ceiling indicators of Doughnut Economics assess the ecological indicators based on what is necessary for maintaining a safe and just operating space for humanity.

While both frameworks aim to inform efforts to achieve a sustainable future, the Doughnut's ecological ceiling indicators take a more integrated and holistic approach to understanding the complex interactions between human society and the environment.

Case Study: Brazil

Gross National Income

According to the World Bank, Brazil is classified as an upper middle-income country (based on its gross national income). Brazil's GNI per capita in 2021 was $7,740 USD (World Bank Group, (n.d.)a).

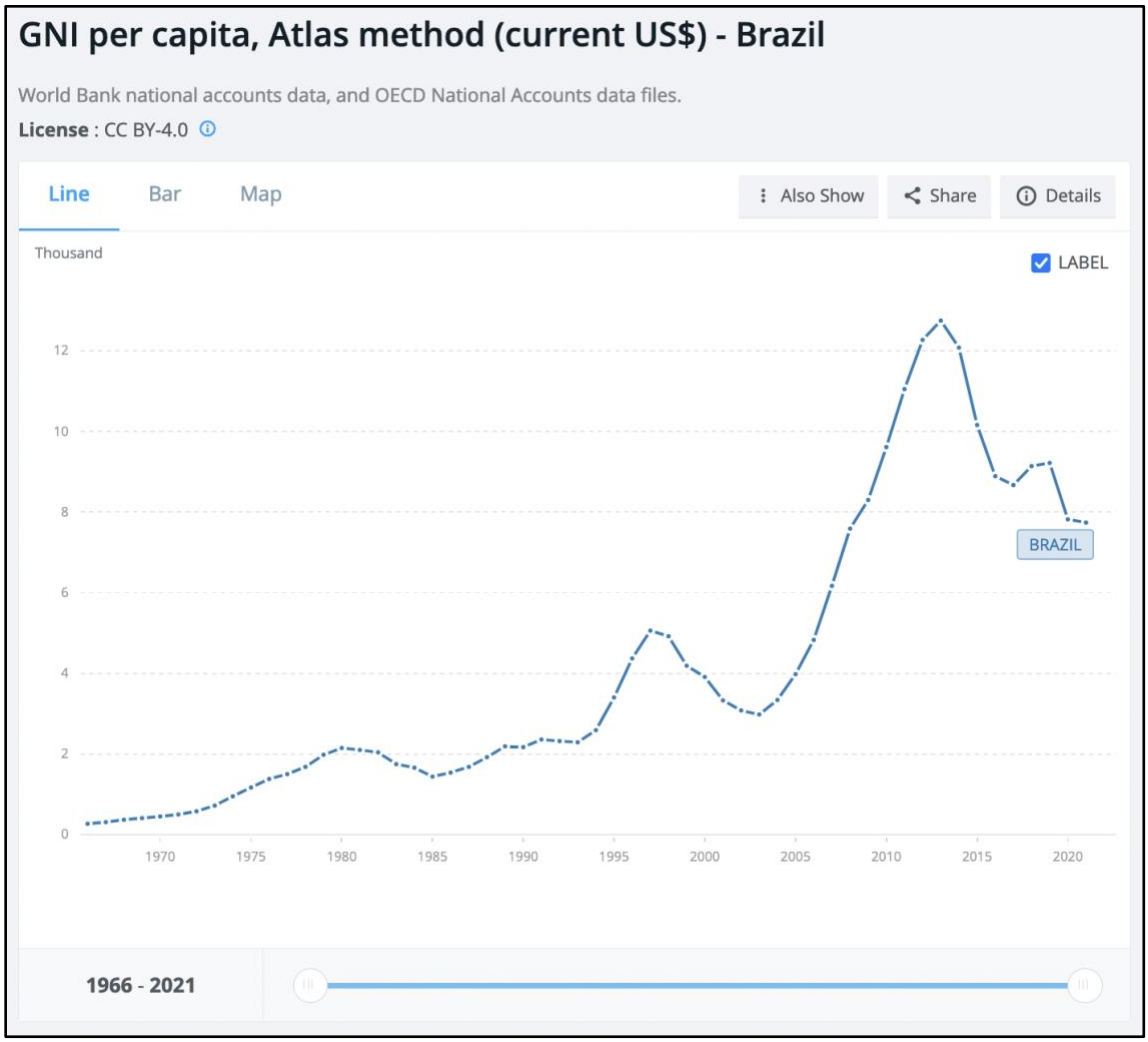

Figure 5. Brazil Gross National Income per capita (World Bank Group, (n.d.)a.)

As seen in Figure 5 above, Brazil's GNI per capita has undergone significant changes since 1966, reflecting the country's economic and political history. In the 1960s and 1970s, Brazil experienced a period of rapid economic growth, which led to significant improvements in GNI per capita. However, this growth was accompanied by rising inequality, and many Brazilians continued to live in poverty. In the 1980s, Brazil experienced a severe economic crisis, which led to a sharp decline in GNI per capita and increased poverty. In the 1990s and early 2000s, GNI per capita began to recover, and Brazil experienced a period of moderate economic growth. This growth was accompanied by significant improvements in social

indicators, such as reduced poverty rates and increased access to education and healthcare. However, more recently, Brazil has faced challenges such as political instability, corruption, and environmental degradation, which have impacted GNI per capita.

Using an absolute number like GNI per capita to determine the level of development in Brazil does not capture the full story of what is going on in the country. Using GNI per capita divides the nation's GNI equally amongst its citizens, but in reality, that is not the case. GNI per capita does not account for the actual distribution of wealth amongst the population.

Poverty in 2019 was 26.2 percent under the international poverty line. In 2020, the percent of the population estimated as living in poverty was 18.7. In 2021, poverty in Brazil jumped back up to 28.4 percent. The income of families living in the bottom 40% of income distribution was lower in 2021 than it was in 2016. At the end of 2021, the total unemployment rate was 11%, but this rate was more than twice higher among individuals under 25 years old. An estimated 31% of the population is estimated to suffer from moderate or severe food insecurity (World Bank Group, 2023).

Gini Index

The Gini index measures the extent to which the distribution of income or consumption among individuals or households within an economy deviates from a perfectly equal distribution, a Gini index of 1 (World Bank Group, (n.d.)b).

As seen in Figure 6 below, Brazil's Gini index, which measures income inequality, has undergone significant changes since 1981. In the 1980s and early 1990s, Brazil had one of the highest levels of income inequality in the world, with a Gini index of around 0.6. However, beginning in the mid-1990s, the Brazilian government implemented a series of social welfare programs aimed at reducing poverty and inequality. These programs, which include Bolsa Familia and the Minimum Wage, have had a significant impact on reducing inequality in Brazil. As a result, the Gini index had been steadily decreasing since the mid-1990s, reaching a low of 0.509 in 2014. However, inequality remains a significant challenge in Brazil, with significant disparities in income and opportunities between different regions, social groups, and ethnicities.

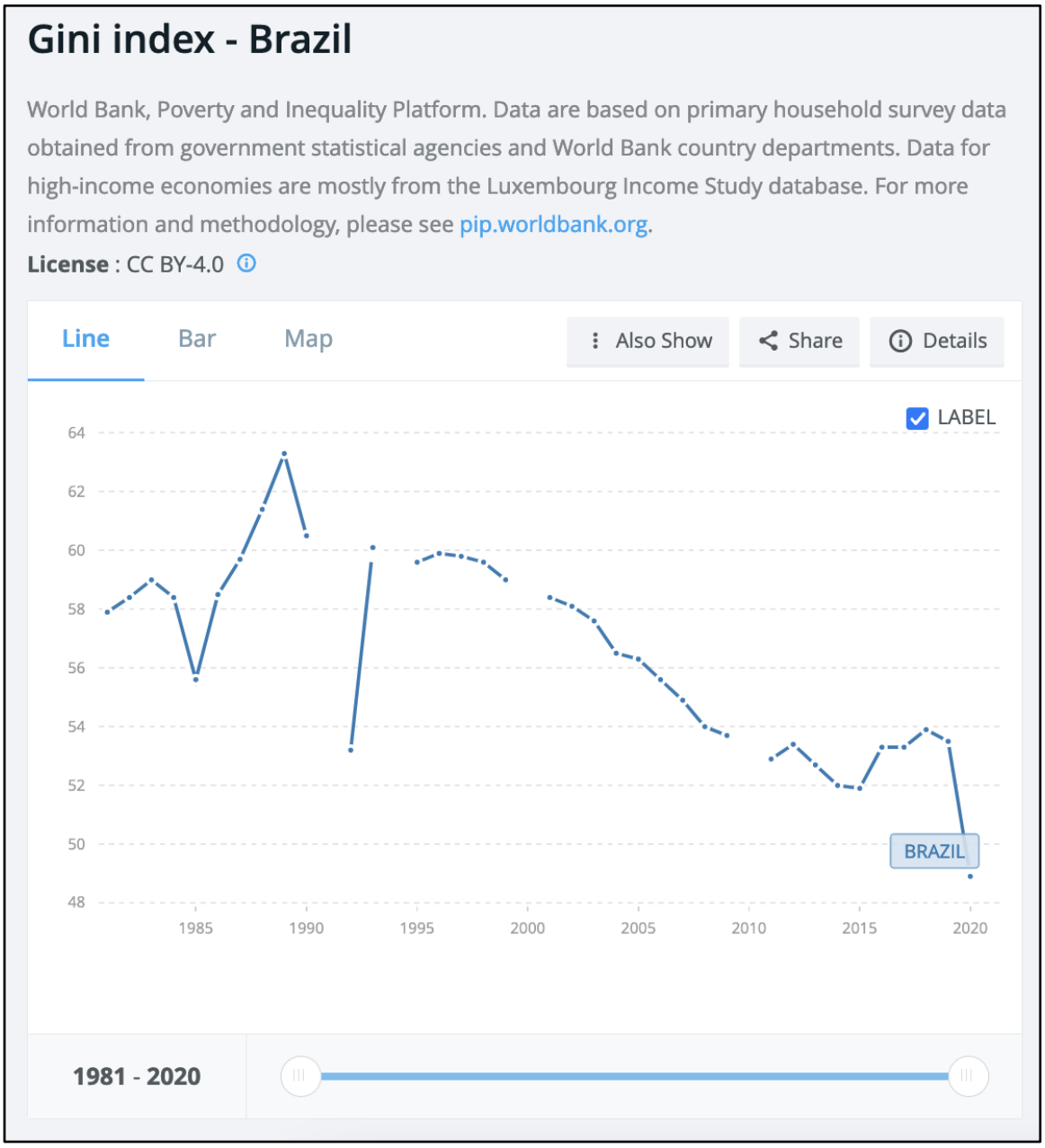

Figure 6. Brazil Gini Index (World Bank Group, (n.d.)b)

In recent years, political and economic instability, as well as cuts to social welfare programs, have led to an increase in inequality, with the Gini index rising to 0.545 in 2019 (World Bank Group, 2023). Despite these challenges, reducing inequality remains a priority for

the Brazilian government, as it is seen as a key factor in promoting economic growth and social stability.

In 2020, Brazil's Gini index was 0.489. However, due to short term changes including expansions to the safety net programs due to the COVID-19 pandemic response and slow labor market recovery from the pandemic, it is not possible to attribute the exact cause of the decrease. Interestingly, the Gini index to bounced back up to 0.529 in 2021 when many of those social safety net programs ended (World Bank Group, 2023). Despite overall economic growth in Brazil over time, economic inequality is still prevalent.

Brazil Contribution to Global Climate Change

The country has made progress in reducing emissions from deforestation in recent years, but this has been offset by increased emissions from other sectors. Brazil has also faced criticism for its environmental policies, including the weakening of environmental protections and the promotion of extractive industries such as mining and oil and gas exploration. As a signatory to the Paris Agreement, Brazil has committed to reducing greenhouse gas emissions by 37% by 2025 compared to 2005 levels. However, achieving this target will require significant efforts to address deforestation, promote renewable energy, and transition to a more sustainable economic model.

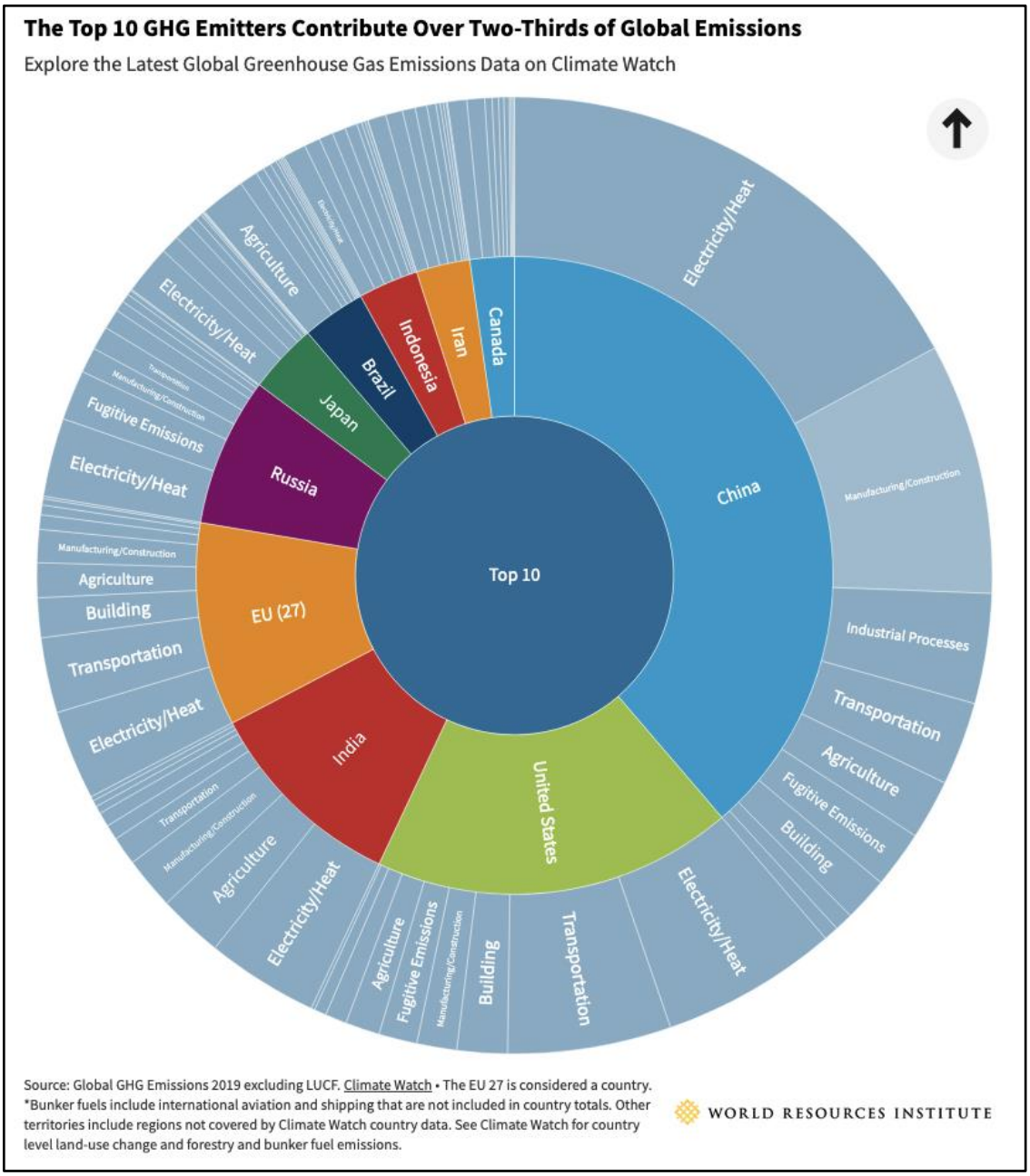

Figure 7. Global Top Ten Greenhouse Gas Emitters (Friedrich et. al., 2023)

As seen in Figure 7 above, in 2019 Brazil ranked seventh in the top ten global emitters of greenhouse gases. Emissions from top ten global emitters account for over two thirds of total global greenhouse gas emissions and totaled 32,818.2 metric tons of carbon dioxide equivalent

(MtCO2e). The unit "CO2e" represents the amount of a GHG whose atmospheric impact has been standardized to that of one unit mass of carbon dioxide (CO2), based on the global warming potential of the gas. In 2019, Brazil emitted 1,451.63 million tons of CO_2 equivalent representing 2.92% of total global emissions. As seen in Figure 8 below, in Brazil, greenhouse gas emissions from the Agriculture Industry (including crop farming, fisheries, and livestock) are responsible for almost half of the country's total emissions, amounting to 504.3 MtCO2e, or 1.05% of total global greenhouse gas emissions in 2019. The total emissions from land use change and forestry totaled 394.37 MtCO2e, 27.17% of Brazil's total greenhouse gas emissions for 2019 (Friedrich, 2023).

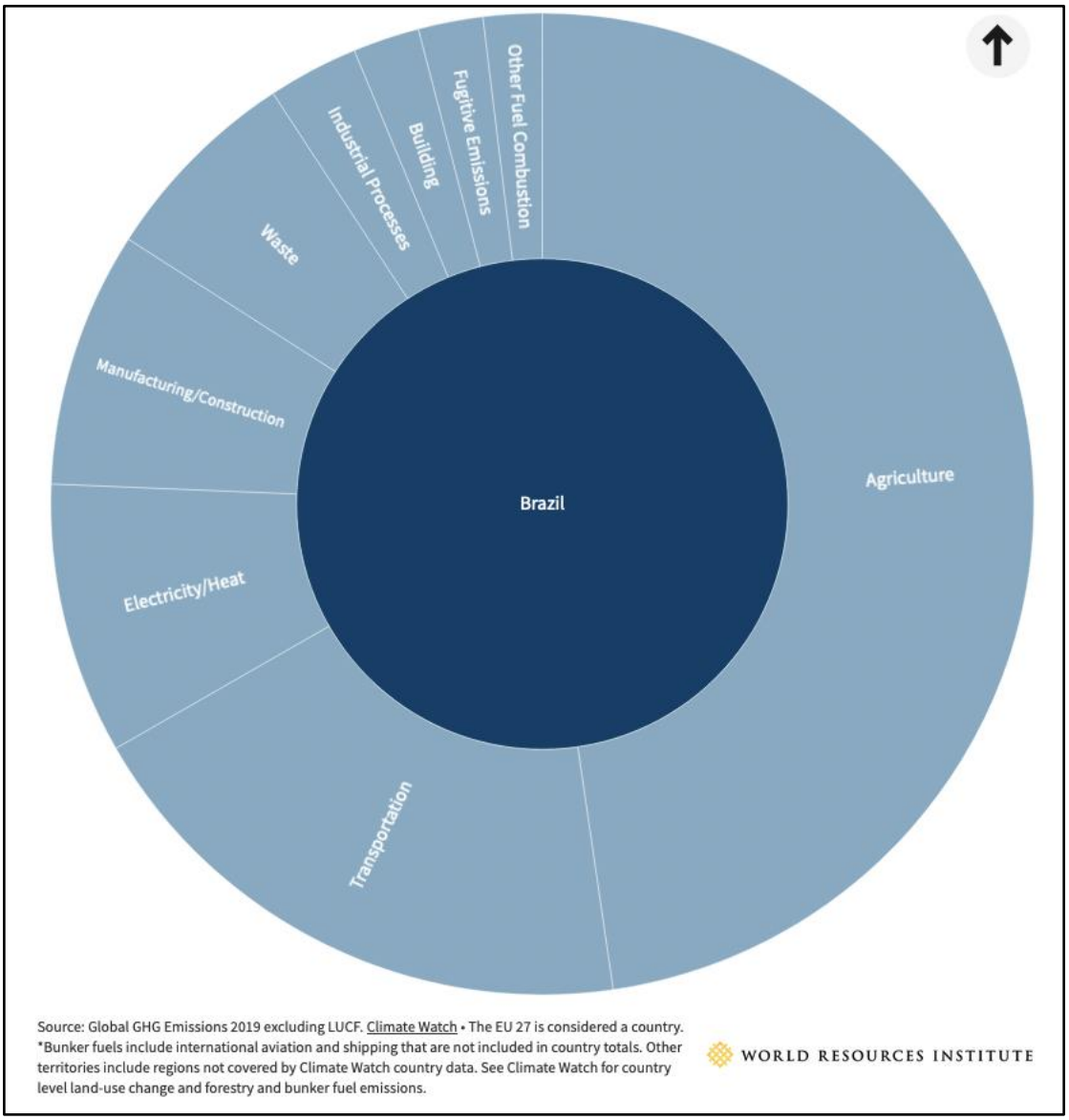

Figure 8. Sector Contribution to Total Country Greenhouse Gas Emissions (Friedrich et. al., 2023)

Brazil Doughnut

"Downscaling" Doughnut Economics refers to applying the concept and framework of Doughnut Economics at a smaller scale, such as a city or community level. While this approach can provide valuable insights into how Doughnut Economics can be applied in practical contexts, it can also create data gaps due to the lack of available data at smaller scales. For example, global

or national data on social and environmental indicators may not be available at a local level or may not accurately reflect the specific conditions and challenges of a particular community.

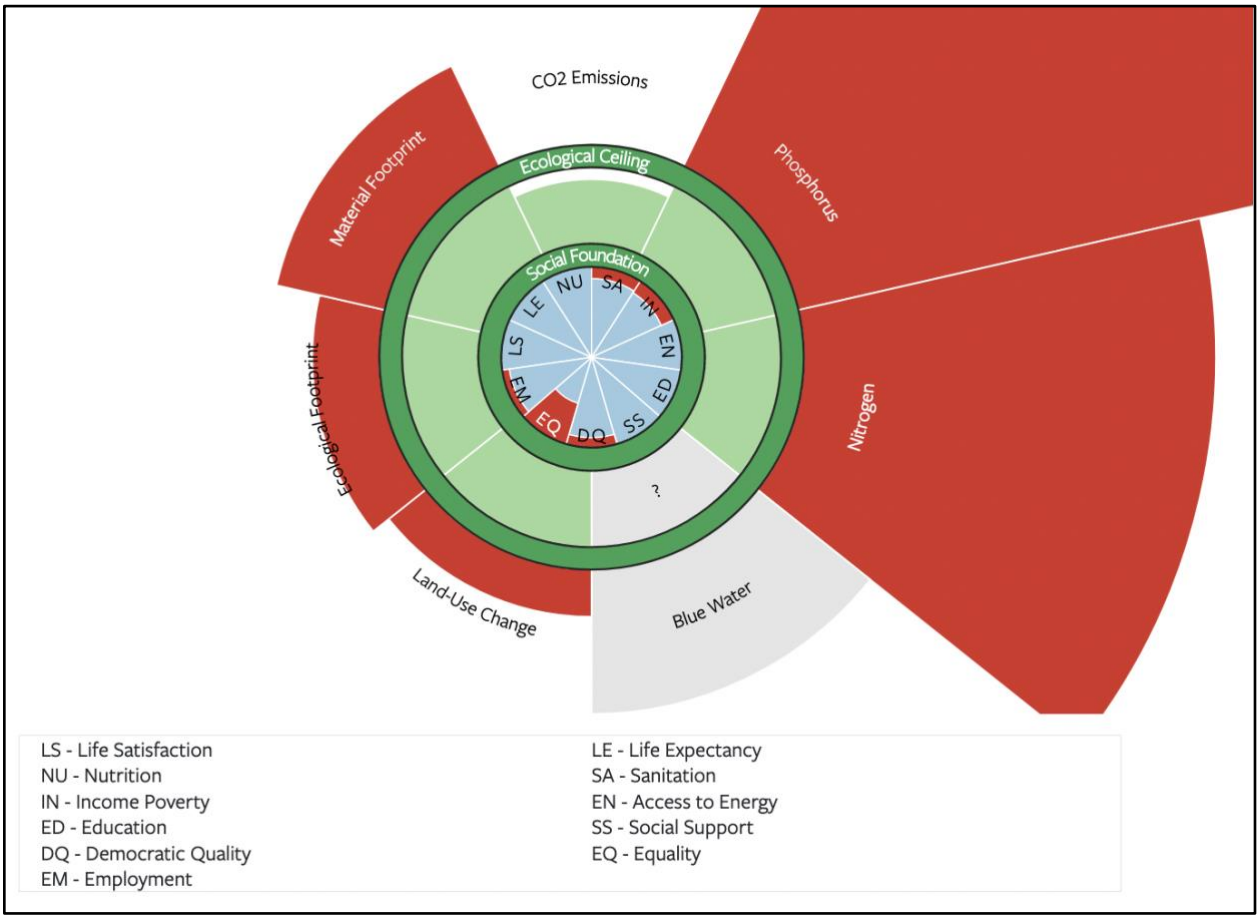

Figure 9. Brazil State of the Doughnut, 2015 (Gutiérrez Martínez & Fanning, (n.d.))

As seen in Figure 9 above, which depicts the scaled down Doughnut for Brazil, to measure the Doughnut on a country scale, some of the defined control variables and targets change. For the ecological ceiling dimensions in particular, some of the measures utilized in measuring global impact would be impossible to collect at the country level. For example, there is no way to measure what portion of the total concentration of atmospheric carbon dioxide

globally can be attributed to one country. However, measuring carbon dioxide emissions from a particular country can be compared over time and can be compared to other countries. In addition to modifying indicators, two separate environmental footprint indicators are added, ecological footprint and material footprint. These are not part of the planetary boundaries framework, but they are widely reported measures of environmental pressure (O'Neill et. al., 2018). Biodiversity loss, chemical pollution, air pollution, ozone layer depletion, ocean acidification, and freshwater withdrawals were not measured.

Furthermore, even when data is collected at the local level, comparing it across different contexts can be challenging due to differences in data collection methods and indicators. Environmental indicators such as air quality may be measured differently in different countries, making it difficult to compare pollution levels between communities in different regions. Therefore, when downscaling Doughnut Economics, it is important to consider these challenges and to use caution when making cross-context comparisons, in order to ensure that the analysis is accurate and relevant to the specific context being studied.

As seen in table 4 below, most of the social foundation Doughnut dimensions reduced the number of indicators from one to two. Housing, Gender Equality, and Peace & Justice are dimensions that were not included in the downscaled version for data collected in Brazil.

Table 4. The Doughnut of Social and Planetary Boundaries in Brazil (Gutiérrez Martínez & Fanning (n.d.))

Doughnut Dimension	**Defined Control Variable**	**Target**	**Actual**
Climate Change	Carbon dioxide emissions (cumulative megatons of CO_2) *	17,176 megatons of CO_2	14,567 megatons of CO_2
Nitrogen & Phosphorus Loading	Nitrogen usage (kilograms of nitrogen per capita) Phosphorus usage (kilograms of phosphorus per capita) *	8.4 kilograms of nitrogen per capita 0.8 kilograms of phosphorus per capita	54.1 kilograms of nitrogen per capita 7.4 kilograms of phosphorus per capita
Land Conversion	Land-Use Change (tons of carbon per capita) *	2.5 tons of carbon per capita	4 tons of carbon per capita
Ecological Footprint	Global hectares per capita **	1.7	3.1 global hectares per capita
Material Footprint	Tons per capita **	6.8	16.7
Health	Life expectancy (in years) *	74	75
Education	Secondary Education (gross enrollment in secondary school %) *	95	100.1
Income & Work	Income poverty (% of the population earning above $5.50 per day) *	95%	80.6%
	Employment (% of labor force employed) *	94	91.6
Political Voice	Democratic quality (0-10 scale) *	7	6.3
Social Equity	Equality [0-100] scale equivalent to Gini index of 0.3 *	70	54.8
Networks	Social support (% of the population with friends or family they can depend on) *	90	90.7
Energy	Access to energy (% of the population with access to energy) *	95	99.7% of the population

Doughnut Dimension	Defined Control Variable	Target	Actual
Water	Population with access to improved sanitation (% of the population) *	95	82.8
Food	Nutrition (kilocalories per person per day) *	2700	3309.9
Life Satisfaction	0-10 Cantril ladder scale **	6.5	6.6

Key: Table 4. Global State of the Doughnut of Social and Planetary Boundaries

	Ecological Ceiling Doughnut Dimension
	Social Foundation Doughnut Dimension
	Not meeting Doughnut target
	Meeting Doughnut target
* Indicates changed indicator from Raworth's Global Doughnut Model	
** Indicates added indicator to Raworth's Global Doughnut	

Table 4 above presents the set of 15 key dimensions in the downscaled Doughnut that measure various aspects of human well-being and environmental sustainability. The table provides information about the target and the actual values for different doughnut dimensions.

It is evident from the table that some of the targets have been achieved, while others have not. For instance, the percentage of the population with access to energy has exceeded the target of 95%, with 99.7% of the population having access to energy. Similarly, the percentage of the population with social support has slightly exceeded the target of 90%, with 90.7% of the population having friends or family they can depend on.

On the other hand, some targets have not been met, indicating a need for more efforts to address these issues. For instance, the target for land-use change was 2.5 tons of carbon per capita, but the actual value was 4 tons of carbon per capita. Similarly, the target for nitrogen and phosphorus usage was significantly lower than the actual values. The target for nitrogen usage was 8.4 kilograms per capita, while the actual value was 54.1 kilograms per capita. The target for phosphorus usage was 0.8 kilograms per capita, while the actual value was 7.4 kilograms per capita.

Furthermore, some dimensions have shown an improvement, but they still require further attention. For instance, the target for income poverty was set at 95%, but the actual value was 80.6%. While this is an improvement, it still means that a significant percentage of the population is living below the poverty line. Similarly, the target for social equity was set at 70, but the actual value was 54.8, indicating that more work needs to be done to achieve a more equitable society.

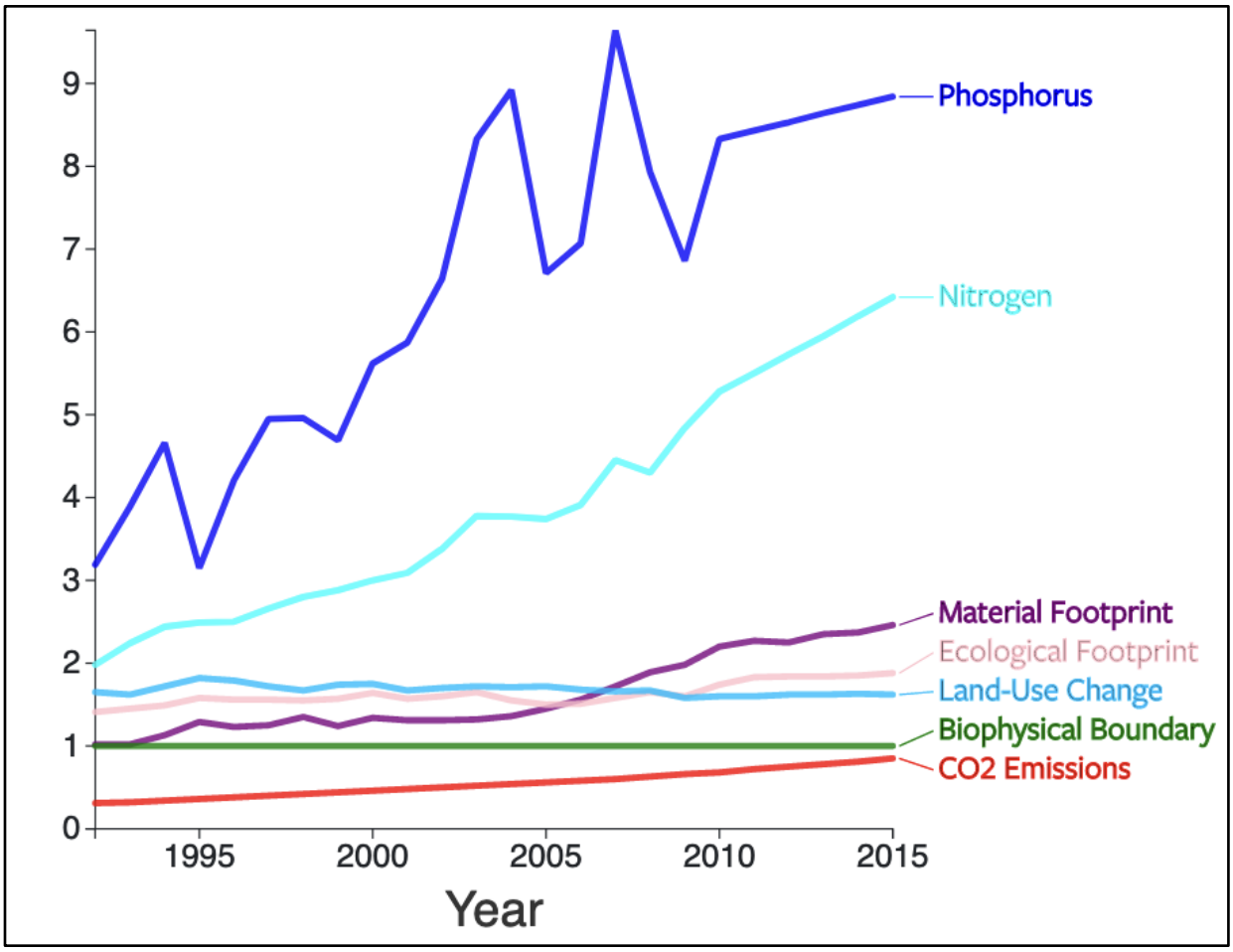

Figure 10. Biophysical Indicators - Brazil Doughnut (Gutiérrez Martínez & Fanning, (n.d.))

Figure 10, above, provides a comprehensive overview of the state of Brazil's environment and natural resources. The graph consists of various indicators related to land use, climate, and pollution. Because the indicators all have different scales, they are shown in this graph based on the ratio of how far above or below the biophysical boundary each annual datapoint is, making it easy to compare and understand trends across indicators and over time.

Through this visual it is possible to see just how far the phosphorus and nitrogen ecological ceiling boundaries are being overshot and that they are still trending in the direction

away from the biophysical boundary. It is also possible to see how much the material footprint indicator has been increasing since 2005.

The biophysical indicators graph is a useful tool for tracking Brazil's progress towards sustainable development. By presenting a comprehensive set of indicators related to land use, climate, biodiversity, water resources, and pollution, the table provides a holistic perspective on the country's environmental performance. Overall, the biophysical indicators graph provides valuable insights into the state of Brazil's environment and natural resources and highlights the need for effective policy interventions to address the country's sustainability challenges.

The biophysical indicators table can be used by policymakers, researchers, and civil society organizations to inform evidence-based decision-making and promote sustainable development in Brazil.

Figure 11 below provides a detailed overview of the social conditions in Brazil. The graph includes various indicators related to health, education, employment, inequality, and governance. Because the indicators all have different scales, they are shown in this graph based on the ratio of how far above or below the social threshold each annual datapoint is, making it easy to compare and understand trends across indicators and over time.

One of the key highlights of the social indicators graph is its coverage of income inequality in Brazil. It shows that while Brazil has made significant progress in reducing poverty and inequality over the past two decades, income disparities remain high. These trends have significant implications for social inclusion, human development, and political stability. Overall,

the social indicators graph provides valuable insights into the social conditions in Brazil and highlights the need for continued efforts to promote social equity and inclusive development.

In conclusion, the social indicators graph is a useful tool for comprehensive monitoring of social progress in Brazil. It can be used by policymakers, researchers, and civil society organizations to inform evidence-based decision-making and promote social equity and inclusive development in Brazil.

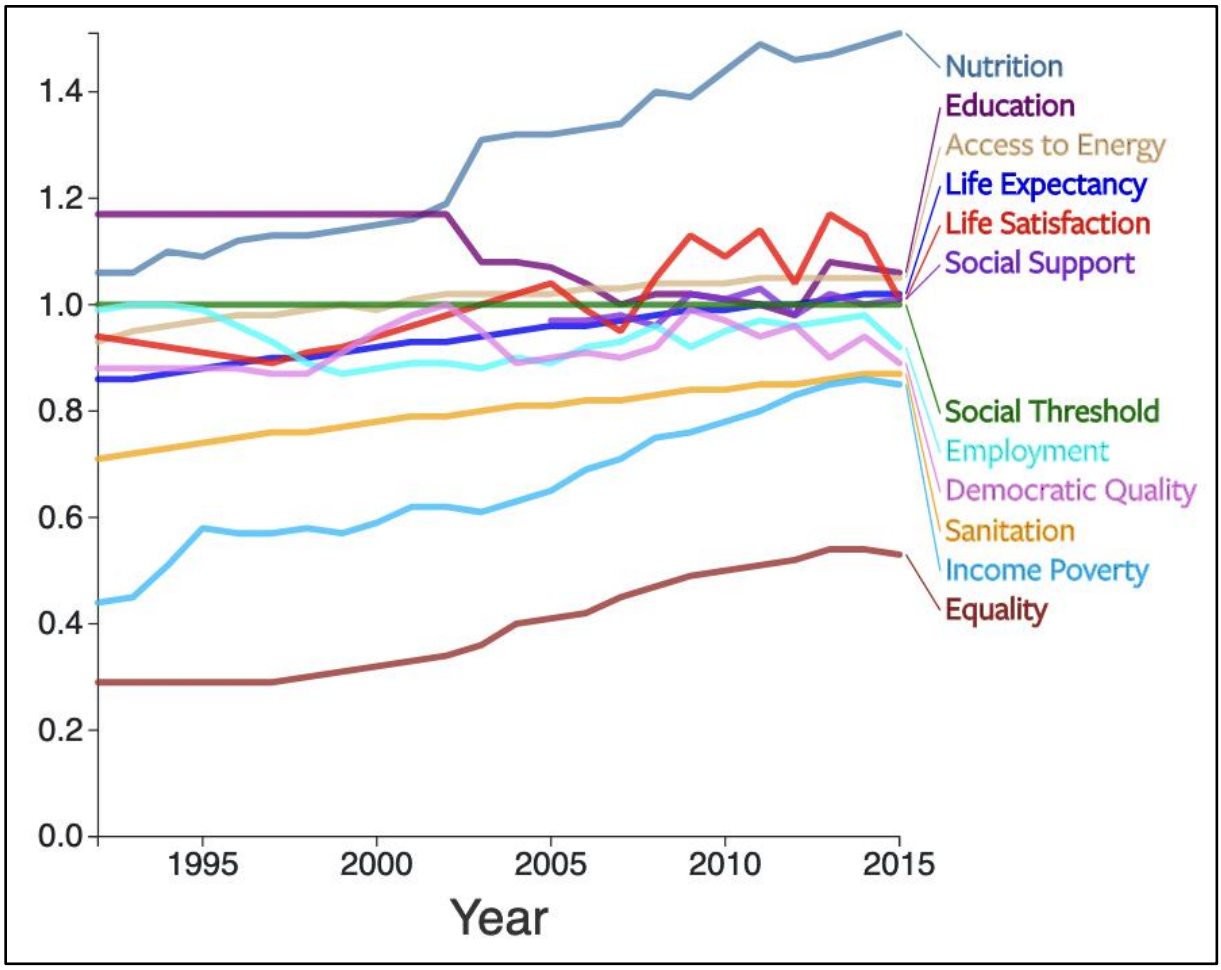

Figure 11. Social Indicators - Brazil Doughnut (Gutiérrez Martínez & Fanning, (n.d.))

Brazil's current economic and social policies show both alignment and divergence from the principles of Doughnut Economics. On the one hand, Brazil has implemented several policies aimed at reducing poverty and promoting social inclusion, which are key elements of the Doughnut's social foundation. For example, the Bolsa Familia program provides cash transfers to low-income families, and the Minimum Wage has been increased in real terms in recent years. Additionally, Brazil has made progress in renewable energy, particularly in the production of ethanol from sugarcane, which aligns with the Doughnut's environmental ceiling.

However, Brazil's economic model is still heavily dependent on extractive industries such as mining and agriculture, which can lead to environmental degradation and social inequalities. Additionally, the government has been criticized for weakening environmental protections and promoting the expansion of agribusiness and infrastructure projects that can lead to deforestation and displacement of indigenous communities. Furthermore, income inequality remains a significant challenge, with high levels of informal employment and regional disparities.

In summary, while Brazil has made progress in some areas that align with Doughnut Economics, there are still significant challenges to overcome in promoting a more sustainable and equitable economic model.

Beef Industry

One of the largest contributors to economic growth in Brazil has been the expansion of cattle farming. Brazil is the largest beef exporter in the world (Lima Filho et. al., 2021). A shortage of beef in Brazil in the 1980s sparked the increase of production through technological modernization in production systems and government subsidies (Faria, 2016). These changes improved productivity, meat quality, and Brazil’s competitiveness in the global market (Malafaia, 2021).

Despite the financial benefits of expanding production, it also caused deforestation in the Brazilian Amazon. In Brazil, the Amazon takes up 61% of total land area and approximately 12% of the country’s population live there. When these areas were settled by cattle ranchers, there was minimal government regulation leading to prolonged and contentious disputes over ownership of the area’s natural resources. Currently, there is weak enforcement of property

rights causing land disputes, sometimes violent, between cattle ranchers, squatters, miners, indigenous peoples, and public authorities. This is particularly prevalent on public lands. These conflicts incentivize cattle ranchers to clear large tracts of virgin forest to claim it before someone else claims it. Despite these claims, most landholders do not have legal title to their lands. This lack of property rights can lead to overexploitation of commonly owned resources (Faria, 2016).

In addition to inter-personal conflict, deforestation of the Brazilian Amazon has environmental consequences. Nearly 40% of the beef cattle in Brazil are located in the Brazilian Amazon. Estimates indicate that cattle ranching has caused more than 70% of the deforestation in the Brazilian Amazon (Lima Filho et. al., 2021). In 2020, greenhouse gas emissions in Brazil rose 9.5% due in large part to increased deforestation (Boadle, 2021). In addition, methane, largely from cattle, accounts for almost a third of Brazil's emissions.

Brazil Beef Industry Contribution to Climate Change

The Brazilian cattle industry has been identified as one of the major contributors to climate change. The industry is responsible for a significant portion of the country's greenhouse gas emissions, primarily due to deforestation for cattle ranching and the release of methane during the digestive processes of cows. The deforestation of the Amazon rainforest has accelerated in recent years due to the expansion of the cattle industry, which clears land for grazing and the production of feed crops. Deforestation not only results in the loss of carbon-absorbing trees but also the release of carbon stored in the forest. Additionally, the large quantities of methane produced by cattle during digestion contribute to greenhouse gas

emissions. The Brazilian government and the cattle industry have taken some steps to reduce deforestation and improve sustainability practices, but there is still much work to be done to mitigate the industry's impact on the environment.

V. Discussion

Doughnut economics has significant implications for international development, as it offers a new framework for achieving sustainable and equitable economic growth. In the past, development efforts have often focused on increasing GDP and promoting industrialization, which has resulted in environmental degradation and social inequality. Doughnut economics, on the other hand, recognizes the interconnectedness of economic, social, and environmental systems, and prioritizes the well-being of both people and the planet. By adopting this approach, international development can move towards a more balanced and sustainable model that benefits everyone, especially those who are most vulnerable to the negative impacts of climate change and inequality. The Doughnut model provides a clear framework for setting development goals that are aligned with the planetary boundaries and social thresholds, and for evaluating the impact of development policies and projects. By embracing Doughnut Economics, international development can become more resilient, inclusive, and sustainable, and can contribute to a healthier planet and a better future for all.

Feasibility

Doughnut economics is a theory that aims to create a sustainable and equitable economic system that operates within the limits of the planet's resources. The feasibility of the Doughnut Economics model depends on various factors, including political will, social acceptance, technological innovation, and financial resources. While it presents an innovative approach to economics, implementing it on a large scale would require significant changes to the current economic system. The feasibility of implementing Doughnut Economics depends on the political will, public support, and collaboration among different stakeholders. It may require a shift from the current focus on growth and profit to a more holistic view of well-being and sustainability. Governments, businesses, and communities would need to work together to transform their economic models such as incorporating environmental and social costs into pricing, investing in renewable energy, and promoting equitable distribution of resources. While implementing Doughnut Economics may face challenges and resistance, its potential benefits for the planet and society make it a worthy goal to strive towards.

Another limitation is that the model does not provide a detailed roadmap for achieving its goals, which could make it challenging for policymakers and stakeholders to translate the model into concrete policy measures. Additionally, the model may not fully capture the complexity and diversity of different societies and cultures, which could limit its applicability in certain contexts. Finally, there may be trade-offs and conflicts between different aspects of the Doughnut model, such as between economic growth and environmental sustainability.

Despite these challenges, there are examples of cities and countries that are beginning to adopt the principles of the Doughnut Economics model in their policies and practices. This

suggests that while the transition to a sustainable and just economy will be difficult, it is feasible with the right political will, social support, and innovative solutions.

Recommendations for Brazil

The beef industry is a significant contributor to Brazil's economy, and it also poses significant environmental challenges. To make the beef industry more sustainable, several measures can be taken, including better land use practices and reducing deforestation.

Doughnut Economics provides a framework for addressing challenges identified in Brazil's beef cow industry. By setting clear ecological boundaries and social foundations, Brazil can prioritize policies and investments that support sustainable development and protect the Amazon rainforest.

One way to improve the sustainability of the beef industry is to promote better land use practices. This can be done by encouraging farmers to adopt more sustainable grazing techniques, such as rotational grazing, which helps to restore soil health and increase biodiversity. Additionally, farmers can implement better manure management practices, which can help to reduce greenhouse gas emissions and protect local water sources. Brazil should also promote agroforestry, which combines agriculture with the planting of trees to restore degraded land, provide livelihoods for small-scale farmers, and reduce greenhouse gas emissions.

In addition, another possible sustainable solution is to improve herd management. Efficient herd management practices such as optimized feeding and watering, responsible use of

antibiotics and growth hormones, and genetic improvements can help increase productivity and reduce the environmental impact of beef production.

Another critical issue facing the beef industry in Brazil is deforestation. Brazil is home to vast swaths of the Amazon rainforest, which is essential for regulating global climate patterns and supporting biodiversity. To reduce deforestation, it is essential to strengthen forest protection measures and enforce regulations on illegal logging and land clearing. Additionally, promoting the adoption of more sustainable land use practices can help to reduce the pressure to clear new land for grazing.

Additionally, Brazil could implement policies to protect the rights of indigenous peoples and other traditional communities, who are often the stewards of the Amazon rainforest and have a deep understanding of its ecological importance. By ensuring that these communities have secure land tenure and access to resources, Brazil can support their efforts to preserve the rainforest and maintain its critical role in regulating the Earth's climate.

Lastly, Brazil should consider increasing traceability and transparency in the beef supply chain. By increasing traceability and transparency in the supply chain, the industry can better identify and address environmental issues, ensure animal welfare, and promote social responsibility.

Overall, a more sustainable beef industry in Brazil will require a combination of these strategies, along with incentives and regulations to encourage sustainable practices and ensure the long-term viability of the industry.

By taking these steps, Brazil can continue to benefit from the economic contributions of the beef industry while also protecting the environment and promoting long-term sustainability. Overall, Doughnut Economics offers a framework for balancing economic development with environmental sustainability and social justice in Brazil and provides practical solutions for addressing the urgent challenges of climate change and deforestation.

Key Messages for Sustainable Development

1. Get rid of the false dichotomy that you are either for economic development or for environmental protection.

   The false dichotomy that one must choose between economic development or environmental protection is a pervasive and harmful myth. This idea suggests that in order to achieve economic growth and prosperity, we must sacrifice the natural environment and its resources. However, this dichotomy is not only inaccurate, but it also creates a false sense of conflict between two critical aspects of society that should be mutually reinforcing.

   In reality, economic development and environmental protection are not mutually exclusive, but rather can work hand in hand. For example, promoting sustainable agricultural practices and protecting biodiversity can improve food security, while also supporting local economies and maintaining healthy ecosystems. Additionally, protecting and restoring natural ecosystems such as forests and wetlands can help to mitigate climate change and improve water quality.

   To truly achieve long-term prosperity and well-being, society must prioritize both economic development and environmental protection in a balanced and integrated manner.

2. Expand how we think about economic development and utilize more diverse metrics.

Economic development should utilize more diverse indicators beyond just traditional economic measures like Gross Domestic Product (GDP). While GDP is useful for measuring the size of a country's economy, it fails to capture other important aspects of development, such as social and environmental progress. By incorporating more diverse indicators, policymakers and stakeholders can gain a more comprehensive understanding of a country's development and make more informed decisions.

Using the Doughnut Economics framework can help guide economic development towards a more sustainable and equitable path. The model focuses on balancing economic growth with social and environmental sustainability, which is critical for creating a more resilient and inclusive economy. It can help ensure that economic growth is sustainable and inclusive, and that it meets the needs of both current and future generations.

Indicators of social well-being, such as access to education, healthcare, and basic needs, are important because they reflect the quality of life of people in a society. Economic development that does not consider the social needs of the population can lead to inequalities, exclusion, and social unrest.

Economic development that does not consider environmental sustainability can lead to irreversible damage to ecosystems, biodiversity loss, and climate change.

The concept of the environmental ceiling refers to the limits of the Earth's natural resources and the capacity of the planet to absorb pollution and waste. While this concept is

important in guiding sustainable development, it does not capture the inequalities that exist in terms of how resources are being used and by whom. Additionally, focusing solely on global scales can overlook critical local or regional thresholds of resource stress that may have serious consequences before they show up on the global scale. This highlights the need for a more nuanced approach to sustainable development, one that takes into account local and regional contexts, as well as the social and economic dimensions of sustainability, in addition to the environmental ceiling.

Incorporating these diverse indicators can help policymakers and stakeholders better understand the impact of economic development on society and the environment and can help ensure that development is sustainable and equitable.

3. Act to address the increasing impacts of climate change.

Doughnut Economics recognizes the need for urgent action to mitigate the impacts of climate change. One of the ways to achieve this is through reducing greenhouse gas emissions and transitioning to lower-carbon economies through policy change. Some of these policy solutions that are essential for addressing climate change include transitioning to a low-carbon economy by promoting circular economy principles can also help in reducing waste and promoting the reuse of materials, thereby reducing the carbon footprint of production and consumption.

Sustainable agriculture and reducing food waste are also important policy solutions for addressing climate change while aligning with Doughnut Economics. Additionally, reducing

inequality and improving social welfare can help ensure that everyone has access to the resources they need to adapt to the impacts of climate change. This includes providing support for vulnerable communities who are disproportionately affected by climate change.

By implementing policy solutions that align with Doughnut Economics, we can address the urgent need to reduce greenhouse gas emissions and transition to a low-carbon economy, while also promoting a more equitable and sustainable future for all. Overall, Doughnut Economics provides a framework for rethinking economic development in the context of planetary boundaries and social justice and offers practical solutions to address the urgent challenge of climate change.

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Appendix 1. Abstract Table of Resources

Author	Title	Year	Topic Area	Summary of Findings	Link
Alcott	A simpler way to achieve the Sustainable Development Goals	2019	Doughnut Model Strengths and Weaknesses	Weakness	http://jwsr.pitt.edu/ojs/jwsr/article/view/854/1160
Barca	In defense of degrowth. Opinions and minifestos/Doughnut economics. Seven ways to think like a 21st century economist	2018	Doughnut Model Strengths and Weaknesses	Strength	https://doi.org/10.1080/13549839.2017.1399997
Krauss	Review of Doughnut Economics: 7 Ways to Think Like a 21st Century Economist by Kate Raworth	2017	Doughnut Model Strengths and Weaknesses	Weakness	http://jwsr.pitt.edu/ojs/jwsr/article/view/854/1160
Nagase	[Review of the book Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist, by Kate Raworth]	2022	Doughnut Model Strengths and Weaknesses	Strengths and Weaknesses	https://www.muse.jhu.edu/article/877993

Schokkaert	Doughnut Economics		2019	Doughnut Model Strengths and Weaknesses	Weakness	https://doi.org/https://doi.org/10.23941/ejpe.v12i1.412
Bernhardt	Economics for the Anthropocene.		2017	Doughnut Model Strengths and Weaknesses	Strength	
Britannica	Economics	n.d.		Traditional Economic Thinking	Definition of Economics	https://www.britannica.com/topic/economics
Amadeo	What is Okun's Law and How Does It Work?		2020	Traditional Economic Thinking	History of Okun's Law	https://www.businessinsider.com/personal-finance/okuns-law
International Monetary Fund	What Are Externalities?		2010	Traditional Economic Thinking	Definition and discussion of Economic Externalities	https://www.imf.org/external/pubs/ft/fandd/2010/12/basics.htm
Moulton	A history of the GDP: A brief look at the origins and evolution of the concept of GDP		2007	Traditional Economic Thinking	History of Gross National Product and its limitations	https://apps.bea.gov/scb/pdf/2007/02%20February/0207_history_article.pdf
Mankiw	Principles of Economics		2018	Traditional Economic Thinking	Definition of Economics	
Pigou	Economics of Welfare		1920	Traditional Economic Thinking	Use of taxes and subsidies to correct for positive and negative externalities	

Stiglitz, J. E.	People, power, and profits: Progressive capitalism for an age of discontent	2019	Traditional Economic Thinking	Markets and market failiure	
Pigou, A. C.	The economics of welfare	2013	Traditional Economic Thinking	Externalities	
Grossman, G. M., & Krueger, A. B.	Economic growth and the environment	1995	Traditional Economic Thinking	Environmental Kuznets Curve	https://doi.org/10.2307/2118443
Kuznets, S.	Economic growth and income inequality	1955	Traditional Economic Thinking	GDP/GNI	
Office for National Statistics	The decoupling of economic growth from carbon emissions: UK evidence	2019	Traditional Economic Thinking	Environmental Kuznets Curve	https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/compendium/economicreview/october2019/thedecouplingofeconomicgrowthfromcarbonemissionsukevidence/previous/v1
Bowles, S.	Institutions and preferences in democratic governance	2004	Traditional Economic Thinking	Social norms to shape economics	https://doi.org/10.1111/j.1468-0343.2004.00129.x

Costanza, R., Daly, H., Farley, J., & Goodland, R.	An introduction to ecological economics (2nd ed.)	2016	Traditional Economic Thinking	Ecological economics	
The Ottawa Citizen	Barnes and Drouin. How 'doughnut economics' could sweeten up Ottawa's official plan	2021	Doughnut Applications - Global North	Canada	https://login.proxy.library.emory.edu/login?url=https://www.proquest.com/blogs-podcasts-websites/barnes-drouin-how-doughnut-economics-could/docview/2515013316/se-2?accountid=10747
Beaudoin	Nanaimo's move to 'doughnut economics'; Yannick Beaudoin says it's healthy for people, planet	2021	Doughnut Applications - Global North	Canada	https://login.proxy.library.emory.edu/login?url=https://www.proquest.com/newspapers/nanaimos-move-doughnut-economics-yannick-beaudoin/docview/2489060046/se-2?accountid=10747
Derkenbaeva	Positive energy districts: Mainstreami	2022	Doughnut Applications - Global North	Europe	https://doi.org/https://doi.org/10.1016/

	ng energy transition in urban areas				j.rser.2021.111782
Sakaki	Doughnut economics pitched to Vancouver Island's business community	2021	Doughnut Applications - Global North	Canada	https://www.proquest.com/newspapers/doughnut-economics-pitched-vancouver-islands/docview/2587127158/se-2?accountid=10747
Surkes	Doughnut Economics launches in Israel with call to update priorities, protect Earth	2022	Doughnut Applications - Global North	Israel	https://www.proquest.com/newspapers/doughnut-economics-launches-israel-with-call/docview/2622842214/se-2?accountid=10747
Turner	Downscaling doughnut economics for sustainability governance	2022	Doughnut Applications - Global North	United Kingdom	https://doi.org/10.1016/j.cosust.2022.101180
Turner	Towards a Sustainable Cornwall: State of the Doughnut	2020	Doughnut Applications - Global North	United Kingdom	https://ore.exeter.ac.uk/repository/bitstream/handle/10871/123909/Cornwall%20State%20of%20the%20Doughnut%20Report%20

						2020.pdf?sequence=1&isAllowed=y
Climate Action Leeds	Leeds doughnut	n.d.		Doughnut Applications - Global North	United Kingdom	https://www.climateactionleeds.org.uk/leedsdoughnut/
Brannigan	Responding to COVID-19 in the Liverpool City Region: The Liverpool City Region Doughnut: A Means for Securing a Green and Resilient Recovery		2019	Doughnut Applications - Global North	United Kingdom	https://livrepository.liverpool.ac.uk/3090892/1/Heseltine_Institute_Policy
Crowley et al.	Towards a necessary regenerative urban planning - Insights from community-led initiatives for ecocity transformation		2021	Doughnut Applications - Global North	Portugal	https://journals.openedition.org/cidades/3384
Stopper et al.	Development of a Sustainability Model for Manufacturing SMEs based on the		2016	Doughnut Applications - Global North	Europe	https://www.iaeng.org/publication/IMECS2016/IMECS2016_pp810-818.pdf

	Innovative Doughnut Economics Framework				
Piciga	Planetary Boundaries and Safe Operating Space for Europe and Slovenia: Research in Progress	2022	Doughnut Applications - Global North	Europe	https://irdo.si/irdo2022/referati/day2-2022-paper-piciga-ok.pdf
Silverthorne	Why would the healthcare industry need a doughnut?	2021	Doughnut Applications - Global North	Europe	https://journal.emwa.org/medical-decision-making-and-health-technology-assessment/why-would-the-healthcare-industry-need-a-doughnut/article/10015/why-would-the-healthcare-industry-need-a-doughnut_.pdf
Hartman & Heslinga	The Doughnut Destination: applying Kate Raworth's Doughnut Economy perspective	2022	Doughnut Applications - Global North	Europe	https://doi.org/10.1108/JTF-01-2022-0017

	to rethink tourism destination management					
Melles	Figuring the Transition from Circular Economy to Circular Society in Australia		2021	Doughnut Applications - Global North	Australia	https://doi.org/10.3390/su131910601
Grabbe & Valášek	Planet. In REFOCUS THE EUROPEAN UNION: PLANET, LIFETIME, TECHNOLOGY		2019	Doughnut Applications - Global North	Europe	http://www.jstor.org/stable/resrep26921.4
Amsterdam Donut Coalition & Doughnut Economics Action Lab	Amsterdam City Doughnut		2020	Doughnut Applications - Global North	Netherlands	https://doughnuteconomics.org/stories/1
Doughnut Economics Action Lab	The Amsterdam City Doughnut: A Tool for Transformative Action		2020	Doughnut Applications - Global North	Netherlands	https://doughnuteconomics.org/amsterdam-portrait.pdf
Doughnut Economics Action Lab	London Doughnut Economy Coalition	n.d.		Doughnut Applications - Global North	United Kingdom	https://doughnuteconomics.org/groups-and-networks/10

Cambridge Doughnut Economics Action Group	Cambridge Doughnut		2021	Doughnut Applications - Global North	United Kingdom	https://www.cambridgedoughnut.org.uk/
Climate Action Leeds	Leeds Doughnut	n.d.		Doughnut Applications - Global North	United Kingdom	https://www.climateactionleeds.org.uk/leedsdoughnut
Planet Cheltenham	Planet Cheltenham - The community space for climate action		2022	Doughnut Applications - Global North	United Kingdom	http://planetcheltenham.org/
Boro Doughnut	BORO Doughnut: DE in Middlesbrough		2022	Doughnut Applications - Global North	United Kingdom	https://doughnuteconomics.org/stories/170
Devon Doughnut Collective	Devon Doughnut		2023	Doughnut Applications - Global North	United Kingdom	https://devondoughnut.org/
Doughnut Economics Action Lab	Milton Keynes Doughnut Economics	n.d.		Doughnut Applications - Global North	United Kingdom	https://doughnuteconomics.org/groups-and-networks/31
Pontypridd Open Network	The beginnings of a Pontypridd doughnut		2022	Doughnut Applications - Global North	United Kingdom	https://doughnuteconomics.org/stories/163
Donut Berlin	Donut Berlin		2022	Doughnut Applications - Global North	Germany	https://donutberlin.de/
Donut Berlin	Designing the Doughnut: A Story of Five Cities		2021	Doughnut Applications - Global North	Germany	https://doughnuteconomics.org/stories/93

Doughnut Coalition Hamburg	Doughnut Hamburg	n.d.		Doughnut Applications - Global North	Germany	https://www.doughnut.hamburg/doughnut-hamburg/
Frankfurt Doughnut Coalition	Doughnut Economy	n.d.		Doughnut Applications - Global North	Germany	http://www.frankfurtdoughnut.org/
Doughnut Economics Action Lab	Donut Munich	n.d.		Doughnut Applications - Global North	Germany	https://doughnuteconomics.org/groups-and-networks/29
Doughnut Economics Action Lab	West Cork Doughnut Economy Network	n.d.		Doughnut Applications - Global North	Ireland	https://doughnuteconomics.org/groups-and-networks/28
Doughnut Economics Action Lab	Doughnut Coalition Vienna	n.d.		Doughnut Applications - Global North	Austria	https://doughnuteconomics.org/groups-and-networks/23
Doughnut Economics Action Lab	Barcelona embraces the Doughnut	n.d.		Doughnut Applications - Global North	Spain	https://doughnuteconomics.org/news/33
Brussels Donut	Together for an ecological and fair transition in Brussels	n.d.		Doughnut Applications - Global North	Belgium	https://donut.brussels/en/homepage/
Københavns Kommune	The donut model in Copenhagen Municipality		2020	Doughnut Applications - Global North	Denmark	https://www.kk.dk/dagsordener-og-referater/%C3%98konomiudvalget/m%C3%B8de-08122020/referat/punkt-5

Smultring Tønsberg	How to transform Donut Economy from idea to action in Norway?	n.d.		Doughnut Applications - Global North	Norway	https://www.smultringtonsberg.no/
Regen Sydney	Exploring Doughnut Economics in Sydney		2021	Doughnut Applications - Global North	Australia	https://www.regen.sydney/
California Doughnut Economics Coalition	About CalDEC	n.d.		Doughnut Applications - Global North	United States	https://caldec.org/about/
Swannanoa Watershed Action Network	SwanWater Continues Its Discovery		2022	Doughnut Applications - Global North	United States	https://doughnuteconomics.org/stories/195
Almerigi, S., Antrobus, P., Barrow, M., Drakes, C., Fanning, L., Gibbs, K., Mahon, R., & McConney, P.	Regenerate Barbados with Doughnut Economics: Report on Action Scoping. CERMES Technical Report No. 103.		2021	Doughnut Applications - Global North	Barbados	https://www.cavehill.uwi.edu/cermes/docs/technical_reports/regenerate_barbados_action_scoping_report_2021_08_.aspx
Coalición Tricolor	Coalición Tricolor Para Transiciones Sustenables	n.d.		Doughnut Applications - Global South	Mexico?	https://tri-color.wixsite.com/my-site
Doughnut Economics Action Lab	Donut Brasil	n.d.		Doughnut Applications - Global South	Brazil	https://doughnuteconomics.org/groups-and-networks/22

Regen Melbourne.	Reimagining and remaking Melbourne, together.	(n.d.).		Doughnut Applications - Global North	Australia	https://www.regen.melbourne/
Vandenhole, W.	De-Growth and Sustainable Development : Rethinking Human Rights Law and Poverty Alleviation.		2018	Doughnut Applications - Global South	Africa	https://doi.org/10.1515/ldr-2018-0033
UN	Climate change. Sustainable Development Goals	n.d.		Current Global Statistics	Climate Change Indicators	https://www.un.org/sustainabledevelopment/climate-change/
Roser, et al.	Life Expectancy		2016	Current Global Statistics	Human Development Indicators	https://ourworldindata.org/life-expectancy/.
UNDP	Human Development Report 2015		2015	Current Global Statistics	Human Development Indicators	http://report2015.archive.s3-website-us-east-1.amazonaws.com/
ILO	Global Employment Trends for Youth 2015		2015	Current Global Statistics	Human Development Indicators	http://www.ilo.org/global/research/global-reports/youth/2015/WCMS_412015/lang--en/index.htm.
WFP	Ending Hunger		2016	Current Global Statistics	Human Development Indicators	https://www.wfp.org/hunger

WHO	Children: improving survival and well-being		2016	Current Global Statistics	Human Development Indicators	http://www.who.int/mediacentre/factsheets/fs178/en/.
Oxfam International	An Economy for the 1%		2016	Current Global Statistics	Economic Development Indicators	https://www-cdn.oxfam.org/s3fs-public/file_attachments/bp210-economy-one-percent-tax-havens-180116-en_0.pdf
EPA	Causes of Climate Change	n.d.		Current Global Statistics	Climate Change Indicators	https://19january2017snapshot.epa.gov/climate-change-science/causes-climate-change_.html
UNEP	Emissions Gap Report 2019		2019	Current Global Statistics	Climate Change Indicators	https://www.unep.org/resources/emissions-gap-report-2019
UNEP	Nature for Climate Action		2021	Current Global Statistics	Climate Change Indicators	https://www.unep.org/resources/factsheet/nature-climate-action
Global Agriculture	Soil fertility and erosion	n.d.		Current Global Statistics	Climate Change Indicators	https://www.globalagriculture.org/report-topics/soil-fertility-and-erosion.html

FAO	State of the world fisheries and aquaculture (SOFIA)	2010	Current Global Statistics	Climate Change Indicators	http://www.fao.org/docrep/013/013/il820e/il820e01.pdf
UN	World Population Prospects: the 2015 revision	2015	Current Global Statistics	Human Development Indicators	https://population.un.org/wpp/publications/files/key_findings_wpp_2015.pdf
PwC	The World in 2050: will the shift in global economic power continue?	2015	Current Global Statistics	Economic Development Indicators	http://www.pwc.com/gx/en/issues/the-economy/assets/world-in-2050-february-2015.pdf
OECD Observer	An Emerging Middle Class	2015	Current Global Statistics	Economic Development Indicators	http://www.oecdobserver.org/news/fullstory.php/aid/3681/An_emerging_middle_class.html
Kaufmann, D.	The worldwide governance indicators: Methodology and analytical issues	2016	Current Global Statistics	Human Development Indicators	https://www.brookings.edu/wp-content/uploads/2016/06/09_wgi_kaufmann.pdf
WHO	Life expectancy	2021	Current Global Statistics	Human Development Indicators	https://www.who.int/data/gho/data/themes/topics/indicator-groups/indicator-group-details/GHO/

					life-expectancy
FAO, IFAD, UNICEF, WFP, & WHO	The state of food security and nutrition in the world 2021: Transforming food systems for food security, improved nutrition and affordable healthy diets for all	2021	Current Global Statistics	Human Development Indicators	https://doi.org/10.4060/cb4474en
WHO and UNICEF	Progress on household drinking water, sanitation and hygiene 2000-2017: Special focus on inequalities	2019	Current Global Statistics	Human Development Indicators	https://www.who.int/publications/i/item/9789241515650
UNDESA	World population prospects 2019: Highlights (ST/ESA/SER. A/423)	2019	Current Global Statistics	Human Development Indicators	https://population.un.org/wpp/Publications/Files/WPP2019_Highlights.pdf
IPCC	Global warming of 1.5°C	2018	Current Global Statistics	Climate Change Indicators	https://www.ipcc.ch/sr15/

World Bank	Global economic prospects, June 2021		2021	Current Global Statistics	Economic Development Indicators	https://openknowledge.worldbank.org/handle/10986/35442
Sustainable Development Knowledge Platform	United Nations Conference on Sustainable Development, Rio+20	n.d.		Current Global Statistics	Human Development Indicators	https://sustainabledevelopment.un.org/rio20.html
Transparency International	Corruption Perceptions Index 2022		2022	Current Global Statistics	Human Development Indicators	https://www.transparency.org/en/cpi/2022
Bernhardt, C.	Economics for the Anthropocene		2017	Current Global Statistics	Climate Change Indicators	https://doi.org/10.1016/j.ecolecon.2016.09.022
Stiglitz, J. E., Sen, A., & Fitoussi, J. P.	Report by the commission on the measurement of economic performance and social progress		2009	Current Global Statistics	Economic Development Indicators	https://ec.europa.eu/eurostat/documents/118025/118123/Fitoussi+Commission+report
Thaler, R. H., & Sunstein, C. R.	Nudge: Improving decisions about health, wealth, and happiness		2008	Current Global Statistics	Human Development Indicators	
Alvaredo, F., Chancel, L., Piketty, T., Saez, E., & Zucman, G.	World inequality report 2018		2018	Current Global Statistics	Economic Development Indicators	https://www.hup.harvard.edu/catalog.php?isbn=9780674980860

Folke, C., Polasky, S., Rockström, J., Galaz, V., & Westley, F.	Transforming the world's food systems	2019	Current Global Statistics	Human Development Indicators	https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(19)30197-0/fulltext
Jackson, T.	Beyond consumer capitalism: Foundations for a sustainable prosperity	2017	Current Global Statistics	Economic Development Indicators	https://www.wiley.com/en-us/Beyond+Consumer+Capitalism%3A+Foundations+for+a+Sustainable+Prosperity-p-9781509505610
United Nations	Transforming our world: The 2030 agenda for sustainable development	2015	Current Global Statistics	Economic Development Indicators	https://www.un.org/sustainabledevelopment/sustainable-development-goals/
Osorio & Lubowski	The economics of cattle ranching in the Amazon: Land use change and policy interventions	2013	Brazil Data	Economic Development Indicators	https://www.climatepolicyinitiative.org/wp-content/uploads/2013/06/The-Economics-of-Cattle-Ranching-in-the-Amazon_Land-Grabbing-or-Pushing-the-Agricultural-Frontier.pdf

USAID	Climate Change Country Profile: Brazil		2022	Brazil Data	Climate Change Indicators	https://www.usaid.gov/climate/country-profiles/brazil
Faria	Relationship between openness to trade and deforestation: Empirical evidence from the Brazilian Amazon		2016	Brazil Data	Climate Change Indicators	https://doi.org/https://doi.org/10.1016/j.ecolecon.2015.11.014
Malafaia	The Brazilian beef cattle supply chain in the next decades		2021	Brazil Data	Climate Change Indicators	https://doi.org/https://doi.org/10.1016/j.livsci.2021.104704
Oxfam International	Brazil: Extreme inequality in numbers	n.d.		Brazil Data	Human Development Indicators	https://www.oxfam.org/en/brazil-extreme-inequality-numbers
Friedrich et al.	This Interactive Chart Shows Changes in the World's Top 10 Emitters		2023	Brazil Data	Climate Change Indicators	https://www.wri.org/insights/interactive-chart-shows-changes-worlds-top-10-emitters
Gutiérrez Martínez & Fanning	Country Trends	n.d.		Brazil Data	Brazil Doughnut	https://goodlife.leeds.ac.uk/national-trends/country-trends/#BRA

Lima Filho, F. L. et al.	The Economics of Cattle Ranching in the Amazon: Land Grabbing or Pushing the Agricultural Frontier?		2021	Brazil Data	Climate Change Indicators	https://www.climatepolicyinitiative.org/publication/the-economics-of-cattle-ranching-in-the-amazon-land-grabbing-or-pushing-the-agricultural-frontier/
Boadle, A.	Brazil's greenhouse gas emissions rose 9.5% in 2020 with Amazon deforestation - study		2021	Brazil Data	Climate Change Indicators	https://www.reuters.com/world/americas/brazils-greenhouse-gas-emissions-rose-95-2020-with-amazon-deforestation-study-2021-10-28/
World Bank Group	Poverty & Equity Brief - Latin America & the Caribbean - Brazil		2023	Brazil Data	Human Development Indicators	https://databankfiles.worldbank.org/public/ddpext_download/poverty/987B9C90-CB9F-4D93-AE8C-750588BF00QA/current/Global_POVEQ_BRA.pdf
World Bank Group	GNI per capita, Atlas method (current US$) - Brazil	n.d.		Brazil Data	Economic Development Indicators	https://data.worldbank.org/indicator/NY.GNP.PCAP.CD?end=202

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World Bank	World Bank Country and Lending Groups: Brazil	2022	Brazil Data	Economic Development Indicators	https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups