International Journal of Research in Engineering, Science and Management
Volume 5, Issue 11, November 2022
https://www.ijresm.com | ISSN (Online): 2581-5792

Is the Philippines within the Doughnut?: Quantifying Doughnut Economics through Sustainability Window Method

Julia Francesca G. Castro[1], Crio Edrick A. Evangelio[2], Catherine Andrei G. Saguiguit[3*], Eric G. Pasquin[4]
[1,2,3,4]*Department of Business Economics, College of Commerce & Business Administration, University of Santo Tomas, Manila, Philippines*

***Abstract*: Sustainability has been a political focus of a broad spectrum of groups during the last decades. Other sustainable development indicators have been used in recent research, like in the United Nations, where they established SDIs for the 17 Sustainable Development Goals. Shifting to the Doughnut Economics framework aligns with the dual goals of sustainable development, which include moving everyone beyond social foundations and lowering stress on the biophysical system within planetary boundaries. As a response to measuring one's country's sustainability, quantifying the doughnut through the Sustainability Window approach specifies the lowest level of economic development required to meet social sustainability standards and the most significant level of economic development that does not exceed the environmental sustainability limit. This approach in measuring sustainable development proves to be useful in developing countries like the Philippines.**

***Keywords*: sustainability, doughnut economics, GDP, sustainable window analysis, planetary boundaries.**

1. Introduction

A. The Philippines and the Pursuance of the Sustainable Development Goals

Research from the World Commission on Environment and Development (WCED) introduced the term "sustainable development" and its environmental, social, and economic dimensions (United Nations, 1987). The report emphasized the importance of long-term ecological sustainability, as well as meeting fundamental human needs and ensuring justice. Since then, other firms, organizations, nations, and other economic actors have utilized the sustainable development concept as a goal in policy-making. Environmental and social concerns associated with various economic activities are receiving more attention. The WCED study has also influenced discussions over development indicators, particularly the frequent practice of using, it said, "*GDP as a macro-level measure of welfare has the limit for focusing solely on the economic dimension and ignoring other factors that influence welfare*."

Except for a few short-lived periods of economic recession during the 1930s and 1990s, the financial crisis in 2008–2009, and external crises such as World War II, oil shocks in the 1970s, and the COVID-19 pandemic in the 2020s, the trend of conventional GDP has been steadily increasing in most countries around the world.

Human Development Index (HDI) (McGillivray, 1990; Sagar & Najam, 1998), ecological footprint (Rees, 1992), and "*Sustainable Society Index (SSI)*" (Van De Kerk & Manuel, 2008), are examples of sustainable development indicators that cover elements besides the economic dimension of sustainability (Kwatra et al, 2020). Empirical studies using these kinds of economic indicators mostly demonstrate the efficacy of countries is far from sustainable (Holden et al, 2014). According to Kovacic and Giampetro in 2015, "moving beyond GDP demands good reflexivity, i.e., knowledge of the essential role that pre-analytical choices play in the concept of well-being and how to assess welfare".

Other alternative monetary and sustainable development indicators have failed to make a significant political impact, and statistical methods have remained largely unchanged. GDP has maintained its dominance. Meanwhile, organizations such as the United Nations (United Nations, 1996), the Organization for Economic Cooperation and Development (OECD, 2004), and the European Union (Eurostat, 2020) have proposed constructing sustainable development indicator sets (SDIs) that describe all aspects of sustainability in depth. Particularly ministries and administrative units responsible for environmental issues and sustainability have established their own SDIs on the national scale.

The United Nations has designed indicators for the 17 Sustainable Development Goals (SDGs) that have been launched in 2015 (United Nations, 2020). Following the UN 2030 Agenda for Sustainable Development, the SDGs have been approved in the EU (Eurostat, 2020) and other countries, and they have inspired work on SDIs. However, the basic issue with SDIs appears to be persisting as time passes—the use of performance indicators at the national scale and in cross-country comparisons continues to be dominated by GDP. The SDIs have not been used in the way that was anticipated (Rosenström, 2009).

There were 192 UN member nations, including the

*Corresponding author: catherineandrei.saguiguit.comm@ust.edu.ph

Philippines, that committed on September 2015 to attaining the 17 Sustainable Development Goals (SDGs) and their 169 targets by 2030. The Sustainable Development Goals (SDGs) are said to be "a universal call to action to end poverty, protect the planet, and ensure that all people enjoy peace and prosperity." They build on the unfinished agenda of the Millennium Development Goals (MDGs) by proposing a larger number and scope of goals and targets across economic, social, environmental, and governance dimensions of sustainable development.

The Philippine government has since taken a few initiatives since the adoption of the SDGs, to establish policies and create an enabling environment for the SDGs to be implemented. The Philippine Statistics Authority (PSA) was in charge of compiling indicators for national SDG monitoring. Meanwhile, the National Economic and Development Authority (NEDA), the cabinet-level organization in charge of economic development and planning, is looking into the SDG indicator framework's synergies with the country's medium- and long-term development plans.

Initiatives for further attempts at data collection and analysis have been carried out to track the country's progress toward the SDGs. The PSA has been recognized as the official source of SDG indicators for the country, with all pertinent government departments being enjoined to provide the required data assistance for monitoring the SDGs. (Roldan, 2018)

B. Going Beyond Planetary Boundaries

As stated in multiple studies such as Foley et al. 2005; Haberl et al. 2007; Hoekstra & Wiedmann, 2014; Likens, 1991; Steffen et al. 2015; Vitousek et al. 1997, "Human actions have destroyed the Earth's life support system over the last half-century to meet social requirements and provide a better quality of life." There were observed changes in global temperature, biogeochemical cycles, and land cover, as well as biodiversity loss and pollution (Rockström et al. 2009). This degradation of ecosystems has led to reduced capacity to supply renewable natural resource supplies, manage climate, water delivery, and disease spread, and provide cultural, esthetic, and recreational benefits to humans (Chapin et al. 2011). Various studies have stated that "life-support systems" have been shifting from the stable Holocene period of the last 12,000 years to the uncertain Anthropocene period due to the active and large-scale human imprint on the global environment, which rivals some natural forces in its impact on the earth's functions. The impending Anthropocene is creating global concerns about the environment's continued ability to supply services for a healthy human civilization as a result of human-induced stress (Carrington, 2016; Lockie, 2017, O'Neill et al. 2018).

Despite increased efforts to improve access to basic needs and the resulting increased biophysical stress, according to the United Nations *"one out of every five people in developing countries still lives on less than $1.25 per day, one out of every nine people worldwide is still malnourished, and 57 million children are still out of school."* It was also mentioned that *"2.5 million people do not have access to basic sanitary facilities, and 1.3 billion people, or one in every five people on the planet, do not have access to modern energy."* When the population grows by 6.3 percent, global unemployment rises from 170 million in 2007 to approximately 202 million in 2012. Lastly, according to the United Nations *"Between 1990 and 2010, there has been income inequality in several developing countries that has increased by 11% on average, and more than 75% of households in those areas live in societies where income is more unevenly distributed."* (United Nations, 2015).

Today's mainstream development framework is being challenged by "rising stress on the biophysical system", "the uncertainties of the approaching Anthropocene", as well as an inadequate social data, and worldwide change. In this setting, sustainable development, defined as "development that meets current demands without jeopardizing future generations' ability to meet their own needs," has risen to the top of the international agenda according to World Commission on Environment and Development in 1987. In line with this, Kate Raworth defines Sustainable development, "as the human use of natural resources for the fulfillment of basic human rights", has been a political and scholarly focus of a wide spectrum of governmental and nongovernmental groups during the last decades. It has evolved into a new development paradigm with numerous interpretations and reactions.

The premise of a Planetary Boundary establishes a safe biophysical zone beyond which there is uncertainty that could jeopardize humanity's existence. Yet, it only addresses the environmental side of sustainable development and ignores the critical social factor that addresses quality-of-life issues.

Kate Raworth created the Safe and Just Space Framework, often known as "The Doughnut," by combining the concepts of "social basis and the fulfillment of basic human rights", like human's need for food, water, health care, and energy, with planetary boundaries and environmental constraints.

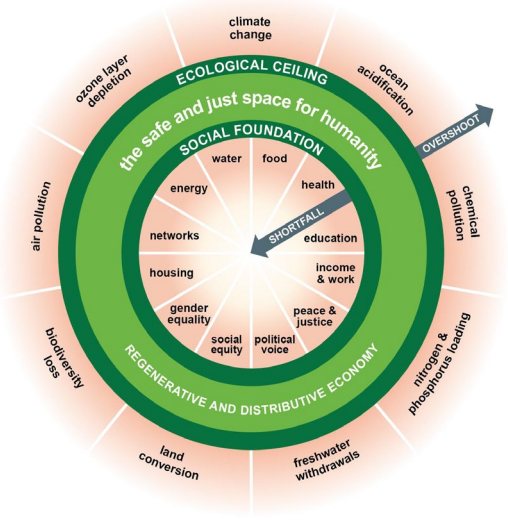

Fig. 1. The doughnut economy framework

This framework is composed of an inner and outer circle that resembles a doughnut, with each circle defining a set of foundations for long-term development. The inner circle

symbolizes the social grounds as well as the multi-dimensional necessities for avoiding human deprivation. The environmental ceiling is the outer layer of the doughnut, reflecting the biophysical threshold beyond which multi-metric environmental degradation occurs. The zone between the environmental ceiling and the social foundations is the environmentally safe and socially just space for human existence, as well as the space where sustainable development occurs.

The doughnut framework "*provides an economic perspective that is appropriate for the difficulties and setting of the twenty-first century. It is a mode of thinking, not a collection of policies and institutions, that pulls the regenerative and distributive forces that this century demands.*"

Shifting to "*the Safe and Just Framework*" aligns with the dual goals of sustainable development, which include moving everyone beyond the social foundations and lowering stress on the biophysical system within planetary boundaries. The Safe and Just Space approach offers a fresh viewpoint on how to analyze the long-term viability of a country's development process by looking at both its social and environmental outcomes.

C. Statement of the Problem

In attempting to meet societal needs as well as provide a better quality of life, humans have degraded the Earth's life-support system in past decades. As a response, other countries, institutions, enterprises, and other economic actors have since embraced sustainable development as a policy goal. Other indicators have been used in recent research instead of GDP, which has been criticized for focusing primarily on the economic dimension and ignoring other aspects that influence well-being. Sustainable development indicator sets (SDIs) were developed by the United Nations to define all aspects of sustainability in depth.

The objective of this research is to evaluate if a certain country is within the doughnut economy's boundaries during a specific period. The Philippine economy will be used as a model for the attempt to operationalize the doughnut economy. In the empirical analysis based on the sustainability window technique, "*a set of selected SDIs describing the different dimensions of sustainability and the SDGs will be used.*" The sustainability window specifies the lowest level of economic development required to meet social sustainability standards and the greatest level of economic development that does not exceed the environmental sustainability limit. This will delimitate the extent of the measure of the GDP as it takes into consideration the selected socio-environmental indicators. With that being said, the research question that the researchers will identify is how to apply the doughnut economy and if it is within the *doughnut* or within the boundaries of the sustainability framework quantitatively in a developing country like the Philippines using the sustainability window approach.

2. Literature Review

A. The Doughnut Economics Model

The Doughnut Economic Model was crafted by Kate Raworth to modernize or bring economic sustainability and to view it through 21st-century minds. Its foundation can be rooted in the seventeen (17) Sustainable Development Goals of the United Nations. Raworth wanted to create a framework that would redefine how the minds of the 21st century view humanity and how humanity can meet the unlimited needs of the people within the capabilities of our environment or planet. She coined this as getting into the doughnut. She wanted to change the goal of incessant GDP growth, and rather a goal that acknowledges life that includes healthy and sustainable growth. Though this model is fairly new, hence why there is fairly little public information and studies that use this model, Luukkanen & Saunders (2022) say that "the doughnut economics model can be used for the analysis of the dynamic of development."

The goal of Raworth's doughnut economics framework is to live sustainably within the doughnut, rather than endless GDP growth. At the same time, analysis can be initiated by viewing the economy as a bigger picture and understanding how society is intertwined and dependent on the economy any individual currently lives in. Human conduct could be made to be cooperative and loving, just as it can be competitive and individualistic, according to Doughnut Economics. It also acknowledges that any economy, society, and the rest of the living world are all very complex, interrelated systems that are better represented through a systems-thinking perspective. Degenerative economies today need to be transformed into regenerative ones, as well as the transformation of divided economies to a more distributive economy is also needed. Furthermore, Doughnut Economics, as defined by Raworth, recognizes that growth is a good stage of life, but that nothing grows indefinitely, and that things that prosper do so by growing until it is time to mature and thrive.

B. Relationship between Sustainable Development and Economic Development

Sustainable development is defined as successful development that satisfies present demands without imperiling the future of others. Economic development is a condition of the economy in which the country's economic position is prosperous in the sense that the nation's capital stock is rising in a good way, affecting overall human welfare and development. Research on the trade-off between environmental concerns and economic development is available (Awan, 2013). According to the study's conclusions, more economic growth entails greater resource usage, hence resource judicious use is both encouraged and required. There is also almost little thought for the long-term effects on the ecosystem for future generations. Studies from Luukkanen (2021), Saunders and Luukkanen (2021), and Kaivo-Oja et al. (2015) have also studied and discussed if the quantitative measures using the Gross Domestic Product and if it is within the sustainability limits using the provided Sustainable Developmental Indicators from the United Nations.

C. Relationship between Social Welfare and Economic Growth

Economists have created a pragmatic way of adding social cohesiveness to quantitative research, according to Sommer (2019). However, you can only utilize basic proxies in their approach, which can only describe portions of the multidimensional idea at best. It was discovered that there was a persistent positive association between social cohesiveness and economic growth, regardless of whether it was operationalized by civic cooperation, trust, income disparity, or ethnolinguistic fractionalization. The positive relationship is founded on changes in formal or social institutions that can lead to economic growth.

D. Relationship of Environment and Economic Growth

Grossman and Krueger developed a technique for assessing the relationship between economic growth and carbon emissions, with the expectation that carbon emissions will climb as the economy grows until it hits a tipping point. Beyond that threshold, the economy will grow while carbon emissions will decrease. The Environmental Kuznets Curve is an inverted U-shaped curve that comes from this. The EKC hypothesis is tested in the majority of the research found by the writers for this literature review. The authors of this study examined the literature for evidence of a link between GDP and CO2 emissions.

To prove the existence of EKC, Adu, and Denkyirah (2017) looked at the relationship between economic growth and the rise in carbon emissions and CoWaste. After examining several West African countries, they discovered that economic expansion raises CO2 levels and COWaste only in the near term, with no long-term effects. It was discovered that, despite rising income levels, environmental contamination does not decrease.

Rani and Kumar (2019) used the autoregressive distributed lag model (ARDL) technique to investigate the EKC hypothesis in India and China. The EKC hypothesis is valid in both short-run and long-run income elasticities in both nations, according to their findings. Their findings revealed that their factors, GDP, energy consumption, and population growth, all have a positive and significant effect on CO2 levels in India and China in the short and long run. According to the studies cited above, both India and China will experience environmental degradation in the next years as they approach the EKC's peak, where environmental recovery can occur.

Sun et al. (2020) examined the Belt and Road group of countries and the Organization for Economic Co-operation and Development countries for EKC from 1992 to 2015. The authors looked at economic development, trade openness, energy consumption, and urbanization as contributory variables for assessing the increase in carbon emissions. As a result, they discovered that rising macroeconomic indices also lead to rising carbon emissions. Economic expansion necessitates an increase in energy use, which releases CO2 into the atmosphere, according to the authors. Economic growth is found to reduce carbon emissions after the threshold is reached. It has also been discovered that trade openness contributes to environmental degradation by increasing air pollution due to increased technology usage. Similarly, as urban population growth necessitates increased energy use, urbanization has been observed to increase carbon emissions.

In some circumstances, the econometric models used to evaluate the EKC hypothesis contain mistakes. Månsson et al. (2018), for example, calculated the EKC when multicollinearity was present. The authors used the Dynamic Ordinary Least Squares (DOLS) approach to estimate their model, which included lagged variables to address multicollinearity. Their findings revealed that their novel technique, Ridge DOLS, outperforms DOLS, which overestimates the influence of GDP on CO2. The Ridge DOLS yields a smaller mean squared error (MSE) than DOLS, implying that the results are more accurate than using the standard estimation method. Even though DOLS corrects bias and other mistakes in a model, multicollinearity is still a problem that contributes to increased MSE, according to the authors. Finally, the authors stated that investigations on EKC that employ the DOLS method should adopt the Ridge DOLS approach to reduce degrees of collinearity.

Some analyses looked into the EKC's foundations, determining whether it existed in most countries. For example, Maneejuk et al. (2020) discovered that EKC is only valid in 9 of the 44 nations they evaluated. The authors regressed these countries' GDP, financial development, urbanization, and industrial sector to their carbon emissions. The EKC does not hold, according to their research, because most countries do not reduce carbon emissions even after maintaining economic growth. To summarize, just because a country has reached a tipping point in its economic growth does not mean it will immediately produce less pollution.

Palanca-tan et al. (2016) found no indication of the "*inverted U-shaped curve*" in the relationship between carbon emissions and economic growth in the Philippines, contradicting the EKC. In a second model, the authors removed GDP squared and discovered a positive linear association between GDP and CO2 emissions in the Philippines in both the short and long run. This research shows that economic growth in the Philippines contributes to carbon emissions and that the country's economic growth strategies should be subjected to tougher environmental limits. Due to the lack of cleaner technology that provides a greener source of energy intensity, Palanca-Tan et al. expected that urbanization would have a positive elasticity to CO2 because the Philippines is a lower-middle-income country. The authors ascribed the Philippines' negative elasticity to the country's high employment rates, which are comparable to those of high-income countries. Furthermore, it was discovered that more than half of Filipinos work in the service industry, as opposed to the manufacturing sector, which emits more CO2.

The relationship between the environment and economic growth has been discussed in multiple studies producing various results. According to a study conducted by Ilham (2018), Chng (2019), and Prasetyanto & Sari (2021), they all support and produce similar results using the Kuznets hypothesis. They all concluded that there is a positive relationship between the GDP per capita and energy consumption per capita on environmental degradation.

Additionally, there was also an observation of a positive relationship between carbon dioxide emission per capita and economic development. All studies agreed that their primary recommendation to policymakers is to make changes and decisions so that energy consumption would decrease to alleviate the worsening environmental degradation.

E. The Philippine Economy from 2009 to 2018

The Philippines, like most other economies throughout the world, had a difficult year in 2009, recording its lowest GDP in 11 years. In 2009, the Philippine economy expanded by 0.9 percent. It maintained moderate, albeit positive, growth rates when the world economy sank to its lowest point in 2009. Despite the devastating effects of the global slowdown on exports, it narrowly avoided a recession, in contrast to the fate of most of its neighbors. The economy received a much-needed lift from large infrastructure investments and strong consumer spending. (Senate Economic Planning Office, 2010)

According to the news released by Rappler, at the beginning of a new administration, *"the Philippines, which has long been referred to as one of the "newly industrialized" countries, has made notable progress throughout the latter years under the term from Arroyo to the Aquino administration. Foreign loans were reduced from 58 percent in 2008 to 47 percent of overall government borrowings by the government. According to the 2012 World Wealth Report, the Philippines' economy grew at the fastest rate in the world in 2010, with a GDP growth of 7.3 percent, thanks to increased business process outsourcing and overseas remittances*." The country's growth rate dropped to 3.6 percent in 2011 as the government focused less on exports and spent less on infrastructure.

In addition, the industrial sector was impacted in the same year by the disruption of raw material imports caused by floods in Thailand and the tsunami in Japan. As of the end of 2011, the Philippines had given more than $125 million to the International Monetary Fund's pool of funds to help European economies deal with the financial crisis. According to the Bangko Sentral ng Pilipinas, the Philippines, "which has to expand foreign exchange reserves, has made available around $251.5 million to the IMF to fund the Financial Transactions Plan (FTP)", an aid program for crisis-hit nations (Philippine Daily Inquirer, 2012). Since 2012, the economy has had uninterrupted real GDP growth of at least 5%. The Philippine Stock Exchange index finished 2012 with 5,812.73 points, up 32.95 percent from its 2011 conclusion of 4,371.96 points.

According to the World Bank year 2019, "*The Philippines has then become one of the most dynamic economies in East Asia Pacific. Because of expanding urbanization, a growing middle class, and a large and young population, the Philippines' economic vibrancy is grounded in robust consumer demand supported by a vibrant labor market and sizable remittances*." They have also mentioned that "*the services sector, which includes BPO, real estate, tourism, finance, and insurance, is flourishing, with high advances in the services sector.*" Based on the data as well that "*lower poverty rates and a lower Gini coefficient suggest that the Philippine economy has improved in terms of delivering inclusive growth.*" This resulted in that poverty falling from 23.3 percent in 2015 to 16.6 percent in 2018, and the Gini coefficient fell from 44.9 to 42.7.

Based on the report released by the Philippine Statistics Authority in 2019, the fourth quarter of 2018 saw GDP expand by 6.1 percent, bringing the full-year growth to 6.2 percent. Construction, trade, and repair of motor vehicles, motorcycles, personal and household goods, and other services were the key drivers of growth for the quarter. The report also says that "the industry grew at the fastest rate of 6.9% among the key economic sectors in the fourth quarter of 2018." Then came Services, which increased by 6.3 percent, and Agriculture, which increased by 1.7 percent. On the other hand, the report also stated that "the country's Gross Domestic Product (GDP) increased by 0.9 percent and the Gross National Income (GNI) increased by 5.2 percent as a result." GNI increased by 5.8% on an annual basis, whereas NPI increased by 3.7 percent. With a predicted population of 107.0 million in the fourth quarter of 2018, per capita GDP and per capita GNI both increased by 4.4 and 3.6 percent, respectively. Meanwhile, "HFCE or what we called the Household Final Consumption Expenditure" increased by 3.8 percent per capita.

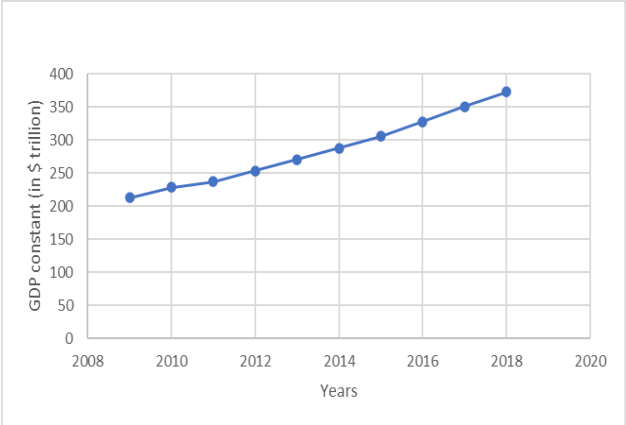

Fig. 2. Real GDP constant of the Philippines from 2009 to 2019 (in trillion $). Data from World Bank

F. Sustainable Window Analysis and Advanced Sustainability Analysis

The Sustainability Window Analysis, according to Hajar et al. (2020), is a multidisciplinary technique that examines the economic, environmental, and social sustainability of current or proposed alternatives. It's an evaluative tool that helps policymakers and decision-makers find acceptable tradeoffs among the three pillars of Sustainable Development and make well-informed decisions on how to promote and build a more equitable and sustainable economic transition. It does not, however, provide an absolute degree of sustainability; rather, it identifies a range of minimum and maximum growth rates that are ecologically and socially sustainable. It helps take a look back on the development of the indicators involved, it can't necessarily look forward and project the future of the indicator's development.

The SuWi Analysis is based on the Advanced Sustainability Analysis methodology. It is a broad framework for assessing sustainability, according to Saunders and Luukkanen (2021),

but because determining whether an "environmental or social indicator is sustainable or not on an absolute scale" is nearly impossible, the method focuses on changes in development rather than absolute values. The Advanced Sustainable Analysis approach analyzes whether or not development is more or less sustainable.

3. Methodology

A. Conceptual Framework

Doughnut economics is more of a conceptual framework than a new economic theory. It's a means of talking about and thinking about the problems that face the 21st-century economy and society in general. With that in mind, throughout this study, the researchers will investigate how economic growth affects our country's environment and other problems, including but not limited to healthcare, education, equity, and so on. Through this model, we can reframe economic problems and set new goals. Two rings constitute the doughnut framework: the social foundations or what we call the minimal standards of any country should meet to ensure citizens' well-being (*the inner circle*) and the ecological ceiling which is the environmental limits beyond which lies the planetary life-giving systems (*the outer circle*). Through this framework, humans can exist in an ecologically and socially just space.

The Doughnut Framework takes a unique perspective on development. Its approach acknowledges humanity's requirements or life basics through the twelve social foundations and seeks to ensure that these needs are universally accessible. All of the population's basic requirements are met, and no one is left without them. The theory acknowledges that consuming planetary resources is required to realize this vision, but it also establishes consumption limits in the form of the ecological ceiling. The ecological ceiling outlines the environmental consequences of excessive consumption, such as ocean acidification and pollution.

Furthermore, understanding the framework, recognizes also the interdependence of economics, societies, and the living environment, and urges for the transformation of degenerative economies into regenerative ones. This also discusses the trade-offs that economic activity has on humans and the environment, and calls for regenerative measures like waste management to ensure accountability for these trade-offs.

Assumptions:

A debate on long-term economic growth must be contextualized in light of the current level of environmental and social degradation, especially in the Philippines. Every metric of global environmental deterioration is rising. According to Washington and Kopnina (2018, p.57), this concern with endless economic expansion reveals that nations still do not grasp that humanity has reached ecological limitations and that this is the main cause of the current environmental and social problems. With that being said, this paper will investigate if the Philippines is still within the doughnut considering that there are a lot of factors that challenge the relationship between our economic growth and our social and environmental indicators.

The researchers assume that the empirical findings of this study support the idea that as GDP rises in the Philippines, there will be a limited chance of sustainability. According to Washington and Kopnina (2018), environmental and social performance are better in transition countries where market reforms have resulted in more effective environmental and social management and more incentive-based environmental and social policies have been implemented. This shows that not just market-based relationships, but also effective environmental and social institutions contribute to the reduction of environmental and social problems.

The relationship between economic growth and environmental and social indicators is tenuous at best. It is possible that economic expansion and environmental and social improvement can coexist, but this will require a highly intentional set of regulations and a desire to create energy and things in the most environmentally and socially friendly way possible.

B. Data Collection

The data to be used for this research will come from the World Bank and the Sustainable Development Indicators of the Philippines from the United Nations coming from the 2009–2018 time frame. These indicators were chosen for the reason that they represent the most pressing concerns in both the environmental and social welfare of the Philippines and also due to the completeness of their data in this time frame.

Table 1
Social, Environmental, and Economics Indicators used for the Sustainability Window and ASA Doughnut Analysis

	Indicators	**Time Frame**
Environmental Indicators	Biodiversity Land Consumption Greenhouse Gases Unsafe Sanitation Clean Energy	2009 - 2018
Social Indicators	Sufficient Food Education Life Expectancy Gender Equality Employment	2009 - 2018
Economic Indicator	GDP Constant	2009 - 2018

Source: World Bank and United Nations SDG Indicator

The data obtained is defined as follows: Biodiversity is defined as the average proportion of terrestrial key biodiversity areas that are covered by protected areas. Land consumption is defined as the percentage of forest area among the total land area. Greenhouse gases as carbon dioxide emissions. Unsafe sanitation is defined as the percentage of people using safely managed sanitation services. Clean energy is defined as the percentage of the population with primary reliance on clean fuels and technology. Sufficient food is defined as the percentage of the population that was prevalent undernourishment. Education is defined as the percentage of total official flows received for free education. Life Expectancy is defined as the mortality rate of children under 5 years old. Gender Equality is defined as the percentage of women that held a seat in the national parliament. Employment is defined as the total unemployment rate in the country. Gross Domestic

Product Constant is in constant 2015 prices, expressed in U.S. dollars.

C. Research Methodology

Similar to the study of Luukkanen et al (2021), we will utilize the framework of Kate Raworth's Economic Doughnut partnered with the quantification concept of the Sustainable Window Analysis that is based on the Advanced Sustainability Analysis. Through the use of the sustainable window analysis, we will be able to quantify the maximum economic development an economy can reach without costing the deterioration of our environmental condition and the minimum economic development an economy can reach and still achieve positive social development. The sustainable window analysis will utilize the minimum and maximum GDP in the economy being studied, along with the social and environmental indicators. This will test at which point of GDP growth is the sustainable criteria satisfied or not through a graphical representation.

1) Plotting the SuWi Analysis Graph for Environmental Indicators

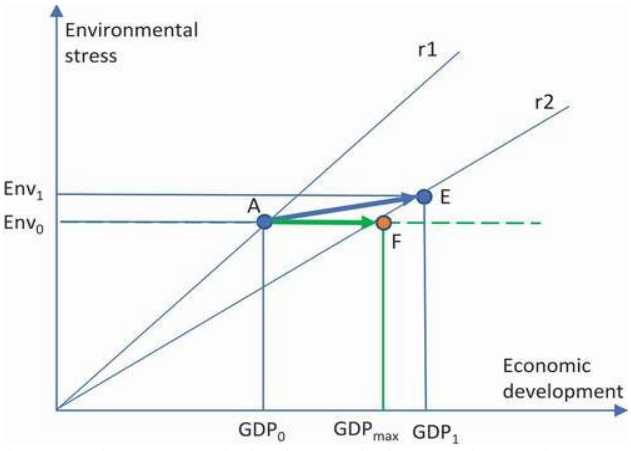

Fig. 3. Maximum economic development in the case where environmental stress is not increased. *Source: Luukkanen, 2015*

Figure 3 shows the development of an environmental indicator as a function of GDP. Point A is the starting point for development. This is where environmental stress (Env0) and economic development intersect (GDP0). The r1 line represents GDP productivity under environmental stress in the base year of analysis. Line r2 depicts the relevant environmental stress productivity in point E if the environmental stress in the final year of analysis is Env1 and the associated economic development GDP1. If the sustainability criterion is that environmental stress should not rise, we will have point F on the productivity line r2 (final year productivity) representing the greatest economic development, GDPmax, to meet the criterion.

2) Plotting the SuWi Analysis Graph for Social Indicators

The method for determining the minimum economic development required to meet the social sustainability criterion is depicted in Figure 4. Point A represents the starting point for analysis, with Soc0 representing social welfare production, GDP0 representing economic development, and line r1 representing social welfare productivity. The last year of analysis is denoted by the letter S, along with the social welfare indicators Soc1 and GDP1, and the social welfare productivity is indicated by line r2. The sustainability criterion now suggests that social welfare shall not diminish, implying that point G on the line r2 reflects the minimum economic development, GDPmin, required to meet the criterion.

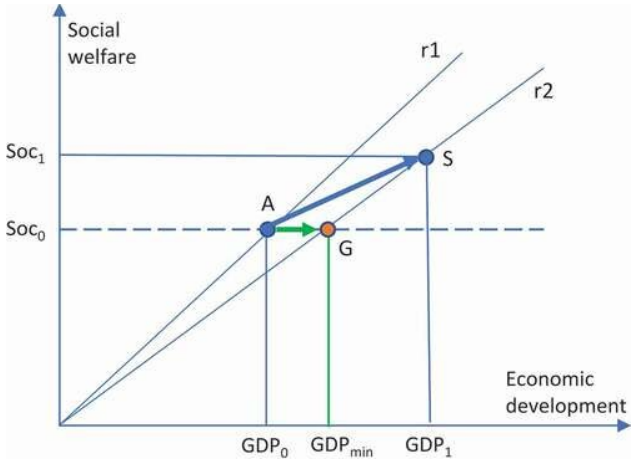

Fig. 4. Minimum economic development to fulfill the social sustainability criterion. *Source: Luukkanen et al, 2015*

3) Plotting the SuWi Analysis Graph for both Environmental and Social Indicators

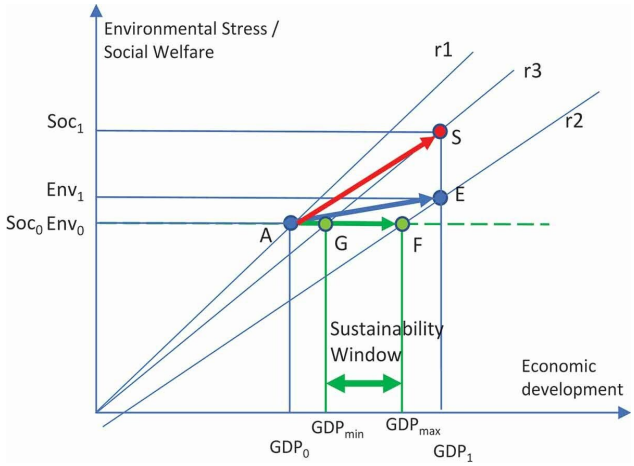

Fig. 5. The Sustainability Window with maximum economic development to fulfill the environmental sustainability criterion and minimum economic development to fulfill the social sustainability criterion. *Source: Luukkanen, 2015*

Figure 5 illustrates the combined social and environmental sustainability analyses. It shows how we can define the minimum and maximum economic development to fulfill social and environmental sustainability criteria based on the Sustainable Window Analysis. This figure depicts the environmental stress productivity line as the *r2*, which determines the maximum economic development (GDPmax), and the social welfare productivity line as the *r3*, which determines the minimum economic development (GDPmin) to fulfill both sustainability criteria.

The equation on how to solve for the window:

$$Environmental\ Indicators = GDP_{max} = \frac{GDP_{t1}}{Env_{t1}} Env_{t0}$$

$$Social\ Indicators = GDP_{min} = \frac{GDP_{t1}}{SOC_{t1}} SOC_{t0}$$

SuWi analysis can be performed over a variety of periods and delivers results for the selected period. Because the development might vary greatly based on the period, the findings must always be compared to the period chosen. For example, if CO2 emissions rise one year, the development may be sustainable or unsustainable the following year. The SuWi method enables us to evaluate and examine the long-term sustainability of different periods. (Luukkanen, 2015)

Scope and Delimitations of the Study:

In this study, through the use of the Sustainability Window method, the researchers will quantify Doughnut Economics, in the context of the Philippines. Through the use of the chosen economic and Sustainable Development Indicators, this study aims to define what is the needed maximum development an economy should achieve and the minimum level of development to fulfill its social sustainability criteria while not exceeding the environmental sustainability limit. For this objective, the Philippines will be the country to be studied. The methodology that we will be utilized, based on other similar studies, is best paired with GDP as the economic indicator. Along with the economic Indicator, we will also utilize the localized data of the sustainable development indicators developed by the United Nations and the World Bank.

Limitations of the Study:

The limitations of this study include the lack of acquired data. As for the sustainable development indicators and their corresponding data, the Philippines lacked data for the later years in which we wanted to examine certain indicators. Although this is an opportunity for further research for future generations that may have access to a more complete data set. There is also the matter of this research being fairly new, that there isn't something similar here in the Philippines for us to use as a basis or comparison, hence why we use similar studies that aren't based here in the context of the Philippines. There is also a time constraint on our part given our status as undergraduate students.

4. Results and Discussion

This study seeks to determine, from 2009 to 2018, if the Philippines is within the range of the doughnut economy. The researchers would quantify the maximum economic development an economy can achieve without incurring a cost to the deterioration of our environmental condition and the minimum economic development an economy can reach and still achieve a positive social development using the framework of Kate Raworth's Economic Doughnut partnered with the Sustainable Window Analysis's quantification concept based on the Advanced Sustainability Analysis.

The quantification of the data collected reveals that there are indications of economic growth at the expense of improvements in social and environmental conditions. The Economic Doughnut in the context of the Philippines demonstrates that, *except for unsafe sanitation*, the environmental sustainability criteria are met by the indicators of biodiversity, land use, greenhouse gases, and renewable energy. All indicators exhibit a consistent development in their data trends. In contrast, unsafe sanitation exhibits an ascend in environmental development, which would mean that there is an increase in the percentage of people who use safely managed sanitation services water in the Philippines, however, based on the results of the quantification of the data, it was seen to be unsustainable taking into consideration the economic development of the country.

Table 1
Computed GDP MIN and GDP MAX for the combined environmental and social indicators

	GDP MIN	GDP MAX
Biodiversity & Sufficient Food	0.56	62.69
Land Use & Education	0.14	60.89
Greenhouse Gases & Healthy Life	0.65	67.2
Gender Equality & Unsafe Sanitation	0.44	52.07
Renewable Energy & Employment	0.61	61.63

The social indicators used for this study—sufficient food, education, healthy life, gender equality, and employment—demonstrate that they meet the criteria for social sustainability. This indicates that none of the social indicators' overall productivity declines below the GDP MIN determined for each indicator.

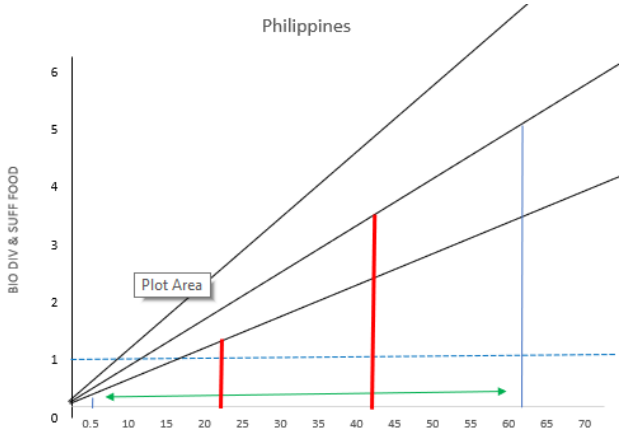

Fig. 6. Sustainability window between biodiversity and sufficient food

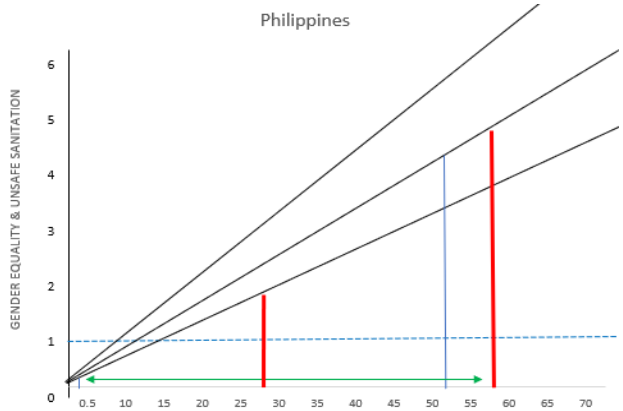

Fig. 7. Sustainability window between gender equality and unsafe sanitation

Figure 6. This graph shows how the environmental indicator, Biodiversity, and the social indicator, Sufficient Food, were able to satisfy the environmental and social sustainability criteria, which resulted in their final productivity falling within the sustainability window.

Figure 7. This graph shows that while the social indicator, Gender Equality has satisfied the social sustainability criteria, the environmental indicator, unsafe sanitation didn't satisfy the environmental sustainability criteria. This resulted in its final productivity falling out of the sustainability window.

A. Discussion of the Results of the Doughnut

The Doughnut Model Framework as seen in figure 8 shows that Unsafe sanitation has a weak sustainability indicator since it lies outside the doughnut's ring. This only serves to demonstrate how unsustainable unsafe sanitation has been from 2009 to 2018. The first green line (outer) shows the level of economic development that must be reached to satisfy the environmental sustainability criteria, while the second green line (inner) shows the level of economic development that must be reached to satisfy the social sustainability criteria. The final productivity for the studied period is shown by the red line. The sustainability doughnut and green areas show possible areas for sustainable development.

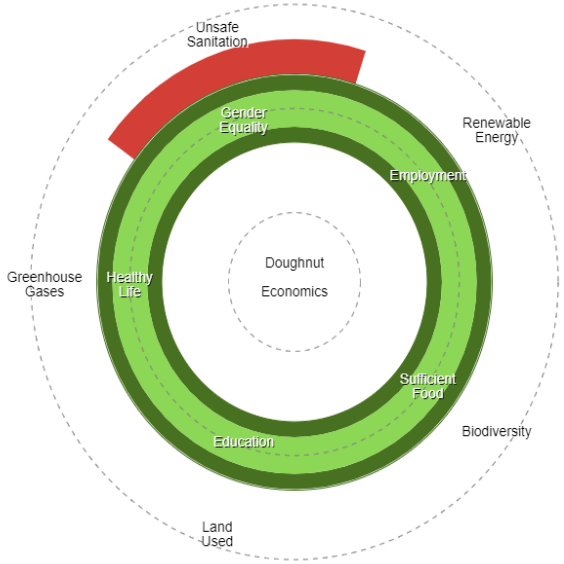

Fig. 8. Doughnut graph of the combined environmental and social indicators

In most instances, environmental indicators—represented by the outer green line in figure 8 are fulfilled. This indicates that the final productivity was sufficient to raise social well-being as evaluated by the selected measures. In the case of Biodiversity, Land Use, Greenhouse Gases, and Renewable Energy the environmental sustainability criteria are fulfilled. As mentioned, only unsafe sanitation crosses the boundary which indicates that its environmental criteria are not fulfilled.

Analysis of the Philippines from 2009 to 2018 using the doughnut model for strong sustainability (reducing absolute in social indices stress). The inner green line shows the lowest possible economic development required to meet the social sustainability standards, while the outside green line shows the maximum economic development required to meet the strict environmental sustainability criterion. The final productivity for the examined period is shown by the red line. The sustainability doughnut and green areas show possible areas for sustainable development.

In most instances, sustainability—represented by the inner green line in figure 8 is fulfilled. This indicates that the final productivity was sufficient to raise social well-being as evaluated by the selected measures. In the case of Sufficient Food, Education, a Healthy Life, Gender Equality, and Employment the social sustainability criteria are fulfilled.

5. Conclusion and Recommendation

The main objective of this study is to ascertain whether the Philippines is capable of achieving certain levels of economic development while remaining socially and environmentally sustainable. The researchers sought to determine whether the Philippines falls under the sustainability doughnut framework by combining Kate Raworth's economic doughnut framework with the quantification idea of the Sustainable Window Analysis formed from the Advanced Sustainability Analysis.

A cutting-edge approach to quantitatively quantifying sustainability in its interdependent social, environmental, and economic dimensions is provided by the Sustainability Window (SuWi) method. It is possible to conduct detailed analyses where the interactions between different sectoral trends are revealed and the issue areas are located owing to the simultaneous examination in several dimensions. As a result, it is possible to consider the policy responses unique to each economic sector and focus interventions where they are most urgently required. Comparatively to one-sector studies, the capacity to examine progress in several policy areas at once can lead to more timely and well-balanced policies.

The SuWi approach can be used to analyze gaps and pinpoint areas in various development sectors where performance has to be improved. Using this method, we can measure the maximum level of economic development that an economy can reach without negatively impacting the environment or social well-being.

Both the Sustainability Window (SuWi) Method and the Advanced Sustainability Analysis (ASA) Doughnut model can be used to evaluate the dynamics of sustainable development. Analyzing trends in the various sustainability-related components can be done using the SuWi approach. It can operate as the basis for scenario creation when numerous component interactions are thoroughly investigated, and future options are rigorously evaluated. The fluid doughnut model can provide a comprehensive overview of how various fields are changing as well as insightful information about the areas that necessitate specialized policy responses.

According to an analysis of the test findings performed by the researchers, the Philippines *falls within the sustainability doughnut.* As can be seen from our calculations and data gathered, only a small number of environmental indicators—

namely, biodiversity, land use, greenhouse gases, and renewable energy—showed to be sustainable and met the sustainability criterion. This is similar to earlier research of a similar nature. It was the Unsafe Sanitation indicator for the Philippines, and its climbing trend indicates weak sustainability for the proportion of individuals who use unsafe water here in the country. The social indicators that were selected for this study—sufficient food, education, a healthy life, gender equality, and employment—were found to meet the criteria for sustainability and to indicate strong sustainability.

Recommendation:

The variables and indicators chosen for the analysis must always be carefully chosen. In this analysis, the indicators were primarily derived from the SSI database, which was used as a reasonably complete and reliable data source. A problem with the Sustainability Society Index database is that it hasn't been updated in a while, and the most current version seems to contain some lacking in the time series. Accurate analysis of the trend and the estimation of potential future development trajectories are already possible enabling the integration of a complete time series of data in the study. For the comparison study, a reliable database with standardized data collection and processing for many countries is necessary. If this is not the case, insufficient data may result in inaccurate development process projections. The UN SDG database should be a reliable source of information for this kind of comparative study, but the database's scope should be broadened to include as many variables as is practical for all countries around the world.

The SuWi approach can be used for analysis at the sub-national level, among groups of countries, as well as at the country level (such as the ASEAN). Although the study at the municipal or provincial levels may provide essential information for local policymaking, the main problem is typically a lack of data.

SuWi is a flexible tool for the analysis of sustainability. It can be used to assess various development domains and sustainability variables (strong, weak) at different analytical levels (regional, national, and global). Only the lack of suitable quantitative indicators limits its application spectrum. By employing the established technique to carefully analyze the social, environmental, and economic linkages, the complex relationships of development in the various scopes can be clarified. This study can help point governmental initiatives toward the most crucial and productive regions in need of improvement.

For the development of policy, the SuWi approach and the ASA Doughnut can provide useful information. This calls for the research's findings to be easily understood, and in this sense, the visual presentation of the research's findings is essential. Illustrating how societies operate dynamically concerning sustainability is one of the major problems. Although this requires more development, it is possible to depict the dynamic changes in sustainability using the tools that have been built. The tools will need to be made as user-friendly as feasible in the future development to be used by all planners and easily incorporated into daily routines. Because data accessibility is vital, this also applies to database construction.

Using the methodology used in this study, which is based on Advanced Sustainability Analysis (ASA) and the Sustainability Window (SuWi) method, a handy tool for assessing the doughnut economy has been created. The overall scope, visual simplicity, and scientific basis of the ASA Doughnut approach provide a solid basis for studying sustainable development as well as for policy-making and implementation.

Moving forward, as seen in the data we have collected and with the result of the doughnut analysis, there has been quite some development in the quality of sanitation that individuals in the Philippines have been using, but as great as that development has been, we cannot ignore that there is still a great percentage of individuals still lack access to proper sanitation, and these usually are individuals who come from the lower socioeconomic classes. As stated in the study conducted by the World Bank in 2008, as years go by, each passing year there will be at least an additional two million individuals who would require clean and safe sanitation facilities.

Since sanitation is one of our first lines of defense against the virus and the pandemic is still ongoing, the issue of sanitation is now far more urgent than it was before. Now more than ever, sanitation has become one of the most important tools we should be focusing on. Through this research, we have discovered that unsafe sanitation and its economic impacts do not fall within the boundaries of the sustainability framework we have chosen. We recommend the need to invest in establishing economical and environmentally friendly portable sanitation services, especially in rural areas, as these are most likely where individuals who lack access to proper sanitation reside. As mentioned by the World Bank in their study, poor families are the ones likely to lack access to proper sanitation. Centralizing these policies on them might not only stimulate the development of both environmental and social welfare but also the economic welfare of the social class residing in those areas.

The Philippines must, however, fill its shoes. Given the Philippines' inability to maintain its social foundations, it is acknowledged that local demands should guide growth. As a result, it is essential to have a full understanding of a community's realities, needs, and goals.

6. Policy Implication

With the findings of this research, we have measured the sustainability of the Philippines through the past years using our set of social and environmental indicators. All indicators were found to be within the sustainable boundaries of the doughnut except one: *unsafe sanitation*. This finding urges better waste management and water filtration through policies.

In the Philippines, 7 million people lack access to better sanitation, and more than 3 million rely on hazardous and unsafe water. The country confronts tremendous obstacles in terms of access to water and sanitation despite its economic growth. Rapid urbanization is taking place throughout the nation, and expanding communities struggle to meet the needs of incoming populations in terms of water sanitation. (Water.org, 2022)

To address unsafe sanitation conditions, the Department of Environment and Natural Resources (DENR) implemented the

Clean Water Program based on the established environmental laws, specifically RA 9275, the Philippine Clean Water Act. It requires the government to develop and carry out legislation as well as strengthen collaborations with stakeholders in order to improve the quality of the water throughout the entire nation. In order to assure compliance, it calls for the use of financial incentives and public transparency, and it promotes sustainability practices and pollution control at the source.

The initiative attempts to enhance water quality in key rivers and other important bodies of water, such as lakes and bays, by the monitoring industry, rehabilitating *esteros*/rivers through partnerships, such as the *Adopt-an-estero* project, and conducting continual, major cleanups. Since the implementation of effluent standards depends on this categorization, water classification is a crucial part of managing water quality. The DENR can create effective water quality management programs and set guidelines to safeguard aquatic life and human use of water bodies with the use of the classification of water bodies. Water quality management areas' operationalization shall also be given priority.

With how the unsafe sanitation indicator is beyond the planetary boundaries, the government must be more aggressive with its Clean Water Program in order to provide clean, safe water to every household in the country.

The results of this study cause a significant impact on existing national plans. As one of the primary research objectives, the researchers have been able to measure the country's sustainability and how it impacts the nation and its laws related to sustainability. In general, to address national sustainability concerns, the Philippine government devised the Philippine Action Plan for Sustainable Consumption and Production, or *PAP4SCP,* which was designed for a more cohesive implementation of sustainable consumption and production in the country. With these comprehensive policy reforms and interventions over the short, medium, and long-term timeline, this action plan aims to serve as the guiding framework to inspire and influence sustainable practices and behavior across different sectors and levels of government (2030-2040).

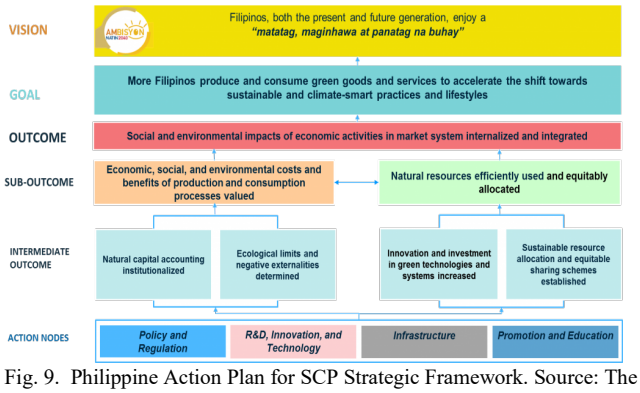

Fig. 9. Philippine Action Plan for SCP Strategic Framework. Source: The National Economic and Development Authority, 2020

The PAP4SCP was also implemented to achieve the Philippine's Ambisyon Natin 2040 so that the initiatives and policies put in place would guarantee that Filipinos, both in the present and next generations, experience a "*matatag* (deeply rooted), *maginhawa* (comfortable), and *panatag* na buhay (secure life)." This will become a reality when more Filipinos adopt sustainable and climate-smart activities and lifestyles and increase their use of environmentally friendly goods and services.

The conducted study and proven efficiency of the utilization of the SuWi Method and the Doughnut Framework gives a new perspective on how the Philippine Action Plan for Sustainable Consumption and Production shall be implemented. The study also highlights issues that the PAP4SCP left out to target. The constructed Philippine doughnut economy in the study shall be used as one of the bases for adapting the socio-environmental impacts of current and future economic activities in the market. This study now provides a more extensive way of measuring the sustainability of the Philippines' consumption and production.

References

[1] Adu, D.T. & Denkriyah, E.K. (2017). Economic Growth and Environmental Pollution in West Africa: Testing the Environmental Kuznets Curve hypothesis. *Kasetsart Journal of Social Sciences, 40*, 281-288.

[2] Awan, Dr. Abdul. (2013). Relationship between environment and sustainable economic development: a theoretical approach to environmental problems. *Int. J. Asian Soc. Sci., 3*.741-761.

[3] Carrington D. (2016). The Anthropocene Epoch: Scientists Declare Dawn of Human-influenced Age. *The Guardian.* http://fromm.usfca.edu/Fall2016/Garrett%20Week%205.pdf

[4] Cederborg, J. & Snöbohm, S. (2016). Is there a relationship between economic growth and carbon dioxide emissions?. *Södertörns University, Institution of Social Sciences.* https://www.diva-portal.org/smash/get/diva2:1076315/FULLTEXT01.pdf

[5] Chapin III, F., Pickett, S., Power, M., Jackson, R., Carter, D., & Duke, C. (2011). Earth Stewardship: A Strategy for Social–ecological Transformation to Reverse Planetary Degradation. *Journal of Environmental Studies and Sciences, 1(1)*, 44-53.

[6] Christopher, S. (2019). Social Cohesion and Economic Development: Unpacking the Relationship. *German Development Institute.*

[7] Department of Natural Resources. (2019). Clean Water Program. Retrieved November 24, 2022, from https://www.denr.gov.ph/index.php/priority-programs/clean-water-program

[8] Dinda, S. (2004). Environmental Kuznets Curve Hypothesis: A Survey. Ecological Economics 49: 431-55.

[9] Domazet, T., Rilovi´c, M., An˘ci´c, A.., Andersen, B., Richardson, B., Brajdi´c, L., Pungas, M., Medak, L. (2020). Encyclopedia of the World's Biomes, 1st ed.; *Elsevier: Amsterdam, The Netherlands*, pp. 276–286.

[10] Dynan, K., Sheiner, L. (2018). GDP as a Measure of Economic Well-being. https://www.brookings.edu/wp-content/uploads/2018/08/WP43-8.23.18.pdf

[11] Eurostat. Sustainable Development Goals and Indicators. Available online: https://ec.europa.eu/eurostat/web/sdi

[12] Foley, J. A., DeFries, R., Asner, G. P., Barford, C., Bonan, G., Carpenter, S. R.; Snyder, P. K. (2005). Global Consequences of Land Use. *Science, 309(5734)*, 570-574.

[13] Haberl, H., Erb, K.H., Krausmann, F., Gaube, V., Bondeau, A., Plutzar, C., Fischer-Kowalski, M. (2007). Quantifying and Mapping the Human Appropriation of Net Primary Production in Earth's Terrestrial Ecosystems. *Proceedings of the National Academy of Sciences of the United States of America, 104(31).* 12942-12947.

[14] Hoekstra, A. Y. & Wiedmann, T. O. (2014). Humanity's Unsustainable Environmental Footprint. Science 344, 1114–1117.

[15] Likens, G. E. 1991. Human-accelerated Environmental Change. Bio Scienece, 41(3), 130.

[16] Hoff, J.V.; Rasmussen, M.M.; Sørensen, P.B. (2020) Barriers and opportunities in developing and implementing a Green GDP. *Ecol. Econ., 181*, 106905.
[17] Hoffren, J. (2019). Progress in welfare measurements and it's political usefulness. In Proceedings of the 13th International Conference of the European Society for Ecological Economics (ESEE 2019), Turku, Finland, 18–21.
[18] Holden, E.; Linnerud, K.; Banister, D. (2014) Sustainable development: Our Common Future revisited. Glob. Environ. Chang., 26, 130–139.
[19] Hajar, A., Tweissi, A., Abu Hajar, Y., Al-Weshah, R.,. Shatanawi, K., Imam, R., Murad, Y., Abu Hajer, M. (2020). Assessment of the municipal solid waste management sector development in Jordan towards green growth by sustainability window analysis. *Journal of Cleaner Production, Volume 258*, 120539.
[20] Ilham, M.I. (2018). Economic Development and Environmental Degradation in ASEAN. *Signifikan: Jurnal Ilmu Ekonomi. Vol. 7 (1)*: 103–112.
[21] Jabba, S., & Verity, A. (2021). About Doughnut Economics,Technology and Humanitarian Crises. https://reliefweb.int/sites/reliefweb.int/files/resources/About%20Doughnut%20Economics%2C%20Technology%20and%20Humanitarian%20Crises%20-%20October%202021.pdf
[22] Kaivo-oja, J., Luukkanen, J., & Malaska, P. (2001). Advanced Sustainability Analysis.
[23] Kovacic, Z.; Giampietro, M. (2015). Beyond "beyond GDP indicators:" The need for reflexivity in science for governance. *Ecol. Complex., 21*, 53–61.
[24] Kwatra, S.; Kumar, A.; Sharma, P. (2020). A critical review of studies related to construction and computation of Sustainable Development Indices. *Ecol. Indic.,112*, 106061.
[25] Lockie, S. (2017). A Better Anthropocene?. *Environmental Sociology, 3(3)*, 167.
[26] Luukkanen, J., Kaivo-oja, J., Vehmas, J., Panula-Ontto, J., & Häyhä, L. (2015). Dynamic Sustainability. Sustainability Window Analysis of Chinese Poverty-Environment Nexus Development. Sustainability, *7(11)*, 14488-14500.
[27] Luukkanen, J., Vehmas, J., & Kaivo-oja, J. (2021). Quantification of Doughnut Economy with the Sustainability Window Method: Analysis of Development in Thailand. Sustainability, 13(2), 847.
[28] Macaraeg, Pauline. (2020). Sariling diskarte': The Heavy Impact of Lockdown on Micro, Small Businesses. https://www.rappler.com/newsbreak/indepth/heavy-impact-coronavirus-lockdown-micro-small-medium-enterprises
[29] Maneejuk, N., Ratchakom, S., Maneejukm, P., & Yamaka, W. (2020). Does the Environmental Kuznets Curve Exist?. *An International Study. Sustainability, 12(21*).
[30] Månsson, K., Kibria, B.M.G., Shukur, G., & Sjölander, P. (2018). On the Estimation of the CO2 Emission, Economic Growth and Energy Consumption Nexus Using Dynamic OLS in the Presence of Multicollinearity. *Sustainability 2018, 10(5)*.
[31] Maximilian, A., and Carson, R. (2008). Forecasting the Path of China's CO2 Emissions Using Province-Level Information. *Journal of Environmental Economics and Management 55:* 229–47.
[32] McGillivray, M. (1990) The human development index: Yet another redundant composite development indicator? *World Dev., 19*, 1461–1468.
[33] M.M. Shah. (2008). Sustainable Development, Editor(s): Sven Erik Jørgensen, Brian D. Fath,*Encyclopedia of Ecology, Academic Press.*
[34] Muyrong, Marjorie S. (2020). "#StayAtHome #Bayanihan: Understanding the Profile of Displaced Workers due to ECQ," Policy Brief No. 2020-03, Economics Department, Ateneo de Manila University.
[35] National Economic and Development Authority. (2020). Addressing the Social and Economic Impact of the Pandemic. *NEDA: Pasig.* https://www.neda.gov.ph/wpcontent/uploads/2020/03/NEDA_Addressing-the-Social-and-Economic-Impact-of-theCOVID-19-Pandemic.pdf
[36] Nguyen T., Quyet T., Linh D., Linh D., Ha D., (2019) Trade-off between environment, energy consumption and human development: Do levels of economic development matter?, *Energy, Volume 173,,* Pages 483-493.
[37] OECD. (2004). Measuring Sustainable Development; Organisation of Economic Co-Operation and Development: *Paris, France.*
[38] O'Neill, W.D.; Fanning, A.L., Lamb, W.F., Steinberger, J.K., (2018). Good Life for All within the Planetary Boundaries. *Nature Sustainability, Vol. 1,* 88-95, http://eprints.whiterose.ac.uk/127264/
[39] Palanca-Tan, R. Dy, T.A., & Tan, A. (2016). Relating Carbon Dioxide Emissions with Macroeconomic Variables in the Philippine Setting. *Low Carbon Economy, 7(1)*, 12-20.
[40] Philippine Statistics Authority, Republic of the Philippines. (2021). GDP Posted a Growth of 7.7. Percent in the Fourth Quarter of 2021, Resulting in a 5.6 Percent Full-year Growth in 2021. https://psa.gov.ph/national-accounts/sector3/Gross%20Domestic%20Product
[41] Philippine Statistics Authority. (2015). 2014 Annual Labor and Employment Status (Comparative Annual Estimates for 2014 and2013). https://psa.gov.ph/content/2014-annual-labor-and-employment-status-comparative-annual-estimates-2014-and-2013
[42] Philippine Statistics Authority. (2016). 2015 Annual Labor and Employment Status (Preliminary results of the 2015 annual estimates). https://psa.gov.ph/content/2015-annual-labor-and-employment-status-preliminary-results-2015-annual-estimates
[43] Philippine Statistics Authority. (2017). 2016 Annual Labor and Employment Status. https://psa.gov.ph/content/2016-annual-labor-and-employment-status
[44] Philippine Statistics Authority. (2018). 2017 Annual Labor and Employment Status. https://psa.gov.ph/content/2017-annual-labor-and-employment-status
[45] Philippine Statistics Authority. (2019). 2018 Annual Labor and Employment Status. https://psa.gov.ph/content/2018-annual-labor-and-employment-status
[46] Prasetyanto, Panji & Sari, Farmila. (2021). Environmental Kuznets Curve: Economic Growth with Environmental Degradation in Indonesia. *International Journal of Energy Economics and Policy. 11*. 622-628.
[47] Rani, R. & Kumar, N. (2019). Investigating the Presence of Environmental Kuznets Curve Hypothesis in India and China: An Autoregressive Distributive Lag Approach. *Jindal Journal of Business Research, 8(2)*, 194-210.
[48] Raworth, K. (2017) Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist; Random House Business Books: London, UK.
[49] Raworth, K. A, (2012). Safe and Just Space for Humanity: Can We Live Within the Doughnut? *Oxfam, Oxford, UK*, https://www.oxfam.org/sites/www.oxfam.org/files/dp-a-safe-and-just-space-for-humanity-13021-en.pdf
[50] Raworth, K. 2017. A Doughnut for the Anthropocene: Humanity's Compass in the 21st Century. *The Lancet Planetary Health, 1(2)*, e49.
[51] Rees, W.E. (1992). Ecological footprints and appropriated carrying capacity: What urban economics leaves out. *Environ. Urban., 4*, 121–130.
[52] Rockström, J., & Lambin, E. (2009). Planetary Boundaries: Exploring the Safe Operating Space for Humanity. Ecology and Society: *A Journal of Integrative Science for Resilience and Sustainability.* http://hdl.handle.net/2078.1/72015
[53] Roldan, M.D.G. (2018). Towards Attaining the Sustainable Development Goals: The Philippines and the 2030 Agenda. https://www.dlsu.edu.ph/wp-content/uploads/pdf/conferences/research-congress-proceedings/2018/sep-01.pdf
[54] Rosenström, U. (2009). Sustainable Development Indicators: Much Wanted, Less Used? University of Helsinki: Helsinki, Finland,
[55] Sagar, A.D.; Najam, A. (1998). The human development index: A critical review. *Ecol. Econ., 25,* 249–264.
[56] Saunders A. & Luukkanen J. (2022) Sustainable development in Cuba assessed with sustainability window and doughnut economy approaches, *International Journal of Sustainable Development & World Ecology, 29:2*.
[57] Smulders, J. A. (1999). Endogenous Growth Theory and the Environment. *In Handbook of Environmental and Resource Economics. Amsterdam: Edward Elgar Publishing,* pp. 610–21.
[58] Steffen, W., Richardson, K., Rockström, J. Cornell, S.E. (2015.) Planetary Boundaries: Guiding Human Development on a Changing Planet. *Science express*, 15.
[59] Stern, David I. (2004). The Rise and Fall of the Environmental Kuznets Curve. *World Development 32:* 1419–39.
[60] Sun, H., Samuel, C.A., Amissah, J.C.K., Taghizadeh-Hesary, F., & Mensah, I.A. (2020). Non-linear nexus between CO2 emissions and economic growth: A comparison of OECD and B&R countries. *Energy, 212*.
[61] Susmita, D., Hamilton, K., Pandey, K., and Wheeler, D. (2006). Environment during Growth: Accounting for Governance and Vulnerability. *World Development 34*: 1597–611.
[62] The National Economic and Development Authority. (2020). Philippine Action Plan for SustainableConsumption and Production (PAP4SCP). https://sdg.neda.gov.ph/philippine-action-plan-for-sustainable-consumption-and-production-pap4scp/

[63] Tuano, Philip. (2021). Review of the Philippine Economic Situation and Analysis of the State of the Nation in 2021. *ASOG WORKING PAPER 21-022*.
[64] United Nations. (1987). Commission on Environment. In Report of the World Commission on Environment and Development: Our Common Future; *Oxford University Press: Oxford, UK*.
[65] United Nations. (2018). Indicators of Sustainable Development: Guidelines and Methodologies; United Nations: New York, NY, USA.
[66] United Nations. (2018). SDG Indicators. https://unstats.un.org/sdgs/indicators/indicators-list/
[67] United Nations. (2018). SDG Indicators–Metadata Repository. https://unstats.un.org/sdgs/metadata/
[68] United Nations. (2014-2018). Country Profile: Philippines. https://country-profiles.unstatshub.org/phl#
[69] United Nations, (2015). The Millennium Development Goals Report 2015. *United Nations, New York*. http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%201).pdf
[70] Wackernagel, M., Rees, W.E. (1996). Our Ecological Footprint: Reducing Human Impact on the Earth; New Society Publishers: Gabriola, BC, Canada.
[71] Washington, H., & Kopnina, H. (2018). The insanity of endless growth. *The Ecological Citizen, 2(1),* 57-63.
[72] Water.org. (2022). Philippines Water Crisis - Water in The Philippines 2022. Retrieved November 23, 2022, from Water.org website: https://water.org/our-impact/where-we-work/philippines/
[73] WCED. (1987). Our Common Future: Report of the World Commission on Environment and Development. *Oxford University Press*, http://mom.gov.af/Content/files/Bruntland_Report.pdf
[74] World Bank. (2008). Economic impacts of sanitation in the Philippines. https://pdf.usaid.gov/pdf_docs/Pnadt138.pdf
[75] World Bank. (2020). The World Bank in the Philippines. https://www.worldbank.org/en/country/philippines/overview#1
[76] World Bank. (2014-2018). GDP (constant 2015 US$)- Philippines https://data.worldbank.org/indicator/NY.GDP.MKTP.KD?locations=Z4
[77] World Bank. (2014-2018). CO2 emissions (kg per PPP $ of GDP) - Philippines https://data.worldbank.org/indicator/EN.ATM.CO2E.PP.GD?locations=PH
[78] World Bank. (2014-2018). People using safely managed sanitation services (% of population) - Philippines. https://data.worldbank.org/indicator/SH.STA.SMSS.ZS?locations=PH
[79] World Bank. (2014-2018). Forest area (% of land area) - Philippines https://data.worldbank.org/indicator/AG.LND.FRST.ZS?locations=PH
[80] World Bank. (2014-2018). Renewable energy consumption (% of total final energy consumption) – Philippines. https://data.worldbank.org/indicator/EG.FEC.RNEW.ZS?locations=PH
[81] Van, G.; Manuel, A.R. (2008). A comprehensive index for a sustainable society: The SSI–the Sustainable Society Index. *Ecol. Econ., 66,* 228–242.
[82] Vitousek, P. M., P. R. Ehrlich, A. H. Ehrlich, and P. A. Matson. (1986). Human appropriation of the products of photosynthesis. *Bioscience 36(6)*: 363–373.
[83] Zhen Yang, C. (2019) "Environmental Degradation and Economics Growth: Testing the Environmental Kuznets Curve Hypothesis (EKC) in Six ASEAN Countries," Journal of Undergraduate Research at Minnesota State University, Mankato: Vol. 19, Article 1.