

**Considerations for the Application of Gross Domestic Product in the United Nations'
Sustainable Development Goals**

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By

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

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Introduction

Gross domestic product (GDP) is defined as the aggregate value of all goods and services produced in a country each year and today is the most widely tracked and reported economic world development indicator both globally and longitudinally (*WDI - Economy*, n.d.). However, applications of the metric are rarely contained within the boundaries of determining the scale of an economy and are often used to evaluate a country's economic health more broadly, as growth of an economy has been used synonymously with success (Stone, 2017; Dynan & Sheiner, 2018). In other words, the health of a complex, sociotechnical system such as the economy is often boiled down to the behavior of a purely technical metric – increasing GDP is interpreted as being equivalent to economic prosperity. In the United Nations' Sustainable Development Goals, GDP is the most influential indicator in determining the progress in achieving Goal 8, “Decent Work and Economic Growth” (*Goal 8 | Department of Economic and Social Affairs*, n.d.). However, GDP was initially designed as a high-level tool for US policymakers desperately trying to recover from the Great Depression to determine how bad the situation truly was and if their proposed policy solutions worked. Quantifying the size of an economy served as a valuable tool for US policymakers both because of the lack of economic metrics available at the time and because tracking the size allowed them to assess an economy's propensity for growth. The importance of the latter was a product of the circumstances; when the massive economic growth that brought prosperity during the Roaring Twenties was hindered by the onslaught of the Great Depression.

Almost 100 years after GDP's conception, if we continue to think change in GDP directly and comprehensively represents the health of a country's economy, then we overlook how the metric itself influenced our perception of what makes a healthy economy in the first place.

Although GDP was originally designed for high level interpretation of general economic health, it has gained momentum over time ultimately determining what society deems a healthy economy. I believe that classifying GDP as a technology that has reached momentum using Thomas Hughes' theory of "technological momentum" will benefit the analysis of GDP's applications, specifically in its use as a metric throughout the United Nations' Sustainable Development Goals (SDGs).

"Technological momentum" theorizes about how technology and society interact. According to Hughes, a young technology is molded by the society in which it is born, and as it grows and develops, gains momentum both in its size as well as the secondary, tertiary, and so on, systems that form around the technology. A matured technology – one that exhibits characteristics of momentum – becomes so ingrained that it ultimately molds its environment.

I argue that GDP's use as a metric in the UN SDGs is misrepresentative of modern economic goals, and rather a product of the immense momentum it has gained and the ultimate influence it has over the society that created it. To support my argument, I will first discuss the context under which GDP was originally created and then explore the extent to which the metric exhibits characteristics of momentum in its use throughout the United Nations' Sustainable Development Goals.

Background

The United Nations' Sustainable Development Goals (SDGs) are 17 objectives and 169 targets which act both as an agenda and collection of progress benchmarks for the organization's overarching *Transforming our World: 2030 Agenda for Sustainable Development*. Each goal has specific sub-goals (targets) deemed necessary in reaching the main goal. Each target has 1-2

accompanying metrics (indicators) to measure progress in achieving the targets (*THE 17 GOALS* | *Sustainable Development*, n.d.).

Literature Review

Scholarly discussion surrounding GDP's inability to represent the well-being of a nation is extensive and falls largely into either a category of work whose focus is on proposing an alternative metric – because GDP is irreparably small-scoped – or one scrutinizing the metric for being inaccurate in its measure of the size of an economy. Existing analyses of the metric's use in the UN SDGs are more limited and tend to focus on how to best replace the metric as opposed to exploring why the metric may have been chosen in the first place. Scholars in neither realm have adequately considered how the purpose and context under which GDP was formed influence the metric's efficacy, how the definition of a healthy economy may have evolved according to new contexts, or how GDP's ubiquitous use may have influenced the very qualities associated with a healthy economy.

Dynan & Sheiner (2018) acknowledge that GDP as a raw statistic is not a comprehensive measure of welfare or economic well-being, but contend its iterations (e.g., changes in real GDP, alterations to GDP deflators, etc.) can provide a useful understanding of the economy and are practical for policymaking. In their work, Dynan & Sheiner (2018) discuss the limitations of GDP as an economic indicator, outlining four specific gaps between GDP's measurements and those which contribute to aggregate economic well-being: 'non-market' activities, foreign ownership of domestic production, depreciation of physical assets, and investment. This work falls into the second category of discussion, scrutinizing the method of calculation GDP uses for measuring the size of an economy. However, it works under the assumption that policymaking

today has the same information needs – size and growth in the size of the economy – as policymaking during GDP’s formulation. Thus, the work lacks an exploration of how economic context affects the metrics’ efficacy as well as how their proposed alterations are valuable according to today’s economic needs.

Looking more specifically at GDP’s role in the UN’s Sustainable Development Goals, Coscieme and co-authors (2020) argue that SDG 8’s indicator, GDP, as a metric for the goal’s success, is not only in direct conflict with the other SDGs but impossible on a planet with finite resources. The work explores how GDP is unrelated to other measures of economic performance such as employment, and even behaves inversely to indicators of environmental sustainability and other broader measures of well-being sought after by the SDGs. Coscieme and co-authors (2020) ultimately proposed guidelines for selecting alternative indicators for SDG 8, but lacked an exploration of GDP’s role in associating growth with economic success and how that association lent itself to GDP being an accurate indicator in that context.

The discussion surrounding GDP’s inability to represent the well-being of a nation is not novel and has led to the development of alternative metrics such as the Index of Sustainable Economic Welfare (ISEW) (Sánchez et al., 2020) or a combination of metrics like dystopia, perception of corruption, generosity, freedom to make life choices, healthy life expectancy, and social support alongside GDP per capita, as curated and synthesized by the World Happiness Report (Helliwell et al., 2022). Yet, neither of these sources addresses the fact that GDP does not inherently claim to account for more intangible metrics of the well-being of a country such as government corruption or happiness, and that the emergence of these new metrics may be driven by changing societal perception of economic wellbeing.

Criticisms of GDP for its inaccuracy in what it claims to measure, for its lack of efficacy beyond what it claims to measure, or those that suggest it should be replaced entirely lack a connection to the context under which GDP was created. As a result, one must infer that these criticisms are working under the assumption that the qualities characterizing a healthy economy in the 1920s remain unchanged in the 21st century. By drawing on “technological momentum” as a conceptual framework, I aim to contribute a more context-aware analysis of GDP as a metric.

Conceptual Framework

My analysis of UN SDG 8’s emphasis on GDP growth draws on Thomas Hughes’ theory of “technological momentum,” which allows me to understand why GDP growth is so frequently used synonymously with success despite a plethora of criticisms surrounding the metric. Hughes defines the following terms, integral to understanding the theory’s nuances:

“technical” refers to physical artifacts and software,

“social” refers to the world that is not technical, hardware, or technical software,

“technological system” encompasses both the technical and social,

“technology” can be a technological or sociotechnical system, and

“environment” refers to the world outside of technological systems that shapes or is shaped by them (Hughes, pp. 142).

“Technological momentum” is a theory about how technology (socio-technical system) interacts with society and can be viewed as the middle ground between technological determinism and social construction of technology (SCOT). Both technological determinism and SCOT are deterministic, meaning that they assert one event causes another, with technological determinism contending that technology causes societal events and social construction of

technology alternately contending people and society determine what technologies look like. Somewhere in between the two lies “technological momentum,” which theorizes that technology evolves over time, oscillating asymmetrically between being more influenced by social systems and technical systems. According to “technological momentum,” qualities of technology in its early life such as its design, purpose, meaning, and role, are molded by society, and as the technology gains momentum, the technology in turn influences society’s qualities, such as its practices, values, power relations, etc. (Johnson & Wetmore, 2009, pp. 143). Ultimately, technology has momentum when it is firmly in the latter scenario – affecting society more than being affected by society. At this point, the technology is so widely accepted as the standard system that it seems to run autonomously.

A technology does not inherently exhibit momentum, rather it must first begin in alignment with the social context, building momentum by exhibiting the following characteristics outlined by Hughes:

1. Gained diversity, complexity, scale, bureaucracy, social integration, skills and knowledge to maintain, special-purpose machines and processes, large physical structures and infrastructure
2. People and groups become more invested in the system’s maintenance and perpetuation
3. The system gains increasing influence on aspects of the society that developed it
4. Characteristics of momentum give the system durability, inertia, rigidity, and resistance to change

Figure 1: Hughes’ Characteristics of Momentum

Hughes also provides advice to those who may seek to shape technology:

1. Shaping is easiest before the system has acquired political, economic, and value components.
2. A system with great technological momentum can be made to change direction if a variety of its components are subjected to the forces of change.
3. After acquiring momentum, systems are resistant to change, for better or for worse.

Figure 2: Takeaways for System Designers and the Public

In the analysis that follows I will draw on Hughes’ “technological momentum” framework to first characterize the context under which the metric was created and then explore how GDP exhibits characteristics of momentum in its use within the UN’s SDGs.

Analysis

Integral to the evaluation of gross domestic product’s impact as a technology with momentum is an understanding of how GDP can be construed as a technology. Merriam-Webster defines technology as the “practical application of knowledge” and the consequent “capability given by the practical application of knowledge” (*Technology Definition & Meaning - Merriam-Webster*, n.d.). GDP uses the knowledge of the total value of goods produced and services provided and applies it to measure the size of an economy. The resulting capability is GDP’s use – including in its application as an indicator in the UN’s SDGs – as a metric capable of influencing the interpretation of the health of an economy. GDP’s use as an indicator in the United Nations’ Sustainable Development goal must be re-evaluated with an understanding of the metric as a technology with momentum operating in the technological system of the evaluation of the health of economies. Given the influence technology with momentum has on the technological system in which it operates, the context-aware analysis this framework provides is critical to gaining a more comprehensive and nuanced understanding of GDP. To

illustrate why, I will first discuss how the young metric was deeply influenced by the society in which it was created and then explore the characteristics of momentum it exhibits by being a chosen metric in these modern-day development goals.

The Society That Created GDP

Gross domestic product (GDP) was created by a suffering society looking to regain the prosperity it experienced alongside a growth economy, so the societal goals of the time are different compared to the modern day. GDP was born in 1937 after Simon Kuznets, an economist at the National Bureau of Economic Research presented his formulation, “National Income, 1929-35,” to the U.S. Congress, and by 1944, GDP was established as the standard tool for measuring the size of a country’s economy (Dickinson, 2011). Kuznet arrived in the United States during the Roaring Twenties, at the height of a flourishing economy thanks to the growth of new technology both for industry and consumers – automobiles, airplanes, radios, and appliances like washing machines and vacuum cleaners. Between 1920 and 1930, production rose 64%, and between 1922 and 1927, the U.S. economy grew more than ever before in that amount of time (*The Business of America: The Economy in the 1920s* | *Encyclopedia.Com*, n.d.). The subsequent Great Depression was starkly contrasted with the prosperity of the Roaring Twenties. Having lived through these two economic extremes, Kuznets, like the congresspeople who adopted his metric, likely equated growth with prosperity. Thus, in the search for a metric to quantify the health of an economy, one that prioritizes consumption and growth was self-evident. Since its conception, however, policymakers continue to equate economic growth, measured by growth in GDP, with economic success. This conflation of the metric with success is a product of its massive momentum.

1. Gained Diversity, Complexity, Scale, Bureaucracy, and Skills and Knowledge to Maintain

Since its introduction, gross domestic product has exhibited momentum through its gained bureaucracy, complexity, diversity, and scale. To explore how, I will designate GDP's use as a metric within the UN's SDGs as a technological system, with GDP as the technical and the United Nations as well as their objectives as the social. Firstly, the United Nations is a complex, bureaucratic organization thus making GDP intertwined with that same complexity and bureaucracy. Secondly, the SDGs are at the heart of the United Nations' proposed plan of action, "Transforming our world: the 2030 Agenda for Sustainable Development" (*Transforming Our World: The 2030 Agenda for Sustainable Development* | Department of Economic and Social Affairs, n.d.). Such a global goal is evidence of the far-reaching scale of what the metric is a part of, and the lofty idea of global transformation in and of itself is deeply diverse and complex. The existence of this agenda and the accompanying goals is evidence of a governing body acknowledging a shifting of needs from society, and GDP's role in measuring the extent to which this transformation is being achieved indicates that the metric has gained diversity, complexity, and scale of applications.

2. People and Groups Become More Invested in the System's Maintenance and Perpetuation

As the most universally documented economic metric and one that contributes to determining if the Sustainable Development Goals are reached, the system of people and groups required to maintain GDP perpetuates the metric's momentum. The Bureau of Labor Statistics and Bureau of Economic Analysis are the main maintainers of the metric, and the United Nations is just one of many organizations that rely on its perpetuation. With GDP being used in some

form in 16 indicators within the United Nations' SDGs, the UN requires the metric to be documented to measure its own success. GDP is used as a benchmark to evaluate policies on a multinational stage, used both directly in indicator 8.1.1, "Annual growth rate of real GDP per capita" for SDG 8: *Decent Work and Economic Growth*, and as a baseline for measuring growth in 5 other SDGs and 15 other indicators such as in indicator 9.5.1, "Research and development expenditure as a proportion of GDP," used to evaluate SDG 9: *Industry, Innovation, and Infrastructure*. Even when solely analyzing the use of GDP within the UN, the metric's application across multiple SDG indicators perpetuates the need for people and groups to continue to maintain it.

3. The System Gains Increasing Influence on Aspects of the Society that Developed It

The aspect of society that initially developed GDP is one that influences policy and sought to maintain the prosperity of a nation, and now the metric's use in the SDGs influences policy whose goal is to increase prosperity. SDG 8: *Decent Work and Economic Growth* is the only goal that directly mentions the economy, thus it is fair to interpret the goal as comprehensive of what the United Nations deems an attractive economy and its targets as concrete qualities that are sought after. Despite the very existence of the SDGs signifying an evolved perception of prosperity from when GDP was created, SDG 8 is largely focused on growth tracked via increasing GDP. The title of the goal, "Decent Work and Economic Growth," references the economy through "growth." "Growth" as the qualifier for "economic" insinuates the principal characteristic of an ideal economy according to the UN is one that grows. The description of the goal provides a more nuanced understanding of an ideal economy according to the UN: "Promote sustained, inclusive and sustainable economic growth, full and productive

employment and decent work for all” (*Goal 8 | Department of Economic and Social Affairs, n.d.*). However, the phrase that composes the first half of the description is evidence of a focus predominantly on growth both because of its position as first in the list and because it makes up half of the words for only one-third of the ideas brought up; growth, employment, and work. These details suggest SDG 8 characterizes an ideal economy as one that grows. Given growth was a behavior GDP was created to track, the SDG’s focus on growth paired with UN’s position as a policymaking and policy-influencing body, is an example of how GDP is influencing the society that developed it.

I have contended that SDG 8 is principally focused on economic growth as a proxy for evaluating the extent to which an economy is performing well. Though some would argue that the presence of targets within SDG 8 unrelated to pure economic growth is evidence that growth in GDP does not entirely influence the UN’s perception of what makes a desirable economic condition, this does not detract from the fact that GDP growth or decline is seen as a representation of the progress of the goal overall. In the *Progress and Info* section of SDG 8, the opening paragraphs give an overview of the health of the economy in recent years:

“In 2020, the COVID-19 pandemic unleashed the worst economic crisis in decades, with a severely damaging impact on working time and income. Although the global economy started to rebound in 2021, waves of spreading COVID-19 infections together with rising inflation, major supply chain disruptions, policy uncertainties and unsustainable debt of developing countries caused the global economy to slow down at the end of 2021. The conflict in Ukraine is expected to seriously set back global economic growth in 2022.

Following an increase of about 1.4 per cent in 2019, global real GDP per capita decreased sharply by 4.4 per cent in 2020. Global real GDP per capita is estimated to have rebounded at a growth rate of 4.4 per cent in 2021 and is projected to increase again by 3.0 per cent in 2022 and 2.5 per cent in 2023 based on pre-war estimations. The war in Ukraine is likely to downgrade global growth. The real GDP of least developed countries had increased by 5.0 per cent in 2019 but showed no growth in 2020 because of the disruption caused by the pandemic.”

“Goal 8,” UN Department of Economic and Social Affairs

In the first paragraph, a clear emphasis is given on economic growth – or the lack thereof – and how that determined progress in the goal. In the second paragraph, the UN provides insight into how they are measuring that growth – GDP. It is clear that GDP has reached a point where it influences the society that developed it through the continued pursuit of economic growth from policy-making bodies.

4. Characteristics of Momentum Give the System Durability, Inertia, Rigidity, and Resistance to Change

The previously explored characteristics of momentum that GDP exhibits give it durability, inertia, rigidity, and resistance to change. The continued use of the metric over the past century is evidence of its durability, and the continued pursuit of unfettered growth in GDP as a critical component of a healthy economy showcases the metric’s inertia, rigidity, and resistance to change. Evidence that this is the case can be seen through the graphic chosen by the United Nations to represent SDG 8 seen below:

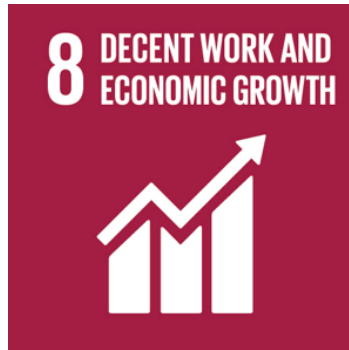


Figure 3: Graphic Representing SDG 8

As shown in Fig. 3, the visual representation of the goal insinuates unlimited growth. Though the line, presumably representing GDP, dips in the middle, the placement of the arrow at the end of an increase indicates it continues to increase. This detail, though small, is evidence of the extent to which the pursuit of economic growth (in GDP) has become intertwined with economic success, giving GDP as a socio-technical system durability, inertia, rigidity, and resistance to change.

Conclusion

Gross domestic product's use as an indicator for the UN's SDG 8 provides evidence that GDP has acquired technological momentum and, as a technology with momentum, now influences the society in which it operates. This influence, however, corresponds more to the context under which the metric was initially created than that which currently dictates what makes a healthy society. Especially given how the metric is well documented globally, has been maintained for many years, and is standardized, GDP is an enticing metric to use in scientific settings. Models of human-earth systems such as the Global Change Assessment Model

(GCAM), for example, designate GDP as a driver, or key factor, of the model (Calvin et al., 2019). Therefore, it is imperative that those who use GDP in some capacity or interpret its applications understand the original intent behind and limitations of the metric. As a result, I do not argue that GDP must categorically be replaced within the SDGs, but rather that the United Nations should re-evaluate its use of GDP to ensure its use is due to the intrinsic capacity of the metric being truly in alignment with the sociotechnical global development goals sought out by the *2030 Agenda for Sustainable Development* as opposed to the metric being chosen out of convention. GDP exhibits all four characteristics of momentum outlined by Hughes, and an exploration of how those characteristics are exhibited especially within the context of the United Nations' Sustainable Development Goals highlights the change in perception today's economic context requires of how GDP can be used appropriately.

Word Count: 3670

References

- Calvin, K., Patel, P., Clarke, L., Asrar, G., Bond-Lamberty, B., Cui, R. Y., Di Vittorio, A., Dorheim, K., Edmonds, J., Hartin, C., Hejazi, M., Horowitz, R., Iyer, G., Kyle, P., Kim, S., Link, R., McJeon, H., Smith, S. J., Snyder, A., ... Wise, M. (2019). GCAM v5.1: Representing the linkages between energy, water, land, climate, and economic systems. *Geoscientific Model Development*, 12(2), 677–698. <https://doi.org/10.5194/gmd-12-677-2019>
- Coscieme, L., Mortensen, L. F., Anderson, S., Ward, J., Donohue, I., & Sutton, P. C. (2020). Going beyond Gross Domestic Product as an indicator to bring coherence to the Sustainable Development Goals. *Journal of Cleaner Production*, 248, 119232. <https://doi.org/10.1016/j.jclepro.2019.119232>
- Deborah G. Johnson & Jameson M. Wetmore (Eds.). (2009). *Technology and society: Building our sociotechnical future*. The MIT Press.
- Dickinson, E. (2011, January 3). GDP: A brief history. *Foreign Policy*. <https://foreignpolicy.com/2011/01/03/gdp-a-brief-history/>
- Dynan, K., & Sheiner, L. (2018). *GDP as a measure of economic well-being*. 53. *Goal 8 | Department of Economic and Social Affairs*. (n.d.). Retrieved February 27, 2023, from <https://sdgs.un.org/goals/goal8>
- Nye, D. E. (2006). *Technology matters: Questions to live with*. The MIT Press.
- Stone, C. (2017, April 27). *Economic growth: Causes, benefits, and current limits*. Center on Budget and Policy Priorities. <https://www.cbpp.org/research/economy/economic-growth-causes-benefits-and-current-limits>
- Technology definition & meaning—Merriam-Webster*. (n.d.). Retrieved April 11, 2023, from <https://www.merriam-webster.com/dictionary/technology>
- THE 17 GOALS | Sustainable development*. (n.d.). Retrieved February 24, 2023, from <https://sdgs.un.org/goals>

The business of America: The economy in the 1920s | *Encyclopedia.com*. (n.d.). Retrieved February 27, 2023, from

<https://www.encyclopedia.com/history/encyclopedias-almanacs-transcripts-and-maps/business-america-economy-1920s>

Transforming our world: The 2030 agenda for sustainable development | *Department of Economic and Social Affairs*. (n.d.). Retrieved February 27, 2023, from <https://sdgs.un.org/2030agenda>

Vanham, P. (2021, December 13). *Stakeholder capitalism: A brief history of GDP - and what could come next*. World Economic Forum.

<https://www.weforum.org/agenda/2021/12/stakeholder-capitalism-episode-1-a-brief-history-of-gdp/>

WDI - Economy. (n.d.). The World Bank. Retrieved October 27, 2022, from

<https://datatopics.worldbank.org/world-development-indicators/themes/economy.html>