

ROLE OF GDP IN THE SUSTAINABLE GROWTH ERA

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Abstract: *While there is a correlation between economic growth and the increase in living standards, economic theory is evident in the purpose of the Gross Domestic Product (GDP) measurement. GDP measures only the production capacity and economic growth, not the nation's development, as often claimed by policymakers. Furthermore, as several studies show, by focusing on economic growth and neglecting the other two crucial systems, the ecosystem, and the social system, we will not be able to achieve economic growth in the future. Since the GDP was developed in 1937, it has faced criticism not only for its limitation related to its construction. Also, the concept of economic growth is currently being challenged and being replaced by the pursuit of sustainable development. Therefore, the role of GDP, as an economic growth indicator, in our economy needs to be clarified and re-assessed. The main aim of this paper is to investigate the usefulness of the GDP in the era of sustainable development. To achieve this, we investigated the historical development of various measures of economic growth, as well as the historical development of the GDP as an economic growth metric. Furthermore, we argue that the future of GDP should be in the multi-dimensional indicators, which are used to measure the sustainable development of a country, as opposed to a self-standing single-dimensional measure of economic growth. As a case study, we also construct two measures, based on Analytical Hierarchical Process (AHP) using the free online software 'SuperDecisions: our Simple three-dimensional index of the nation's growth and the enhanced holistic three-dimensional index - Holistic Nation's Growth Index. Using the AHP method, we showcase the difference between the countries' rankings if we consider only economic growth and if we focus on the country's development more holistically. Our comparative study reveals that it is not enough to look only at three main systems, the economic, social, and ecosystem while assessing the countries' development. It is necessary to also investigate and try to capture the relationships between those three main systems.*

Keywords: Holistic Nation's Growth Index, Gross Domestic Product, degrowth, post-growth, inclusive growth, gross ecosystem product, sustainable growth.

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Introduction

Since the Gross Domestic Product (GDP) measure was created in 1937 by Simon Kuznetz, it has been deployed for different purposes. Its first role was to measure how much the U.S. economy produced and how fast it recovered from the crisis. Later in 1944, it became a widely used measure of economic activity and growth of countries. As early as the 1970s, it was clear that GDP has flaws, and the journey of trying to correct, improve, or completely replace GDP has started. There were methodological issues and conceptual matters flagged and worked on. From the methodological perspective, GDP does not correctly reflect the actual economic production of a country, as it cannot capture unpaid work, the underground economy, or the value of leisure. From the conceptual perspective, other systems, such as the ecosystem and social system, have been harmed by focusing solely on economic growth.

Furthermore, we have already realized that by focusing on economic growth and neglecting the other two crucial systems, the ecosystem, and the social system, we will not be able to achieve economic growth in the future. The damaged ecosystem, which cannot meet human needs anymore, is not providing the necessary resources for economic growth. Therefore, the focus on the GDP as a measure of economic growth is short-sighted.

Several initiatives were put forward between the 1970s and now to correct these issues, ranging from simplistic Measure of Economic Welfare in 1972 and slowly progressing to more sophisticated measures such as Net Economic Welfare in 1980, The index of Sustainable Economic Welfare in 1989, the Human Development Index and Ecological Footprint in 1990, Genuine Progress Indicator in 1995, the Green Net National Product in 1997, Green GDP in 2004, Happy Planet Index in 2006, Gross Ecosystem Product in 2015. The underlying data systems, the national accounts systems, have also been going through an innovation process, incorporating the system of Environmental-Economic Accounting (approved as a statistical guideline in 2021).

Analyzing the importance of the GDP and its role in the era when sustainable development is promoted, it is necessary to clarify whether and how this measure is still valid. The future of this measure is closely related to the importance of economic growth that is under scrutiny as we move toward a more sustainable future. Several theories have been put forward, such as the necessity of degrowth in the future or decoupling economic growth from well-being and becoming agnostic to economic growth. In this case, it might appear that GDP will lose its prominent role as a measure. Other theories suggest that we will be able to sustain our economic growth without destroying our planet, thanks to technological advancements. In this case, GDP will still play an essential role as a financial measure.

Several theories about sustainable, inclusive, green, or balanced growth are being proposed between these extreme views. In their statements, economic growth and GDP could still play an important role, with few adjustments in the economic system, such as proper pricing of natural resources and environmental damage, market regulations targeting the environment, and transition to new economic systems, such as circular or doughnut economy.

The first part of this paper brings forward the economic theories dealing with the future of economic growth. Based on the analysis of the existing approaches, the paper concludes that there is a need to rethink how we look at economic growth and its measurement. Furthermore, it provides a chronological overview of the newly constructed measures and initiatives to improve, supplement, or replace the GDP. Based on the analysis of this information, the paper claims that while GDP might lose its prominence as a single-dimensional measure of economic growth, it is gaining importance as a part of new multi-dimensional multidisciplinary measures of holistic development of a nation.

In the practical part of the paper, we collect secondary data reflecting the economic, social, and ecosystem and construct a three-dimensional holistic measure of the nation's growth (HNG). In this part of the paper, we prove that the ranking of the countries using the different measures of growth varies, and the focus only on economic growth is rather short-sighted.

Literature review

Issues with the GDP as a measure of economic growth

Over the last 80 years of the existence of the GDP, economic growth has been correlated with improving society's living standards. As Soubbotina (2004) mentioned, economic growth can reduce poverty and solve other social problems. Economic growth is "a means to fuel progress in societal terms - including increasing well-being and equity - rather than increasing economic output as an objective in itself" (Sen, 2021).

On the other hand, there has been rising skepticism about the accuracy the GDP can provide in measuring economic growth. Samuelson (1995, p. 419) states that GDP and even GNP are not perfect measures of genuine economic welfare. It is also not constructed to reflect well-being and living standards, as it is often used for. The first warning regarding GDP not being able to measure the welfare of a country came already in 1959 when Economist Moses Abramovitz stated that "we must be highly skeptical of the view that long-term changes in the rate of growth of welfare can be gauged even roughly from changes in the rate of growth of output" (As cited in Payden & Rygel, 2012).

Also, the purpose of the System of National Accounts (SNA), from which GDP is derived, is clear, as stated by Paul McCarthy P. (2018): "The main purpose of the national accounts framework is to support a statistical approach to the measurement of economic activity by estimating the volume of value added that sums up to the GDP aggregate. SNA states that it is not intended as a framework for measuring welfare (cf. SNA2008 §1.1 and § 1.75), and it does not even need to mention that it is not fit for resource use and environmental sustainability analysis."

History has given us several examples where economic growth was not followed by more remarkable progress in human development but rather by greater inequality, unemployment, overconsumption, or depletion of natural resources (Soubbotina, 2004). The following issues are arising connected with the continuous economic growth, such as:

- pollution of air, soil, and water caused by the continuously increasing economic activities;
- depletion of natural resources caused by unsustainable continuous usage of unrenovable natural resources;
- related social issues, such as inequality.

As Samuelson and Nordhaus mentioned in their earlier version of the Economics textbook (1995), in 1972, Nordhaus and Tobin discussed the criticism of the GDP as not meaningfully representing the national output. The methodological shortcomings are as follows:

- Not reflecting the activities produced by the underground economy and unpaid work;
- Not remembering the value of leisure;
- Not reflecting on how nature (ecosystem) is contributing to the economic activity.

Rethinking focus on the economic growth

Several previous publications touched upon GDP and economic growth and its future in Sustainable Development Era. Economists are calling for a rethinking of how we measure progress, such as Maxton (2011), as we can observe that the economic ideas and behavior in the last few hundred years of business and economics have not faced real progress at all because progress is expressed exclusively through objective indicators (and their material nature, for example, shopping and consumption) based on which improvement cannot be fully quantified. Modern society is characterized by growth obsession, often seen in the context of an exclusive increase in economic wealth (Ivkovic, 2016).

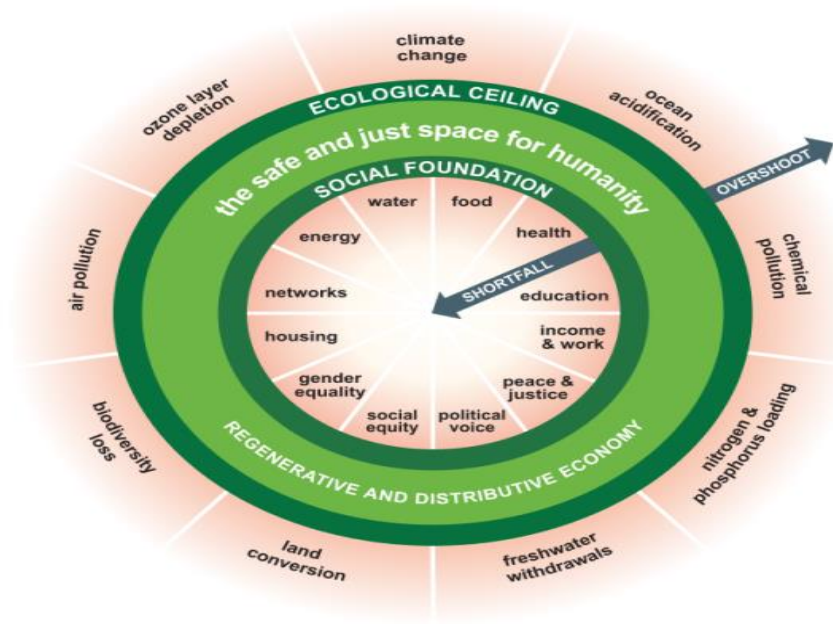
Samuelson's and Nordhaus' comment about economic growth is "a race between depletion and invention" (2010, p. 15). In general, there are two extreme views proposed in this sense. The first extreme view claims that our

society can't continue economic growth without destroying and completely exploiting our planet. The economists accepting this view propose two ways of dealing with the (EEA, 2021):

- Degrowth – to slow down production and consumption and focus on other criteria for development than economic growth.
- Post-growth – to decouple economic growth and well-being and become agnostic about economic growth.

The IMF Working Paper on the Sustainable Development Goals (SDGs) and GDP (Alexander et al. 2018) brings awareness to "the need for GDP growth to be decoupled from environmental degradation and linked with sustainable production, consumption, and meaningful jobs." Such solutions are proposed at politically high levels, and related initiatives have been pursued, such as the European Green Deal and the U.N. Sustainable Development Goals. However, scientists have not yet provided a consensus on whether it is possible to return to the 19th-century level of decoupling (EEA, 2021).

The other opinion suggests that achieving our current economic growth rate is possible without destroying our environment. Economists following this thought are called "cornucopians," "technological optimists" (Samuelson & Nordhaus, 2010, p. 268), or "Ecomodernists" (EEA, 2021), and they believe that the human race and the market economy will cope with any limitations in resources by improving technological and scientific advancements. In between these two extreme views, several economic theories are rising. In general, those theories focus on "sustainable" economic growth and learning to live within the limitations of our scarce natural resources, or we will suffer dire and irreparable consequences." (Samuelson, 2010, p. 267). New economic growth theories evolved, such as Welfare economics (Encyclopaedia Britannica, 1998) or the Economy of Well-being (OECD, 2019). Other terms used in the context of the new sustainable growth are: a) "Balanced" (Mennillo et al., 2011), b) "inclusive" (The Scottish Government, 2022), c) "green" (OECD, 2011). To be able to measure the newly proposed growths, several challenges need to be addressed, such as the proper pricing of natural resources; effective pricing of environmental damage; market regulations targeting environment. Reflecting on these new economic growth theories and sustainable growth, new systems of economies have been proposed, such as circular (The Circular Economy in Detail, n.d.) or doughnut economy (Raworth, n.d.).



The Doughnut of social and planetary boundaries.

Figure 1. Doughnut economy framework

Source: Doughnut economics action lab (n.d.).

Also, several projects are underway, either in the context of corporate or national accounting, that are trying to create a new category of assets that will adequately capture natural resources and their value. Despite the fact mentioned by Samuelson (2010, p. 274) that "few would doubt that a healthy and clean environment has a high value, but placing reliable values on the environment, particularly on the nonmarket components, has proved a difficult business," several initiatives were realized in this direction, such as System of Environmental-Economic Accounting (U.N., 1993) and the UN SEEA system of ecosystem accounting (U.N., 2021).

Diving further into the theory of sustainable growth, in the book *Human Ecology*, Marten (2001) stated that "Economic growth is impossible to sustain if it depends upon ever-increasing quantities of resources from ecosystems with limited capacities to provide the resources. Nor is sustainable development a luxury to be pursued after economic development and other priorities such as social justice are achieved. Damaged ecosystems that lose their capacity to meet basic human needs close off economic development and social justice opportunities. A healthy society gives equal attention to ecological sustainability, economic development, and social justice because they are all mutually reinforcing." Marten, in the book, illustrates the interaction between the social system and ecosystem, emphasizing the energy, material, and information outflows and inflows between the two ecosystems."

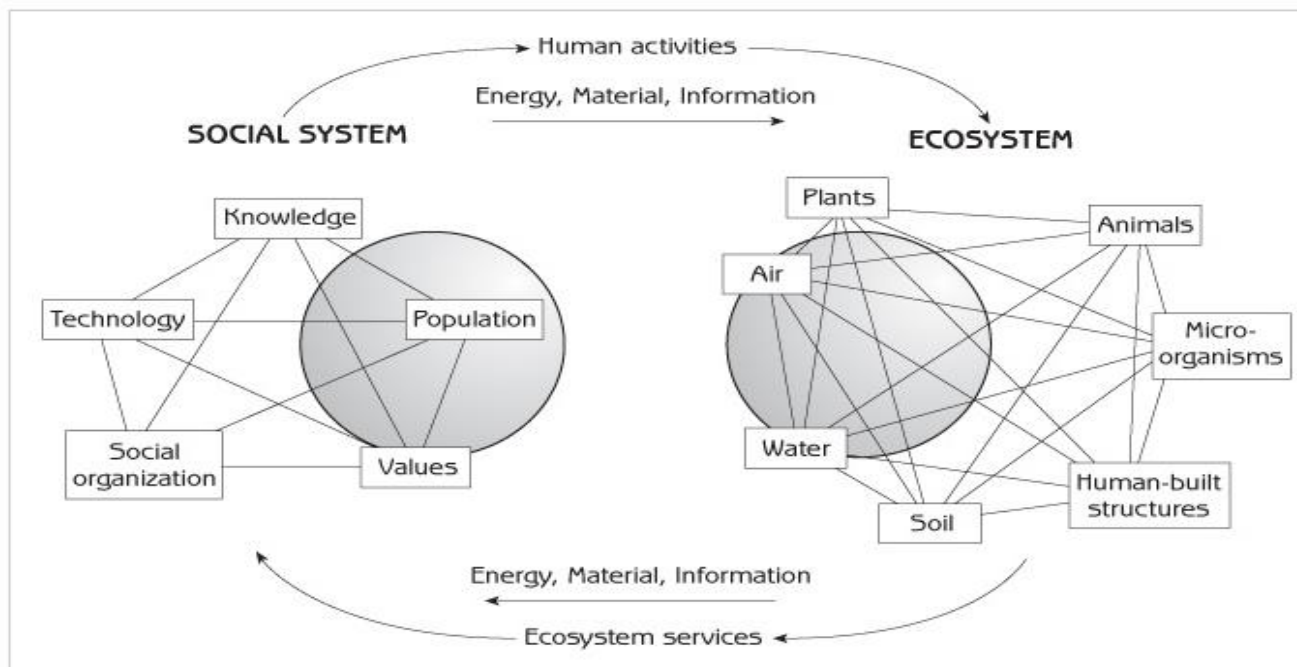


Figure 2. Interaction of the human social system with the ecosystem

Source: Marten (2001).

The idea of connecting the ecosystem and social system with the economic system was further developed by the 'Gross Ecosystem Product' project, measuring the ecosystem's contribution to human well-being, which started in 2015 in China. The project is based on the idea of using the GEP as a measure of the ecosystem's contribution, GDP as a measure of the economic system's contribution, and the Human Development Index (HDI) as a measure of the social system's contribution to the sustainable growth (Ouyang, 2020).

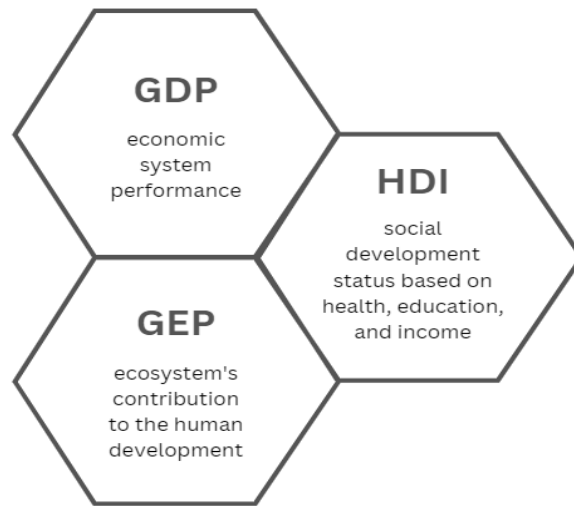


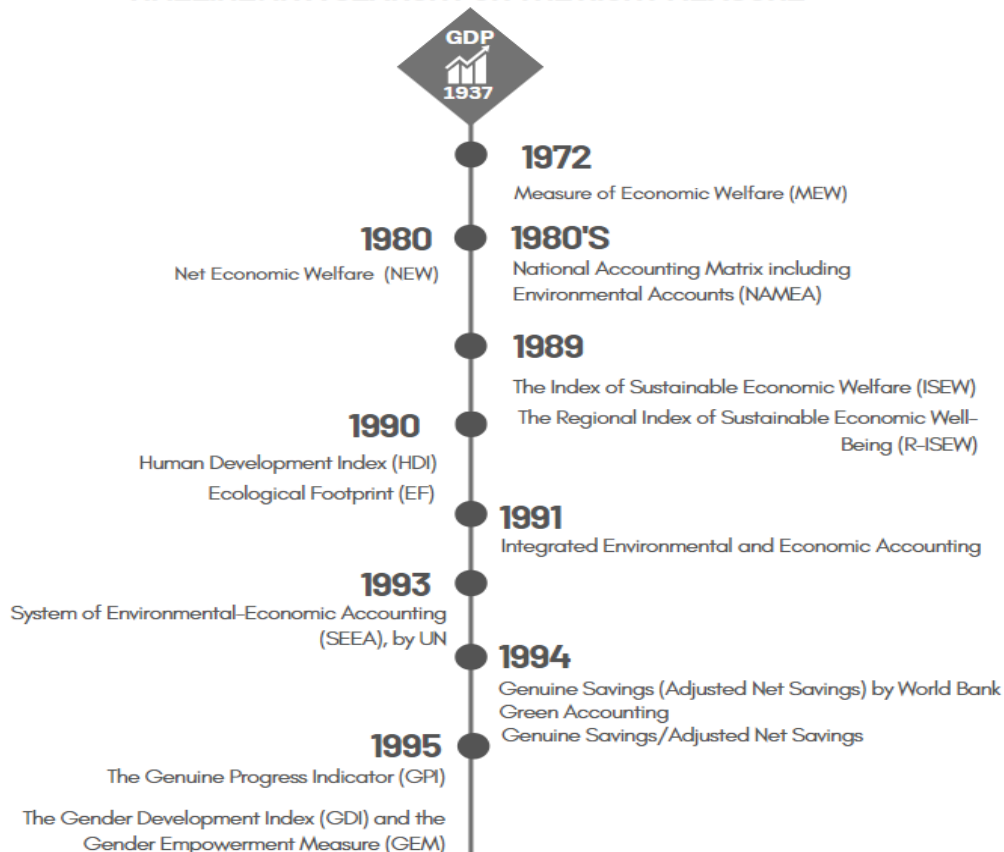
Figure 3. Interrelation of the three main systems in measuring the nation's growth and development

Source: Adopted from Ouyang (2020).

Chronological overview of the practical initiatives tackling the issues related to GDP and economic growth measurement

Hand in hand with the theoretical developments, practical initiatives have been taking place to handle the issues related to economic growth measurements and GDP. The detailed chronological evolution of different newly proposed measures, indices, and statistical standards have been developed by Gajdosova (2023), and it is presented below.

TIMELINE: IN A SEARCH FOR THE RIGHT MEASURE



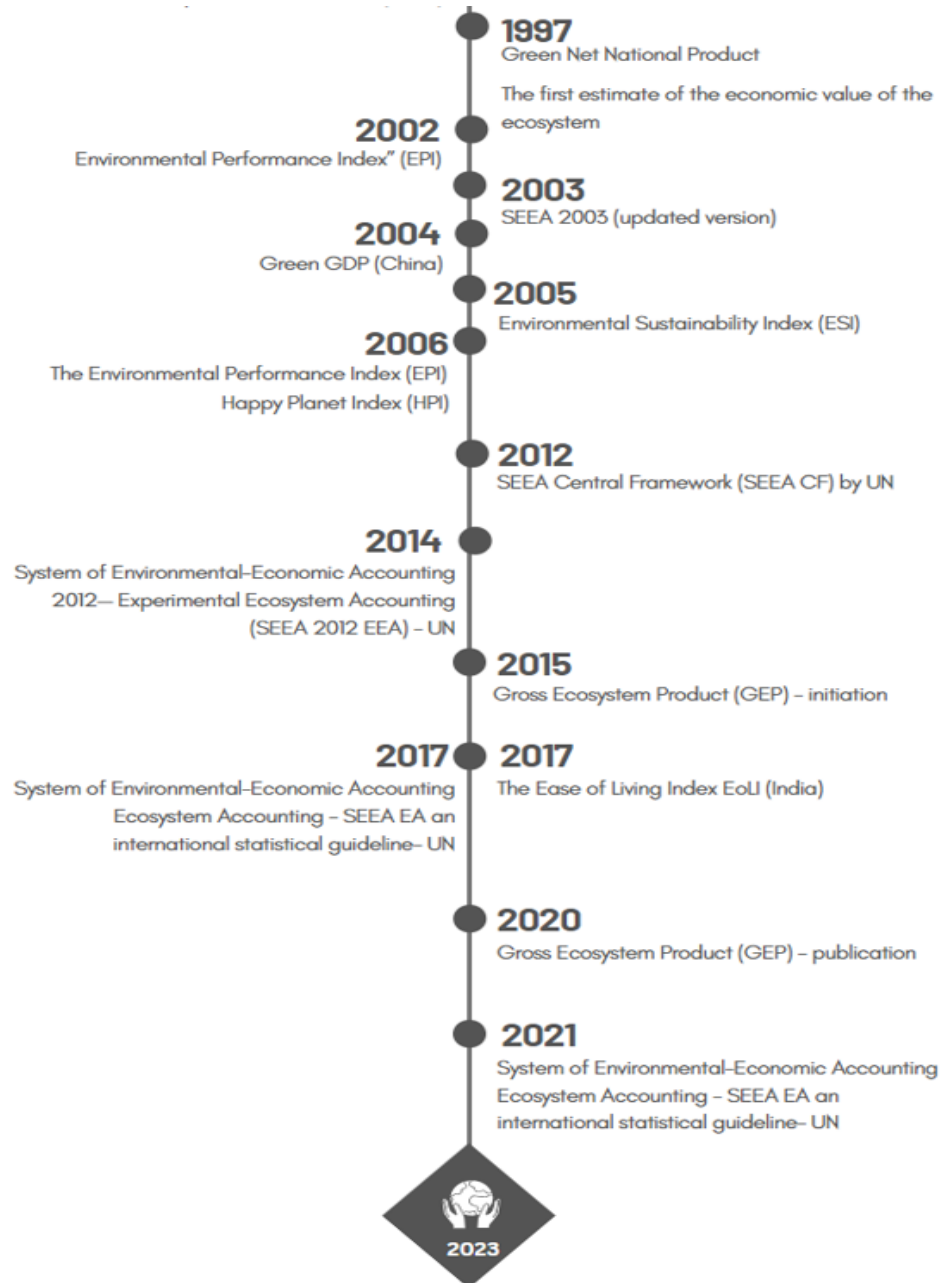


Figure 4. Timeline of initiatives to handle the issues related to economic growth measurement

Source: Gajdosova (2023).

Methodology and research methods

This paper consists of two parts, the theoretical and the empirical part. Firstly, we analyzed the existing literature on the importance of economic growth in the future and developments in the field of GDP measurement. The paper also presents a chronological overview of the practical work regarding the newly proposed measurements, indices, and statistical standards related to the transition to sustainable growth.

The empirical part of the paper focuses on the comparison of the ranking of the six countries with the highest achieved GDP in 2020 based on the three criteria:

- Ranking based on the GDP growth;
- Ranking based on the simple three-dimensional index, representing the three main systems; economic (GDP), social system (Human Development Index), and ecosystem (Environmental Performance Index – in the future to be replaced by the Gross Ecosystem Product);
- Ranking based on our designed three-dimensional holistic index of the nation's growth (HNG).

Methodological process

To perform the analysis mentioned above and comparison and to construct the two indicated indices, the following methodological process was followed:

- | | |
|----------|--|
| 1 | Identification and definition of the
necessary systems |
| 2 | Identification of the relationships between
the systems |
| 3 | Selection of measures |
| 4 | Data collection |
| 5 | Index calculation (in SuperDecisions) |

Identification and definition of the necessary systems and their relationships and measures

The simple three-dimensional index is based on the theory that the nation's development depends on the three main systems; the economic, social, and ecosystem. Therefore, this kind of indicator should better estimate the true nation's growth than the GDP growth alone.

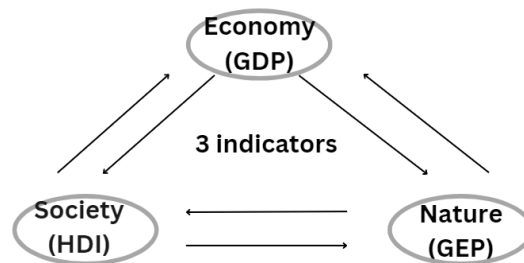


Figure 5. Simple three-dimensional index of the nation's growth

Source: Adopted from Ouyang (2020).

The HNG index is further used to test the null hypothesis that the economic growth measured solely by the GDP differs from the holistic economic growth measured by the HNG. The HNG index is a more complex three-dimensional measure of the nation's growth, incorporating the three main systems like the simple index (economic, social, and ecosystem) but also taking into account the sub-systems that are created by the interconnection of the main systems: the socio-economic system, the environmental-economic system, the socio-ecological system.

Figure 5 illustrates the three main systems and three sub-systems and their interrelationship, together with the indexes and measures selected to calculate the HNG index. The relationship between the systems and the measurements is also considered when constructing the HNG index.

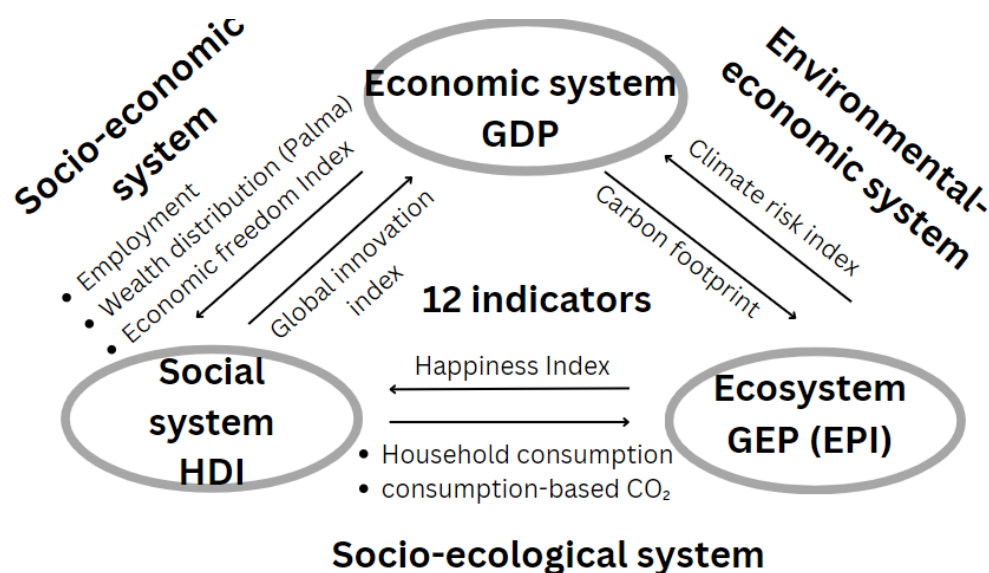


Figure 6. Holistic three-dimensional index of nation's growth (HNG)

Source: author's compilation.

To represent the three sub-systems, further measures were selected, and the HNG model uses 12 measures in total. The Socio-Economic system is referenced by the unemployment rate, wealth distribution (Palma), Economic Freedom Index, and Global Innovation Index. The Climate risk index and carbon footprint represent the Environmental-economic system. The Happiness Index, household consumption, and consumption-based CO₂ represent the socio-ecological.

The simple index and the holistic index HNG are constructed as a rating model based on Analytical Hierarchical Process (AHP) using the free online software 'SuperDecisions.' The AHP method was developed by Professor Thomas Saaty (SuperDecisions, n.d.), and he supported the development of the SuperDecisions software.

The AHP is, according to its developer, professor Saaty (1987), "a general theory of measurement. It is used to derive ratio scales from discrete and continuous paired comparisons.... It has found its widest applications in multi-criteria decision-making, planning and resource allocation, and conflict resolution. In its general form, the AHP is a nonlinear framework for carrying out both deductive and inductive thinking without using syllogism by considering several factors simultaneously and allowing for dependence and feedback, and making numerical tradeoffs to arrive at a synthesis or conclusion."

This method is well-suited for this paper, as Professor Saaty (1987) already illustrated in his article an example of the use of the AHP in reflecting on the 'overall welfare of a nation.' Also, the method of AHP has already been used in other forms of sustainability assessment based on the multi-dimensional nature of the concept (Hermann et al., 2007; Krajnc & Glavič, 2005; Singh et al., 2007). The structure of AHP is illustrated below:

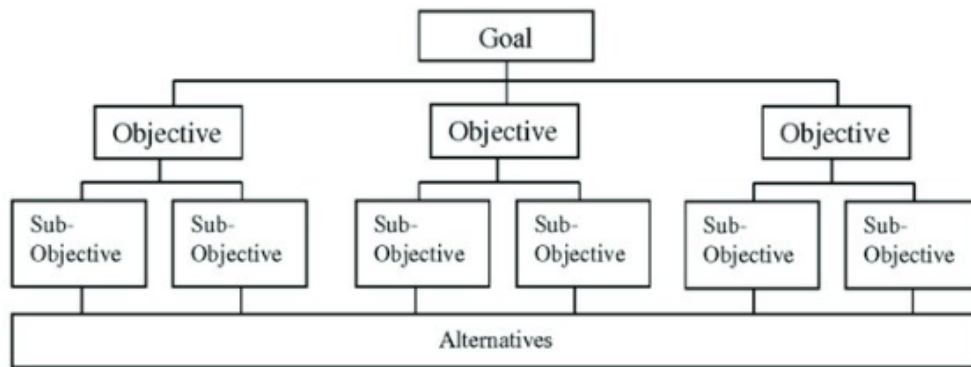


Figure 7. The Structure of the analytic-hierarchy process (AHP) process.

Source: Razikin & Isa (2013)

Based on the analyzed theoretical background, economic growth cannot be sustained if it depends upon ever-increasing demand quantities of resources from an ecosystem with limited resources (Marten, 2001). Therefore, stable economic growth needs to be sustainable and consider all three main systems, not only the economic system but also the social system and ecosystem.

The decision tree of the rating model of the simple three-dimensional index is represented in Figure 8 below:

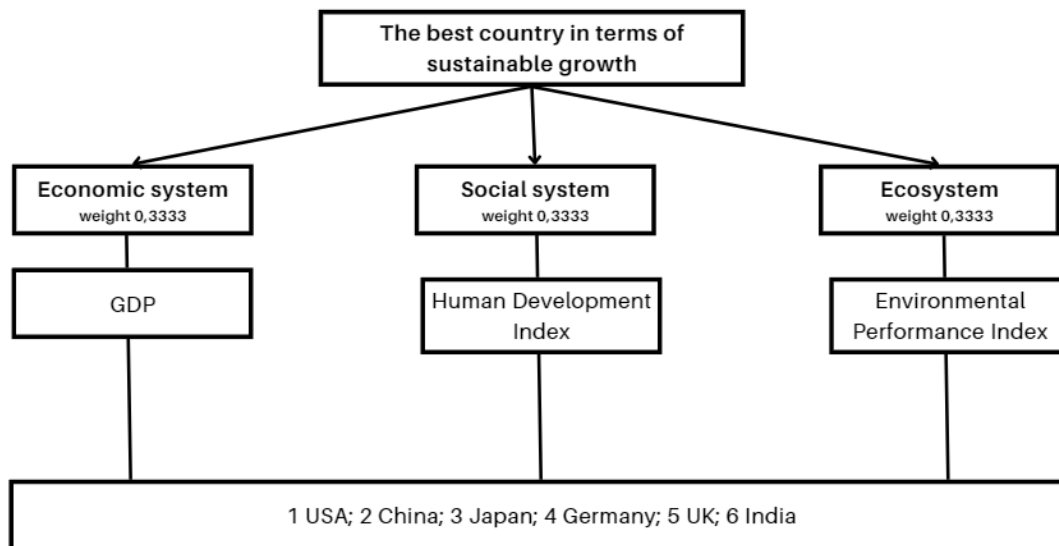


Figure. Simple three-dimensional index of nation's growth AHP hierarchy

Source: author's compilation.

The step-by-step process of AHP hierarchy analysis of the simple three-dimensional index in the SuperDecisions software is demonstrated on the screenshots from the software below:

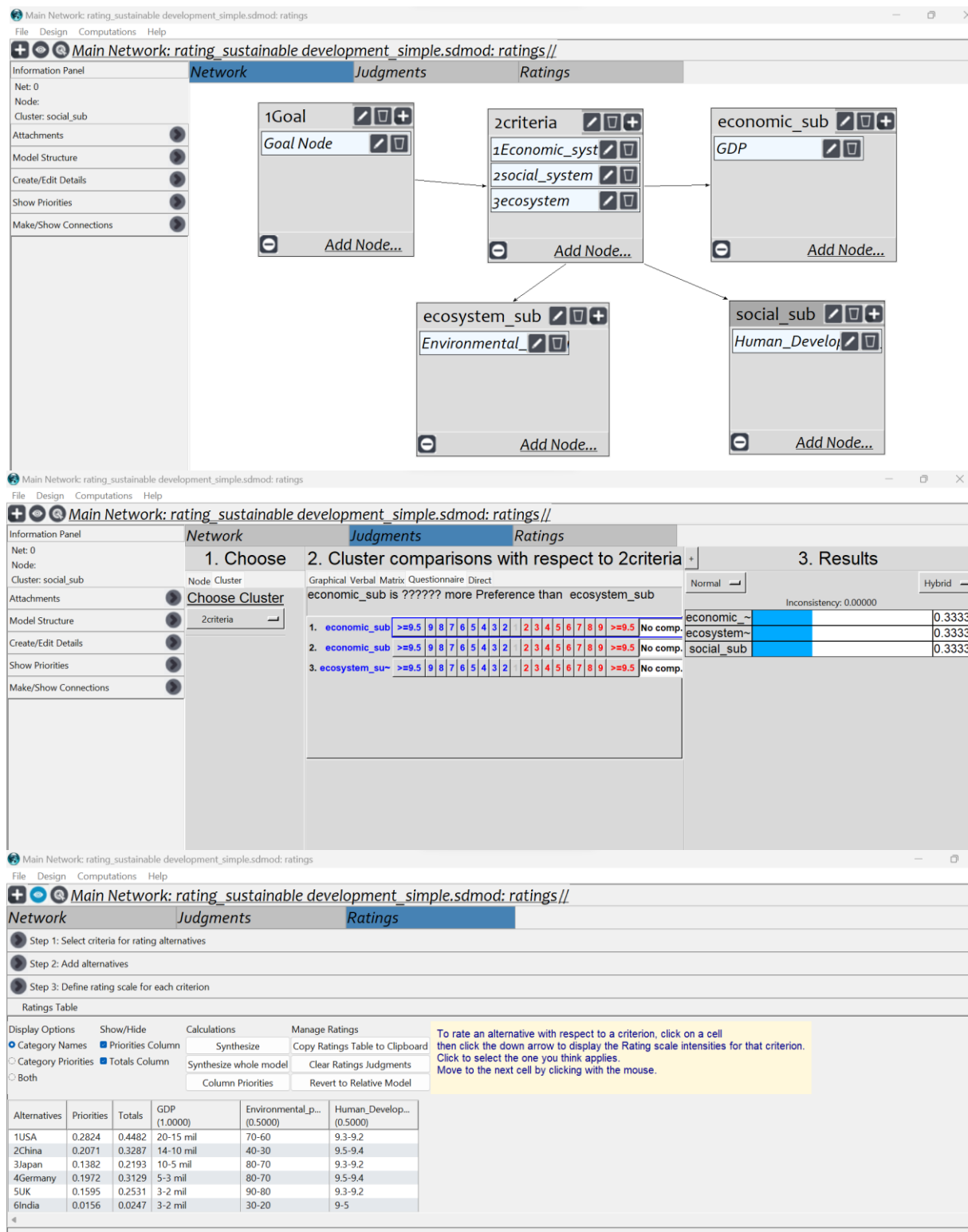


Figure 9. Simple three-dimensional index of nation's growth AHP hierarchy analysis process in the SuperDecisions software

Source: Source: author's compilation.

The enhanced HNG index follows a similar structure. However, it is further improved and incorporates 12 measures and the relationships between the main systems that form the sub-systems. Based on this idea, we developed the structure tree for the HNG index as follows.

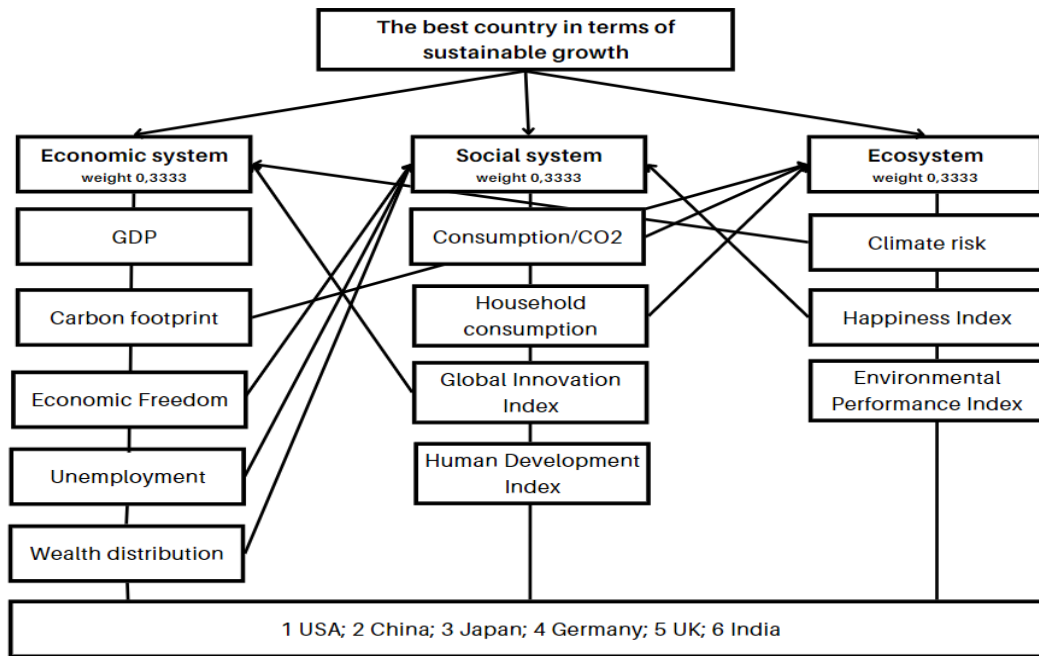
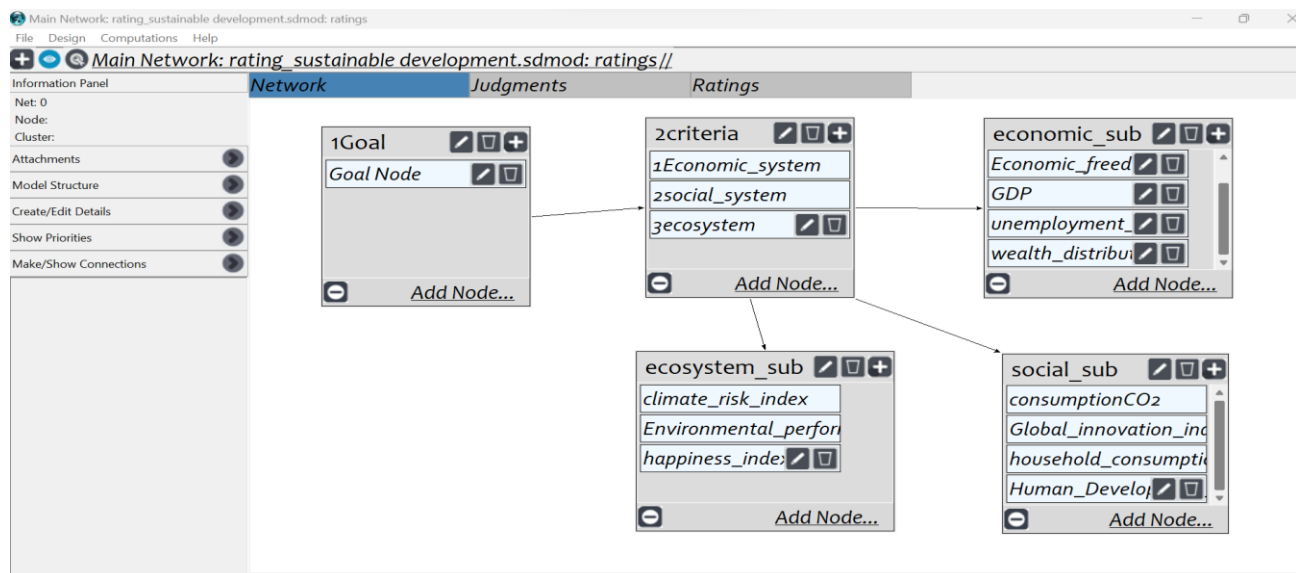


Figure 10. HNG index AHP hierarchy

Source: author’s compilation.

The importance of all three main systems is the same in both ranking models. Therefore, all three primary objectives weight 0.3333 with 0.0000 inconsistency (the inconsistency should not be higher than 0.10 for the model to be valid). Each objective has a relevant scale designed, and each objective value is recorded on the created scale.

The step-by-step process of AHP hierarchy analysis of the HNG index in the SuperDecisions software is demonstrated on the screenshots from the software below:



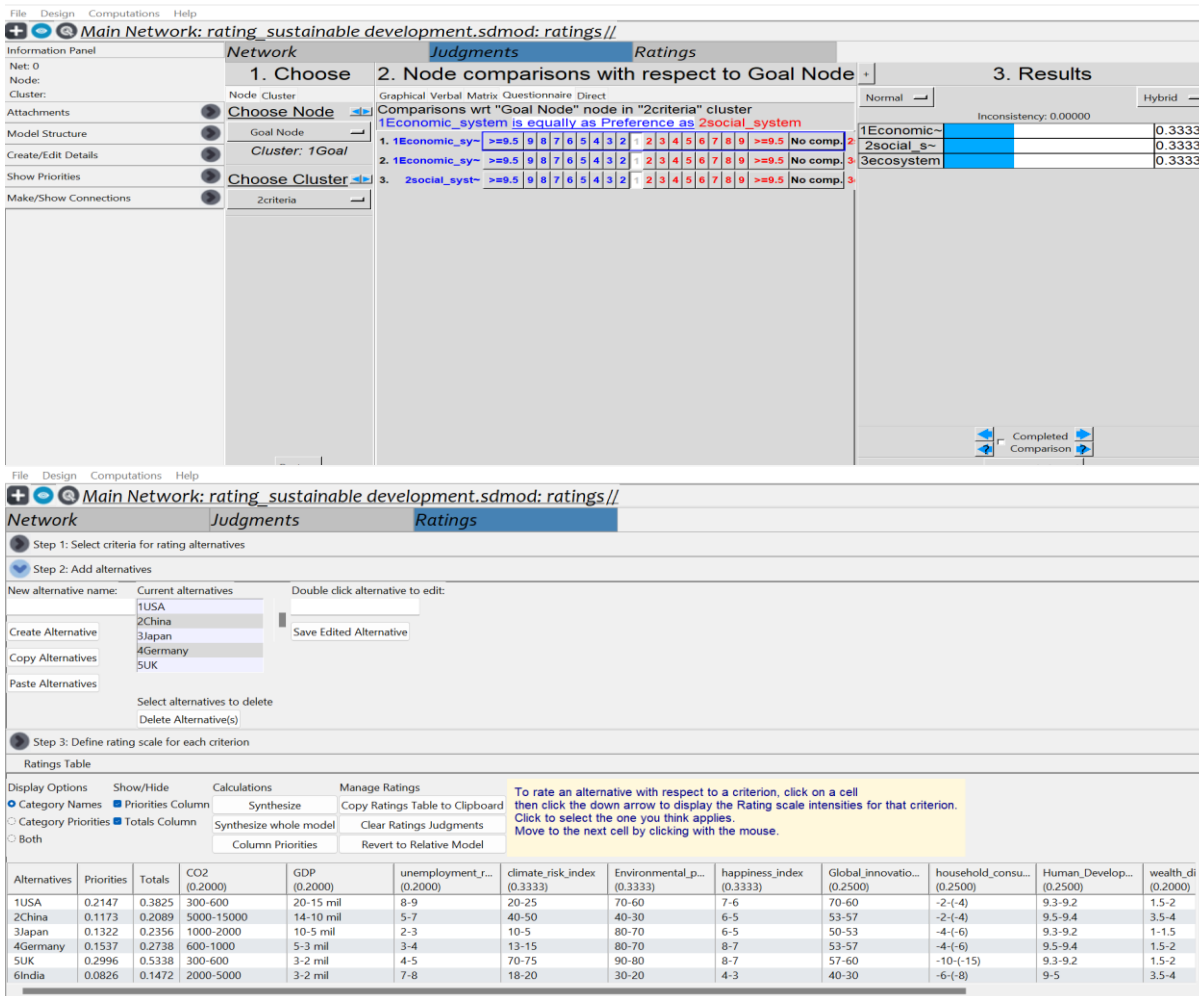


Figure 11. HNG index AHP hierarchy analysis process in the SuperDecisions software

Source: author’s compilation.

Table 1. Data collected for the construction of the HNG index 2020 (in mil. U.S. \$)

Country	GDP (mil. U.S. \$)	HDI	EPI (in the future GDP)	Carbon footprint (Total CO2 in Mt)	Happiness index	Electricity consumption per capita (kWh)	Economic freedom index	Unemployment rate	Population growth	Household consumption (2019)	Climate Risk index (CRI) higher the number better	Palma ratio (2019) lower the better	Global Innovation Index
	higher better	closer to 1 better	higher the better	lower the better	higher the better	lower the better	higher the better	lower the better	higher the better	lower the better	higher the number better	lower the better	higher the better
USA	9,377,380.52 ¹	.92	9.3	535.3	.94	2,037	6.6	.1		3	3.83	.65 (2020)	0.56
China	4,616,539.91 ¹	.949	7.3	1680.42	.124	,429	9.5		.2	2.5	5.17	.86 (2011)	3.28
Japan	,363,130.6 ⁴	.923	5.1	061.77	.871	,698	3.3	.8	0.3	5.3	.5	.28	2.7

	6											(2018)	
Germany	,463,685.4 ³ ₃	.944	7.2	36.88	.076	,871	3.5	.8	.1	5.7	3.83	.9	6.55
K	,824,026.2 ² ₃	.924	1.3	13.73	.165	,585	9.3	.5	.4	13.2	3.83	.47 (2020)	9.78
India	,508,593.7 ² ₅	.642	7.6	411.73	.573	,119	6.5			6	8.17	.09 (2011)	5.59

Source: World Bank Data (n.d.), Greenwatch (n.d.), World Happiness Report (2021), Heritage (n.d.), Human Development Reports (n.d), OECD (2020).

The following data for the relevant countries for 2020 were collected from various statistical sources and used in computing the indices.

Results

Theoretical analysis

The GDP as an economic growth measure is generally adopted and well-accepted due to its simplicity and objectivity. However, it also has several shortcomings when we assess it from the perspective of shifting toward sustainable growth. We can look at the deficiencies from a methodological and conceptual perspective.

The methodological shortcomings are as follows:

- Not reflecting the activities produced by the underground economy and unpaid work;
- Not remembering the value of leisure;
- Not reflecting on how nature (ecosystem) is contributing to the economic activity.

The conceptual shortcomings are as follows:

- Ignoring the depletion of the environment;
- Including activities that are damaging the environment;
- Not reflecting other factors of societal development and well-being;
- Includes activities not aligned with societal development (such as weapons trading, war activities, crime activities boosting consumption of certain goods, etc.);
- Not reflecting the distribution of the income;
- Not reflecting accurately contemporary trends in economic development, such as the value of social media.

After analyzing the various literature and research related to the future of economic growth as an indicator of a nation's growth and to the GDP as its measure, it is clear that there is a need to rethink how we view the development of our society. We are heading from the exclusive focus on economic growth towards focusing on more complex sustainable growth and development. Academics, researchers, national statistical institutions, and international organizations recognized the pressing need. They started to develop new measures that would reflect the new way of perceiving human development. Several concepts, measures, and indices were developed that aim to either adjust, complement, or replace GDP. Analyzing the newly proposed measures, we concluded that capturing a nation's growth and measuring it is a complex matter and will require more than one measure. The complexity must be captured by multi-dimensional measures incorporating various aspects necessary to nurture growth. Therefore, the future of the GDP is not clear when it comes to being only the measure of economic growth. However, it is increasingly becoming a part of more complex and dimensional measures that are continuously developed and tested.

Empirical analysis

To determine whether a country's short-term economic growth varies from its long-term perspective of growth, we performed a comparative analysis of the three different rankings of the six countries with the highest GDP achieved in 2020. The first ranking shows how countries perform in terms of the GDP annual growth (%).

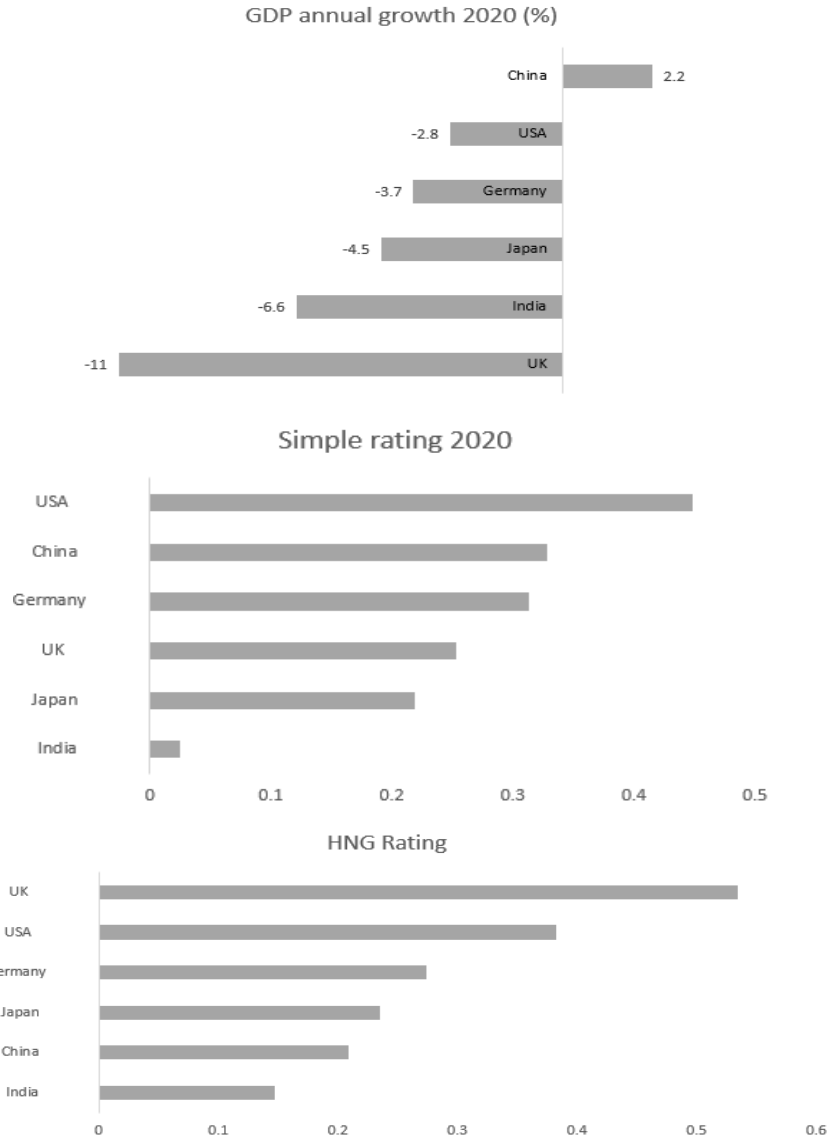


Figure 12. Results of the countries' ranking in GDP growth, simple rating index, and HNG index

Source: author's compilation.

Table 2. AHP ranking model results for the simple index 2020

Country	Rating	Weights	0.333333	0.333334	0.333335
		Priorities	GDP	Environmental performance index	Human Development Index
1. USA	0.448177	0.282432	1	0.19245	0.152082
2. China	0.328686	0.207131	0.415244	0.037037	0.533776
3. Japan	0.219281	0.138186	0.172427	0.333333	0.152082
4. Germany	0.312903	0.197185	0.071599	0.333333	0.533776
5. UK	0.253054	0.15947	0.029731	0.57735	0.152082
6. India	0.024748	0.015596	0.029731	0.021383	0.023129

Source: author’s compilation.

Table 3 can be found at the Author’s OneDrive. Please follow the link https://docs.google.com/spreadsheets/d/1PzJXtEHSU2f5zIyFRJLA8oSM_7DtxV0_e93V0XEGOE/edit?usp=sharing.

As it is clear from Figure 10, the highest annual GDP growth in 2020 was achieved in China. However, when looking at the simple multi-dimensional measure we constructed, China switches first with the USA. Only looking at the more complex and holistic multi-dimensional measure that incorporates the sub-systems, such as the socio-ecological, socio-economic, and environmental-economic systems, will reflect the long-term perspective of the nation's growth – sustainable growth.

On the third chart in Figure 11, it is evident that the national growth of China is not sustainable as opposed to the growth of the U.K. From this example, we can assume that China would be overexploiting the other two systems and the three sub-systems, to perform well economically in the short term. The U.K. seems not to balance well between short-term economic growth and potential growth, focusing more on the latter.

India seems to be a case of a country that is not doing well in terms of short-term economic growth and still lacks in increasing its potential for long-term sustainable growth. In some cases, however, we can observe that some countries kept their position regardless of the rating scheme.

Germany kept its ranking, whether looking at the short-term performance or the long-term perspective of sustainable growth. It seems that the economic growth of Germany is balanced, and the country is already incorporating the aspects of interconnected systems and sub-systems in its policies. A similar conclusion we can make out of our analysis of Japan.

The comparative study also reveals that only looking at three main systems, the economic, social, and ecosystem, is not enough to reflect the long-term potential of the nation's growth fully. It is necessary to look into and try to capture the relationships between the main systems.

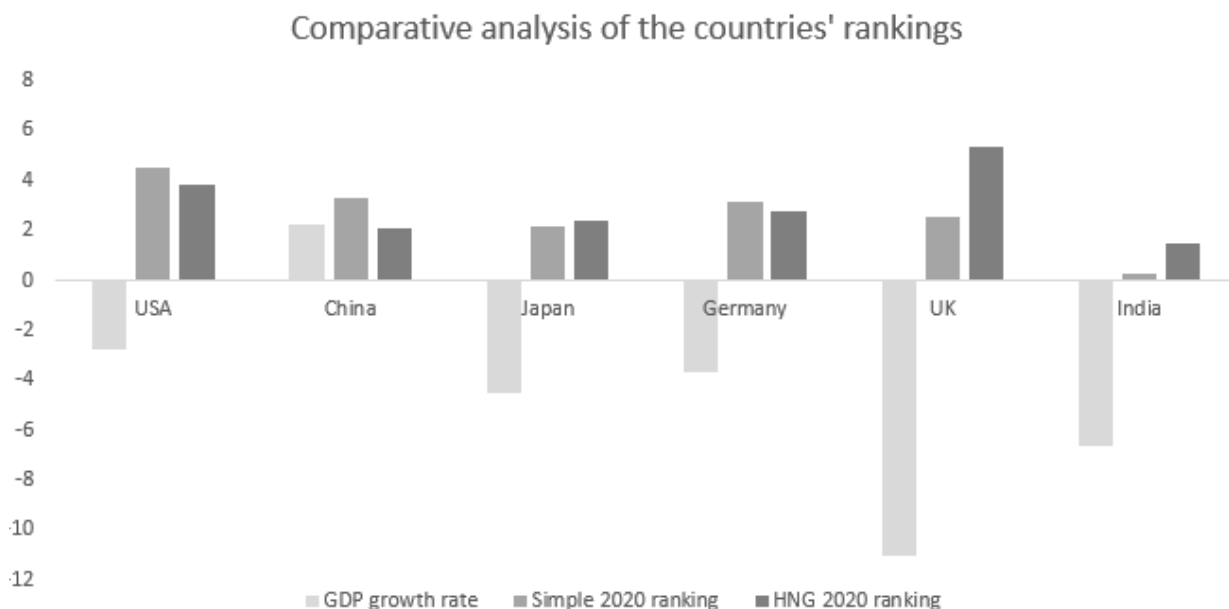


Figure 13. Comparative analysis of the countries' ranking

Source: author’s compilation.

Conclusions

During the decades of the wide usage and acceptance of the GDP as a measure of economic growth, it became apparent that it has several methodological and conceptual shortcomings. Several initiatives have been launched to improve or replace the GDP. Even though economic growth correlates with improving living standards, GDP cannot be used as a well-being and nation's growth measurement. Furthermore, the focus on economic growth started to be scrutinized more often as we also realized its negative aspects, such as environmental damage.

Analyzing the various literature and research, it is clear that the role of the GDP as a single measure of economic growth will be slowly decreasing in significance. However, GDP, as a part of more complex and multi-dimensional measures, will be booming shortly as we are becoming better at capturing the complexity and interconnectivity of our systems.

We also confirmed that measuring the GDP growth is relevant only for short-term economic growth and does not capture the potential of future growth or the nation's actual growth and development. The latter can be measured via multi-dimensional measures. We tested a simple three-dimensional measure already proposed in the literature, encompassing the economic, social, and ecosystem. This measure provides a better view of a country's potential and sustainable growth. However, it still fails to reflect on the interconnectivity of these systems.

Therefore, we designed a new measure, a more holistic nation's growth index (HNG), that also considers the three sub-systems: environmental-economic system, socio-economic system, and socio-ecological system. This index seems to capture well the complexity of economic growth in a more comprehensive way, as it also incorporates the long-term potential and sustainability of the nation's development.

This paper gives a clear vision for future research in economic growth that is long-term and sustainable. Further research can construct the HNG index over time and compare and analyze whether the respective countries are developing in the right direction. Another proposal would be to compare the HNG index with the SDG index, measuring the countries' progress in achieving their 17 sustainable development goals. This can serve as a reasonable control variable as it monitors the progress of 231 sustainable development indicators.

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