https://doi.org/10.3311/PPso.19995


**Periodica Polytechnica Social and Management Sciences**, 31(2), pp. 112–119, 2023

# Green Growth Analysis of Social Development in OECD Countries

Anıl Yıldırım Poyraz[1*]

[1] Doctoral School of Business and Management, Budapest University of Technology and Economics, Műegyetem rkp. 3., 1111 Budapest, Hungary
[*] Corresponding author, e-mail: anil.poyraz@eik.bme.hu

Received: 09 February 2022, Accepted: 31 March 2022, Published online: 30 June 2022

**Abstract**

This paper seeks to elucidate the inter and intrarelationships between a selected set of OECD green growth indicators (GGI). In addition to the selected GGI, the analysis includes the Human Development Index (HDI) and its sub-indicators. The novelty of the analysis comes from the incorporation of these established indicators, which have been utilised and developed to reflect human well-being and prosperity for decades. Production-based $CO_2$ intensity and emission change are significantly correlated to average length of schooling across the 36 countries that were members of the OECD in the year 2019. Longer years spent in school on average can facilitate the green transition of countries. The correlations among intra-GGI also suggest where OECD countries are lagging in terms of green transition. For example, renewable energy supply share in energy and air transport-related $CO_2$ per capita are positively correlated in the countries. This indicates that countries with a successful path toward green energy are not paying much attention to their high level of $CO_2$ emissions caused by aviation. Infrastructural and technological advancement as well as increased public awareness are needed to challenge such issues.

**Keywords**

green growth, human development index, OECD countries, sustainable development

## 1 Introduction

The accumulation of wealth that has coincided with economic growth has caused exclusions, not only in a financial sense but also in terms of health, education and basic freedoms (Duraiappah, 2014). GDP fulfilled the role of a significant indicator regarding economic growth after the Great Depression (Szabó et al., 2021), but we need something different to include other aspects of progress (i.e., social, environmental) now (Ates and Derinkuyu, 2021). Traditional and limited growth measuring has been criticised for a long time (Nadanyiova et al., 2020). GDP-focused assessment allows people to ignore the unsustainability of a path of growth that is threatening basic assets required for human well-being (Duraiappah and Fernandes, 2014). A new measurement is required to look beyond economic growth.

A more inclusive and comprehensive development indicator suggestion cannot be discussed without reference to the green growth concept. It is a new concept with various definitions (Kim et al., 2014). In line with the particularities of development in developing countries, the term was first promoted by the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) in 2005 as a way of exploring opportunities to introduce a new low-carbon sustainable development model for fast-developing Asian countries (ESCAP, 2005; Kim et al., 2014). However, this concept is different from sustainable development because it seeks economic growth which is something developing countries was worried about in the case of sustainable development (Brundtland, 1987; Popp, 2011). The green growth paradigm was described as seeking "*to harmonize economic growth with poverty reduction and improved well-being with environmental sustainability, while improving the eco-efficiency of economic growth and of consumption patterns and enhancing the synergy between the environment and the economy*" at the UNESCAP Conference in 2006 (ESCAP, 2006). Both sustainability and green growth need cognitive decisions and holistic perspective especially in the era of digitalisation (Zoldy et al., 2022; Fűr and Csete, 2010); Esses et al., 2021. This conference gave impetus to the widespread use and acceptance of the concept at a global level (Sterner and

**Cite this article as:** Poyraz, A. Y. (2023) "Green Growth Analysis of Social Development in OECD Countries", Periodica Polytechnica Social and Management Sciences, 31(2), pp. 112–119. https://doi.org/10.3311/PPso.19995

Damon, 2011). Another definition for green growth concerning climate change mitigation is "the process of transition towards a low-carbon and resource-efficient society with economic development that safeguards the functioning of ecosystems and enhances human well-being and social equality" (Lyytimäki et al., 2018). The emphasis on carbon-neutrality is compatible with raising concerns about the immediate impacts of climate change that is already visible in daily life and the economy. On the other hand, there are critics questioning the inclusiveness of green growth discourse. For example, Kasztelan (2017) argues that green growth indicators lack a social dimension and are focused on economic growth and utilisation of the environment in a way that may bring even bigger environmental burdens (Ates & Derinkuyu, 2021).

Green growth is especially relevant for developing countries because it reflects economic growth and environmental quality at the same time (Ates and Derinkuyu, 2021). This is particularly important for developing countries that are struggling to curb GHG emissions (Scrieciu et al., 2013). Therefore, it has been regarded as a development guide that may facilitate bridging the efforts toward global challenges and development by various countries such as Thailand, Brazil and Turkey (Ateş, 2015).

Achieving green growth necessarily requires a monitoring frame that accommodates a robust analysis of determinants and internationally comparable indicators (Ness et al., 2007; Ates and Derinkuyu, 2021). The existing evaluation approaches provide only single-indicator interpretations or single-sector based comparisons, so they lack the ability to reveal an overall perspective on green growth (Kim et al., 2014, Ates and Derinkuyu, 2021). The discussion on sound and comprehensive growth indicators brought the OECD Green Growth indicators (Ates and Derinkuyu, 2021). OECD proposes green growth as an alternative approach towards development which involves accelerating economic growth while securing both the quality and quantity of natural assets (OECD, 2011). Therefore, the OECD approach to indicator establishment can be considered as an extended version of the growth-accounting approach (Kim et al., 2014). Moreover, its measurement framework and indicators offer flexibility which makes them suitable for application in various national contexts (Kim et al., 2014). Some countries have already performed the assessment based on these indicators: Germany, Czechia, the Netherlands (Ates and Derinkuyu, 2021).

Indicator selection is important, so there should be a coherent framework (Zefreh et al., 2020), one that is non-arbitrary, and plays a guiding role (Kim et al., 2014). Schomaker (1997) formulates SMART concept for indicators generally: they must be specific, measurable, achievable, relevant, and time-bound. Similarly, OECD suggests policy relevancy, analytical soundness, and measurability as appropriate selection criteria for indicators (OECD, 2010). This set of criteria addresses a balanced coverage of key features of green growth which do not jeopardise the common objectives of OECD member and partner countries (Kim et al., 2014). Easy interpretation and transparency of indicators are also crucial, as they permit their adaptation to diverse national contexts as well as application of the analysis at different levels and scales (OECD, 2011). They should be based on widely accessible, reliable, and up-to-date data (Kim et al., 2014).

The present preliminary set of green growth indicators includes four main categories, namely:

- Environmental and resource productivity
- Natural asset base
- Environmental dimension of quality of life
- Economic opportunities & policy responses

Every set of indicators reflects different aspects of sustainable development with respect to the proposed dimensions of green growth (Török and Sipos, 2021). They give society an opportunity to understand and analyse the prevalence of green growth through the provided data. Kim et al. (2014) suggest that the OECD green growth framework is based on the "interrelations between indicators" and the data addresses ecological, social, economic, structural, and institutional aspects which are linked to politics and economics (Majerova et al., 2020). Therefore, the OECD measurement framework is a reliable indicator set to outline the current situation in terms of economic growth and social benefits (Kim et al., 2014). Ateş and Derinkuyu (2021) also draw attention to correlations and spillovers among indicators and they suggest that "these should be examined to have a better understanding of elements affecting the green growth performance of countries".

This paper discusses the interrelations between a selected set of OECD green growth indicators (GGI) from the environmental and resource productivity categories, placing particular emphasis on the potential of the framework to highlight interrelations and links among the indicators. In addition to the selected GGI, the analysis includes Human Development Index (HDI) and its sub-indicators. The novelty of the analysis comes from the incorporation of these established indicators which have been being utilised and developed to reflect human well-being and prosperity for decades.

## 2 Literature review

There are studies in the literature that discuss the interrelations between indicators based on their impacts on country ranking regarding green growth or else examine the inter-indicator correlations (Kim et al., 2014; Koçak, 2020; Ates and Derinkuyu, 2021). Regarding the indicator impact weights in the green growth framework, Koçak (2020) examines the contribution of socio-economic context to three other indicator sets (i.e., environmental and resource productivity, natural asset base, the environmental dimension of quality of life and technology) by using GDP as reference series. They find out that the share of GDP, which is accepted as a basic measure of its economic progress, in green growth is a stubborn fact. Besides, production-based $CO_2$ productivity and energy productivity are critical indicators addressing the transition to green growth in developed economies. Their study implies that the production-based $CO_2$ emission is the most important indicator.

Ates and Derinkuyu (2020) challenge such approaches, arriving at their set of green growth-oriented country rankings by applying the I-distance method. Moreover, they investigate indicator impacts on ranking by applying the Pearson correlation test. Official development assistance emerges as the most significant contributor to green growth. GDP per capita, development of environment-related technologies and renewable electricity share are also important indicators that count towards figuring out the ranking. Their study suggests that real GDP, forest and arable cropland are the least impactful indicators.

## 3 Data and methodology

Table 1 shows the selected set of GGI from the environmental and resource productivity category, plus HDI with four sub-indicators. OECD defines "environmental and resource productivity" as an indicator that shows "whether economic growth is becoming greener with more efficient use of natural capital and to capture aspects of production which are rarely quantified in economic models and accounting frameworks" (OECD, 2017). Three sectors have been used in this analysis to seek inner and intra-sector and socio-economic indicator-related correlations: production, transport, and energy. There are four, two and five indicators under each sector, respectively. These indicators are either a number showing a certain amount in total or capita (e.g., $CO_2$ emissions) shares (e.g., renewables in energy supply) or changes (e.g., $CO_2$ emissions compared to 2000).

The United Nations suggests that HDI was created to ensure that people and their capabilities were prioritised in the development assessment of countries as opposed to solely focusing on economic growth and monetary

**Table 1** Descriptive of the selected indicators

| Sector or context | Description | Unit | Abbreviation |
|---|---|---|---|
| Production | Production-based $CO_2$ productivity, GDP per unit of energy-related $CO_2$ emissions | USD per kilogram, base year 2015 | PRO B $CO_2$ PRO |
| | Production-based $CO_2$ intensity, energy-related $CO_2$per capita | Tons | PRO B $CO_2$ INT |
| | Production-based $CO_2$ emissions, index 2000 = 100 | Index, 2000 = 100 | PRO B $CO_2$ EM CHANGE |
| | Production-based $CO_2$ emissions | Tons, Millions | PRO B $CO_2$ EM |
| Transport | $CO_2$ emissions from air transport per unit of GDP | Kilograms, 2015 | TRANSPORT B $CO_2$ PER GDP |
| | $CO_2$ emissions from air transport per capita | Tons | TRANSPORT B $CO_2$ PER CAP |
| Energy | Renewable energy supply (excluding solid biofuels) | % Total energy supply | RENEW EN PERC |
| | Energy productivity, GDP per unit of TPES | USD, 2015 | ENERGY PRO |
| | Energy intensity, TPES per capita | Tons of oil equivalent (toe) | ENERGY INT |
| | Total primary energy supply, index 2000 = 100 | Index, 2000 = 100 | TOTAL ENERGY SUPP CHANGE |
| | Total primary energy supply | Tons of oil equivalent (toe) Millions | TOTAL ENERGY SUPP |
| Human development | HDI | Index | HDI |
| | Life expectancy at birth | Years | LIFE EXP |
| | Expected years of schooling | Years | SCHOOLING EXP |
| | Mean years of schooling | Years | MEAN SCHOOLING |
| | Gross national income (GNI) per capita | USD | GNI PER CAP |

indicators (UNDP, 2020). HDI outlines the average level of nations in key dimensions of human development: *a long and healthy life, being knowledgeable and have a decent standard of living* (UNDP, 2020). It is a geometric mean of normalised indices for each dimension.

In this paper, the interrelations of indicators are analysed based on 16 selected GGI and HDI data for 36 OECD countries and the year 2019. Analysing a set of GGI and HDI together may make it feasible to scrutinise possible correlations between different sectors in a socio-economic context. Furthermore, the results can suggest how different trends affect human wellbeing and environmental quality. We can better understand which sectors are more likely to benefit human wellbeing and our planet in the context of a green growth framework.

## 4 Analysis steps and results

The analysis was conducted based on quantitative methods which facilitate a clear and deep understanding of the relations between different variables. First, the multicollinearity was checked for 16 variables and six of them were omitted due to the high variance of inflation. Afterwards, the relations among 10 variables from different categories were investigated through correlations and factors.

### 4.1 Variable multicollinearity check

In the first step of the analysis, the variables were evaluated through regression analysis. The multicollinearity has been checked to obtain a more consistent variable set. The variable with the highest variance of inflation (VIF) of each step was identified as a dependent variable at the next step. Six variables with high VIF were omitted until the highest VIF has appeared less than 5.

There is no omitted variable from the production category in the dataset. *$CO_2$ emissions from air transport per capita* remains in the evaluation dataset while the other air transportation-related variable *$CO_2$ emissions from air transport per unit of GDP* is found to be less important due to high VIF. *Renewable energy supply* and *energy productivity* are the two variables out of five which are still a component of the analysis from the energy category. Three variables are omitted from this category: *energy intensity, total primary energy supply (change since 2000)* and *total primary energy supply.* When we consider the human development index (HDI) category with its four sub-indicators, *HDI and gross national income per capita* are omitted due to high VIF. However, three HDI sub-indicators from this category seem relevant in the analysis: *life expectancy at birth, expected years of schooling (INSEE, 2019) and mean years of schooling (UNESCO, online).*

### 4.2 Correlations

After removing the variables with high VIF to reduce multicollinearity, a correlation matrix based on the Pearson method was extracted. The results based on Table 2 can be outlined as follows:

1 – There is a negative correlation between *Production-based $CO_2$ productivity* and two variables: *Production-based $CO_2$ intensity* and *Production-based $CO_2$ emission (change since 2000)*. This implies an important relationship among production-related indicators. Higher productivity is compatible with less $CO_2$ intensity at a 0.01 significance level. Furthermore, a decline in $CO_2$ emissions is correlated with higher productivity at a 0.05 significance level.

2 – *Production-based $CO_2$ productivity* is positively correlated with both energy indicators: renewable energy supply and energy productivity. The correlation detected at 0.05 level between production-based $CO_2$ productivity and renewable energy supply remarks a link between productivity and renewable energy. There is also a correlation between production-based $CO_2$ productivity and energy productivity at a 0.01 significance level that highlights the synchrony in different sectors regarding productivity.

3 – *Production-based $CO_2$ intensity* from the productivity section also correlates with *production-based $CO_2$ emission* and mean years of schooling. The correlation detected between production-based $CO_2$ intensity and production-based $CO_2$ emission at 0.01 significance level shows that countries with already high production-related emission amounts are more effective. This implies that there is currently a gap between countries with higher emissions and the rest in terms of productivity. Mean years of schooling is a sub-indicator of HDI, and it has a positive correlation with production-based $CO_2$ productivity at a 0.05 significance level. A higher mean year of schooling and higher energy-related $CO_2$ emission is correlated in OECD countries.

4 – P*roduction-based $CO_2$ emission (change since 2000)* is negatively correlated with *production-based $CO_2$ productivity* and *Mean years of schooling* at 0.05 significance level. This indicates a society that is greener, more productive, and educated for longer. These aspects may be feeding each other.

5 – The positive correlation between *$CO_2$ emissions from air transport per capita and Renewable energy supply*

**Table 2** Correlations between variables

| | PRO B $CO_2$ PRO | PRO B $CO_2$ INT | PRO B $CO_2$ EM CHANGE | PRO B $CO_2$ EM | TRANSPORT B $CO_2$ PER CAP | RENEW EN PERC | ENERGY PRO | LIFE EXP | SCHOOLING EXP | MEAN SCHOOLING |
|---|---|---|---|---|---|---|---|---|---|---|
| PRO B $CO_2$ PRO | *** | -0.548** | -0.377* | -0.266 | 0.311 | 0.419* | 0.539** | 0.215 | 0.182 | 0.099 |
| PRO B $CO_2$ INT | -0.548** | *** | 0.135 | 0.448** | 0.130 | -0.213 | -0.301 | 0.249 | 0.069 | 0.366* |
| PRO B $CO_2$ EM CHANGE | -0.377* | 0.135 | *** | -0.006 | -0.014 | -0.090 | -0.132 | -0.229 | -0.212 | -0.383* |
| PRO B $CO_2$ EM | -0.266 | 0.448** | -0.006 | *** | -0.061 | -0.140 | -0.165 | -0.077 | -0.134 | 0.133 |
| TRANSPORT B $CO_2$ PER CAP | 0.311 | 0.130 | -0.014 | -0.061 | *** | 0.620** | 0.143 | 0.292 | 0.258 | 0.151 |
| RENEW EN PERC | 0.419* | -0.213 | -0.090 | -0.140 | 0.620** | *** | -0.195 | 0.263 | 0.324 | 0.086 |
| ENERGY PRO | 0.539** | -0.301 | -0.132 | -0.165 | 0.143 | -0.195 | *** | 0.113 | -0.088 | -0.118 |
| LIFE EXP | 0.215 | 0.249 | -0.229 | -0.077 | 0.292 | 0.263 | 0.113 | *** | 0.386* | 0.162 |
| SCHOOLING EXP | 0.182 | 0.069 | -0.212 | -0.134 | 0.258 | 0.324 | -0.088 | 0.386* | *** | 0.171 |
| MEAN SCHOOLING | 0.099 | 0.366* | -0.383* | 0.133 | 0.151 | 0.086 | -0.118 | 0.162 | 0.171 | *** |

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

indicates a similar fact mentioned in item 3. A higher air travel-related emission is correlated with greener energy generation at a 0.01 significance level.

6 – *Life expectancy at birth and Expected years of schooling* appear as positively correlated HDI sub-indicators.

Taking the focus on green growth and socio-economic development relations into account, we should take a closer look at the correlations between HDI sub-indicators with $CO_2$ referred indicators from three sectors in line with the Pearson test results. Only one HDI sub-indicator (i.e., mean years of schooling) shows a significant correlation with two indicators from only one sector (i.e., production).

Fig. 1 demonstrates production-based $CO_2$ intensity vs mean years of schooling. According to this figure, the majority of the 36 OECD countries have an energy-related $CO_2$ per capita of fewer than 9 tons and a mean year of schooling of more than 10 years. On the other hand, countries from different continents like Korea, US and Luxembourg have relatively high numbers which indicate a lagging in the green transition. Other outliers in this scattered plot seem to be the countries with low energy-related $CO_2$ per capita with short mean years of schooling like Mexico and Turkey. Even though this does not necessarily mean that these countries are following the green growth concept, it can imply a growing acceptance of the concept in developing countries.

Another statistically significant correlation has been found between production-based $CO_2$ emission (change since 2000) and mean years of schooling (Fig. 2). The change stands for the ratio of $CO_2$ emission from 2019 to 2000. Therefore, a value under 100 remarks a transition to sustainability thanks to less GHG emission while values over 100 give a negative signal in terms of green growth. The Pearson test shows a negative correlation between

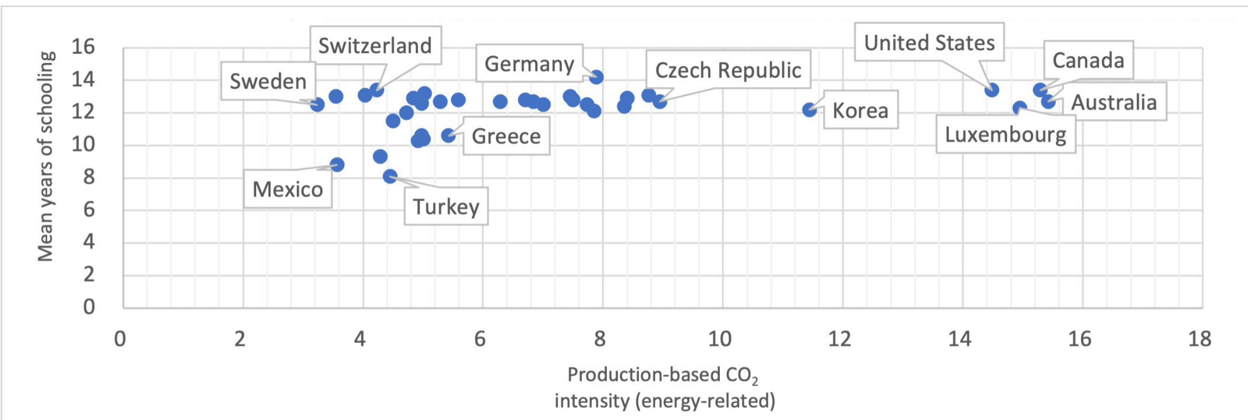


**Fig. 1** Plot of 36 OECD countries with mean years of schooling

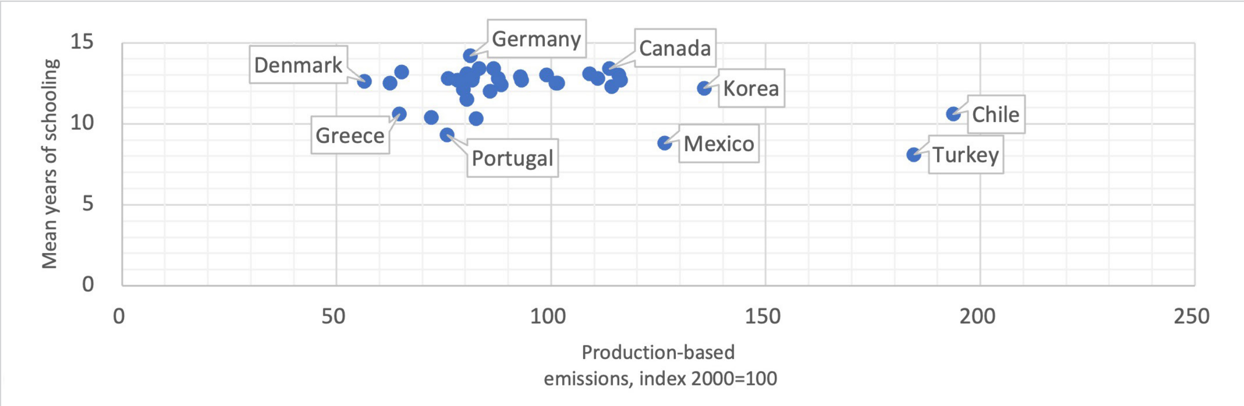


**Fig. 2** Plot of 36 OECD countries with mean years of schooling

these indicators regarding 36 OECD countries together and this implies that a decrease in $CO_2$ emissions is associated with a longer mean duration of schooling in society.

While most of the 36 OECD countries have achieved reductions in emissions, there are several other countries with a higher emission in 2019 than in 2000. Besides, levels of mean years of schooling vary widely among these countries. For example, Korea – a country with a mean year of schooling over 12 years – has experienced an increase of around 140 per cent in $CO_2$ emissions compared to 2000. On the other hand, two OECD countries with the highest increase in emissions (i.e., Chile and Turkey) have mean years of schooling of around 10 and 8, respectively. Geographical and political links and conditions can also play a role in successful green transition. For example, countries from southern Europe such as Greece and Portugal perform well in terms of their $CO_2$ emission trend even though they have relatively lower mean years of schooling.

### 4.3 Factor analysis

Factor analysis is another important element to investigate the possible correlations among variables. Hence, it has been conducted for the 10 variables. Table 3 and Table 4 show different elements of variance analysis.

Table 5 demonstrates the grouping of the variables according to 4 factors (components). The number of factors was manually determined and identified to SPSS in advance. The results show that there is one group with four variables while the rest of each group include two variables. *Air transport-related $CO_2$ emission per person, renewable energy supply, life expectancy and expected years of schooling* constitutes the first factor. These factors assure the results regarding the correlation. A higher human development level (i.e., longer lifetime and longer education) brings more enhanced green energy transformation as well as

**Table 3** KMO and Bartlett's test results

| | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | | 0.462 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 121.537 |
| | Df | 45 |
| | Sig. | 0.000 |

**Table 4** Eigenvalues withing the factor analysis

| Component | Total | % of Variance | Cumulative % |
|---|---|---|---|
| 1 | 2.678 | 26.777 | 26.777 |
| 2 | 2.074 | 20.739 | 47.517 |
| 3 | 1.366 | 13.660 | 61.177 |
| 4 | 1.028 | 10.275 | 71.452 |
| 5 | 0.954 | 9.539 | 80.991 |
| 6 | 0.686 | 6.861 | 87.852 |
| 7 | 0.555 | 5.546 | 93.398 |
| 8 | 0.395 | 3.947 | 97.344 |
| 9 | 0.148 | 1.484 | 98.828 |
| 10 | 0.117 | 1.172 | 100.000 |

**Table 5** Rotated component matrix with 4 factors

| | Component | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| AirT $CO_2$ emission – person | **0.852** | 0.066 | -0.106 | 0.194 |
| Renewable energy supply | **0.795** | -0.355 | 0.026 | -0.209 |
| Life expectancy at birth | **0.586** | 0.212 | 0.281 | 0.213 |
| Expected years of schooling | **0.542** | -0.107 | 0.366 | -0.230 |
| ProB $CO_2$ intensity | 0.145 | **0.913** | 0.044 | -0.194 |
| ProB $CO_2$ emission | -0.122 | **0.673** | 0.051 | -0.019 |
| ProB $CO_2$ emission change | 0.002 | 0.158 | **-0.864** | -0.154 |
| Mean years of schooling | 0.157 | 0.332 | **0.711** | -0.087 |
| Energy productivity | -0.023 | -0.144 | -0.004 | **0.947** |
| ProB $CO_2$ productivity | 0.347 | -0.547 | 0.316 | **0.558** |

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization[a]
[a] Rotation converged in 7 iterations

more GHG emissions due to travelling. *Production-based $CO_2$ intensity* and emission are two variables of the second factor. This can be considered to be due to the common nature of these variables. *Production-based $CO_2$ emission change and mean years of schooling* constitute the third component in different ways. This means that a common indicator based on these variables can be attributed considering the negative correlation among them. The fourth factor consists of *energy productivity* and *production-based $CO_2$ productivity*. This output can also be regarded as due to the nature of these variables.

## 5 Conclusion

GGI and HDI are important instruments that can enable researchers to understand interrelations and trends in terms of sustainable development. This study investigates the correlations among GGI and HDI with HDI sub-indicators on different subjects related to green growth and human well-being.

Production-based $CO_2$ intensity and emission change are significantly correlated to an HDI sub-indicator (i.e., mean years of schooling) considering 36 OECD countries. This indicates that longer education on average in a country can correlate with climate-friendly production with less and decreasing $CO_2$ emissions. A society with qualified and universal educational opportunities can achieve carbon neutrality thanks to the nature of the sectors which requires highly skilled workers. However, we should consider the migration of more polluting sectors to other countries if we aim for a holistic view and understanding. In addition to this, some OECD countries such as Mexico and Turkey have relatively low $CO_2$ emission per capita even though they are far behind other OECD countries in terms of mean years of schooling. The results of this analysis should be further examined to determine whether this can really be due to a strong green growth commitment on the part of such countries when their rapidly increasing level of $CO_2$ emissions might very well suggest the opposite.

The correlations among intra-GGI also suggest where OECD countries are lagging in terms of green transition. For example, the positive correlation between renewable energy supply and air transport-related $CO_2$ per capita indicates that countries with a successful path toward green energy do not pay much attention to their high level of $CO_2$ emissions caused by aviation. Infrastructural and technological advancement as well as increased public awareness are needed to challenge this issue.

OECD green growth indicators offer a useful and flexible framework to reveal the current situation and trends in sustainable development and green transition. Evaluating GGI with reference to the HDI can contribute to this framework from a comprehensive development perspective.

## Acknowledgement

The research was supported by OTKA - K21 – 138053 Life Cycle Sustainability Assessment of road transport technologies and interventions project appraisal led by Mária Szalmáné Csete.

## References

Ateş, S. A. (2015) "Development planning in twenty-first century: The case of green growth strategy, South Korea", In: Yülek, M. (ed.) Economic Planning and Industrial Policy in the Globalizing Economy, Springer, pp. 345–354. ISBN 978-3-319-06473-4 https://doi.org/10.1007/978-3-319-06474-1_16

Ates, S. A., Derinkuyu, K. (2021) "Green growth and OECD countries: Measurement of country performances through distance-based analysis (DBA)", Environment, Development and Sustainability, 23, pp. 15062-15073. https://doi.org/10.1007/s10668-021-01285-4

Brundtland, G. H. (1987) "World commission on environment and development: Our common future", Oxford University Press, ISBN 019282080X.

Duraiappah, A., Fernandes, C. (2014) "GDP Reexamined", Human Dimensions, 4(1), pp. 33–35.

Duraiappah, A. (2014) "Editorial", Human Dimensions, 4(1), pp. 2–3.

ESCAP (2005) "State of environment Asia and the Pacific 2005: economic growth and sustainability", United Nations. ISBN: 92-1-120487-9

ESCAP (2006) "Second green growth policy dialogue: Role of public policy in providing sustainable consumption choices: Resources saving society and green growth", Beijing, Standard Certification Centre, China, May, 23–24. [online] Available at: https://westminsterresearch.westminster.ac.uk/event/q759x/second-regional-policy-dialogue-role-of-public-policy-in-providing-sustainable-consumption-choices-resources-saving-society-and-green-growth [Accessed:08 Fbruary 2022]

Esses, D., Szalmáné Csete, M., Németh, B. (2021) "Sustainability and Digital Transformation in the Visegrad Group of Central European Countries", Sustainability, 13(11), 5833. https://doi.org/10.3390/su13115833

Fűr, A., Csete, M. (2010) "Modeling methodologies of synergic effects related to climate change and sustainable energy management", Periodica Polytechnica Social and Management Sciences, 18(1), pp. 11–19. https://doi.org/10.3311/pp.so.2010-1.02

INSEE (2019) "Expected years of schooling for a 2-year-old child", [online] Available at: https://www.insee.fr/en/metadonnees/definition/c1156 [Accessed: 23 May 2019]

Kasztelan, A. (2017) "Green growth, green economy and sustainable development: Terminological and relational discourse", Prague Economic Papers, 26(4), pp. 487–499. https://doi.org/10.18267/j.pep.626

Kim, S. E., Kim, H., Chae, Y. (2014) "A new approach to measuring green growth: Application to the OECD and Korea", Futures, 63, pp. 37–48. https://doi.org/10.1016/j.futures.2014.08.002

Koçak, D. (2020) "Green Growth Dynamics in OECD Countries: An Application of Grey Relational Analysis", Grey Systems: Theory and Application, 10(4), pp. 545–563. https://doi.org/10.1108/GS-01-2020-0016

Lyytimäki, J., Antikainen, R., Hokkanen, J., Koskela, S., Kurppa, S., Känkänen, R., Seppälä, J. (2018) "Developing key indicators of green growth", Sustainable Development, 26(1), pp. 51–64. https://doi.org/10.1002/sd.1690

Majerova, J., Sroka, W., Krizanova, A., Gajanova, L., Lazaroiu, G., Nadanyiova, M. (2020) "Sustainable brand management of alimentary goods", Sustainability, 12(2), 556. https://doi.org/10.3390/su12020556

Nadanyiova, M., Gajanova, L., Majerova, J., Lizbetinova, L. (2020) "Influencer marketing and its impact on consumer lifestyles", Forum Scientiae Oeconomia, 8(2), pp. 109-120. https://doi.org/10.23762/fso_vol8_no2_7

Ness, B., Urbel-Piirsalu, E., Anderberg, S., Olsson, L. (2007) "Categorising tools for sustainability assessment", Ecological Economics, 60(3), pp. 498–508. https://doi.org/10.1016/j.ecolecon.2006.07.023

OECD (2010) "Indicators for the green growth strategy: Meeting of the committee on statistics", OECD Conference Center, Paris, France.

OECD (2011) "Towards Green Growth: Monitoring Progress", [pdf] OECD, Paris, France. Available at: https://www.oecd.org/greengrowth/48224574.pdf

OECD (2017) "Green Growth Indicators 2017", OECD Green Growth Studies, OECD Publishing, Paris, France. ISBN: 9789264268623 https://doi.org/10.1787/9789264268586-en

Popp, D. (2011) "The role of technological change in green growth", [pdf] Center for Policy Research, The Maxwell School, Syracuse University, New York, NY, USA, Work. Paper18506. Available at: http://www.nber.org/papers/w18506

Schomaker, M. (1997) "Development of environmental indicators in UNEP", In: Proceedings of the Workshop organized by the Land and Water Development Division FAO Agriculture Department and the Research, Extension and Training Division FAO Sustainable Development Department, pp. 25–33. ISBN: 92-5-103975-5

Scrieciu, S., Rezai, A., Mechler, R. (2013) "On the economic foundations of green growth discourses: The case of climate change mitigation and macroeconomic dynamics in economic modeling", WIREs Energy and Environment, 2(3), pp. 251–268. https://doi.org/10.1002/wene.57

Sterner, T., Damon, M. (2011) "Green growth in the post-Copenhagen climate", Energy Policy, 39, pp. 7165–7173. https://doi.org/10.1016/j.enpol.2011.08.036

Szabó, Z., Török, Á., Sipos, T. (2021) "Order of the Cities: Usage as a Transportation Economic Parameter", Periodica Polytechnica Transportation Engineering, 49(2), pp. 164–169. https://doi.org/10.3311/PPtr.13786

Török, A., Sipos, T. (2021) "Cognition of sustainable mobility", In: 12th IEEE International Conference on Cognitive Infocommunications (CogInfoCom 2021), Online, pp. 921-924.

UNDP (2020) "Human Development Report 2020, The next frontier Human development and the Anthropocene", United Nations Development Programme, New Yor, NY, USA. ISBN: 978-92-1-126442-5

UNESCO (online) "Mean years of schooling" [online] Available at: http://uis.unesco.org/en/glossary-term/mean-years-schooling [Accessed: 08 February 2022]

Zefreh, M. M., Hussain, B., Sipos, T. (2020) "In-depth analysis and model development of passenger satisfaction with public transportation", KSCE Journal of Civil Engineering, 24, pp. 3064-3073. https://doi.org/10.1007/s12205-020-1871-7

Zoldy, M., Szalmane Csete, M., Kolozsi, P. P., Bordas, P., Torok, A. (2022) "Cognitive Sustainability", Cognitive Sustainability, 1(1). https://doi.org/10.55343/cogsust.7