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COMPARATIVE ASSESSMENT OF HDI WITH COMPOSITE DEVELOPMENT INDEX (CDI)

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Abstract. This paper presents a novel approach to measure the human development, progress and growth of any country. The authors have developed an alternative index to the conventional 'HDI', named as 'Composite Development Index (CDI)' and have also presented an original approach to evaluate it quantitatively. The CDI integrates all the three (social, economic and environmental) aspects of sustainable development, along with peace and happiness. As proposed, the CDI is based on four parameters, i.e. Inequality adjusted HDI (IHDI), Scaled Green Index, Scaled Peace Index and Scaled Happiness Index, evaluated from globally accepted standard databases. Hence, the CDI is much more comprehensive and rational than the conventional HDI or GDP. The CDI values have been evaluated quantitatively for 126 countries of the world. Further, comparative assessment of the CDI has been done with the HDI for all the 126 nations. The results obtained have been startling as no country was even able to have a CDI score of 0.8 on a scale of 0.1 to 1. Switzerland had the highest CDI of 0.767. A country like Norway with the highest HDI of 0.953 had a CDI of only 0.742. On the other hand, countries like Costa Rica, Romania and Uruguay are in the top 20 nations in the CDI Ranking, much ahead of the countries like United Kingdom, France, and USA. The CDI can act as a single point of reference for policy-makers, governments and other development agencies, as it presents a consolidated picture of a country's development. Future course of action on the basis of the concept of CDI are also proposed. It can be concluded that efforts to have a high CDI (in comparison to a high GDP or HDI only) will pave the way forward for sustainable development and holistic progress for all the countries of the world.

1. Introduction

The adequacy of the GDP and the HDI as a measure of human welfare and development has been questionable for many years now. GDP is an indicator of economic activity of an economy, but it has wrongly been referred to as a very broad measure of human welfare (Costanza et al., 2009, Stiglitz et al., 2010). Nobel Laureate Joseph Stiglitz (2009) has linked the economic recession in 2009 to GDP fetishism of countries. Kuznets (1934), Marcuss and Kane (2007), McCulla and Smith (2007) have mentioned that GDP had never been developed to measure the socio-economic welfare of a nation; still it is the most prevalent parameter in measuring the overall growth and

performance of any country. Costanza et al (2004) have exemplified a major issue with the GDP with an oil spill, whose occurrence would increase the GDP due to the associated cost of cleanup and remediation, but obviously its occurrence is undesirable from the environmental perspective. One more potential flaw with the GDP is that it does not take into account the distribution of income among individuals, which has a major impact on the social well being of any person (Wilkinson and Pickett, 2009). Kubiszewski et al (2013) have developed the GPI (Genuine Progress Index) because of these drawbacks of the GDP. Costanza et al (2009) have explicitly mentioned the shortcomings associated with the GDP by stating that GDP is a measure of 'economic quantity' and not 'economic quality' and 'human welfare'. They have also stated that due to the 'continued misuse' of the GDP, an immediate change in the indicators is required for the policy makers and the governments to frame policies and evaluate progress**.**

Due to these pitfalls associated with the GDP, many other indices of human welfare like the Human Development Index (HDI), Index of Sustainable Economic Welfare (ISEW), Sustainable Net benefit Index (SNBI), Index of Economic Well-Being (IEWB), Happy Planet Index (HPI) were developed (Lawn, 2005; Koroneos and Rokos, 2012). Prakash (2011, 2013) has developed the HPI (Holistic Progress Index) that is more comprehensive and based on more factors than the HDI or GDP to reflect peaceful and sustainable development without curtailing human freedom.

The Human Development Index (HDI) was created to emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country, not economic growth alone. The HDI is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and having a decent standard of living. It is the geometric mean of normalized indices for each of the three dimensions (HDR: Human Development Reports, UNDP).

But, the widely adopted HDI has also been a subject of much criticism and subsequent modification. Smith (1993) pioneered to bring about and support significant modifications to the HDI. Noorbakhsh (1998) has highlighted various criticisms of the HDI and has also developed four modified indices of the HDI. Taner et al. (2011) have developed an alternative to the HDI considering unemployment. Mazumdar (2003) has developed an alternative method to calculate the HDI using the unadjusted Per Capita Real Gross Domestic Product (PCRGDP)**.** Comim (2016) has tried to enlarge the human development perspective by using the capability approaches of Amartya Sen and Martha Nussbaum. He also investigates alternative measures of human development, including subjective, goals-based, sustainability and other indicators of human development**.** Jahan (2002) has identified some imperfections in the HDI and has also listed some alternative indices like the HPI (Human Poverty Index), GDI (Gender-related Development Index) and Gender Empowerment Measure (GEM)**.** In 2010, a new index named as Inequality Adjusted HDI was published considering the Gini Coefficient and the relevance of inequalities due to efforts of Paul (1996), Hicks (1997) along with Hirschowitz and Orkin (1997). Ogwang (2000) and Fukuda-Parr (2003) have given suggestions for the addition of gender dimensions to the HDI. Harttgen and Klasen (2010) have advocated the use of a household based HDI. Furthermore, Doessel ve Gounder (1994) has suggested the importance of absolute values over rankings in the estimation of the HDI. Panigrahi and Sivramkrishna (2002), Osberg and Sharpe (2003), Cherchye, Ooghe and Van Puyenbroeck (2008) have expressed their concerns with the HDI rankings. Harkness (2004) has highlighted reliable data collection as a major obstruction in low-income countries**.**

Relevant scientific literature on security and sustainability issues around the world can be found; which indicates a variety of approaches adopted for sustainable development. For energy security in the European Union, Melas et al (2017) and Abrhám et al (2018) have pointed out the positive role of renewable energy and distributed 'green energy' systems for self reliance. Bilan et al (2017) and Dudzevičiūtė and Prakapienė (2018) point out inclusive growth in European countries by examining social enterprises and interlinkages between poverty and income

inequality. Ślusarczyk and Kot (2018) have examined plastic free sustainable packaging as a contributor to sustainability in Poland. Smaliukiene (2018) points out a new trend of incorporating sustainability in military activities. Suleimenova et al (2018) examine requirements of environmental protection in food sector in a megalopolis.

Rees (1992); Wackernagel and Rees (1996); Rees (2017); Wackernagel et al. (2002, 2005) have utilized ecological footprint as an indicator of sustainable consumption. Moran et al. (2008) have mentioned that the ecological footprint to biocapacity could act as a useful indicator of environmental sustainability. They have also incorporated ecological footprint as a sustainability indicator alongwith the HDI so that development is within the regenerative biocapacity of planet Earth (Moran et al., 2008). Hence, the inculcation of the ecological footprint as an indicator of environmental sustainability is gaining much importance. Costanza et al., 2009 have also advocated for development that is within the carrying capacity of our supporting ecosystems.

In view of the deficiencies of important development parameters such as ecological footprint, peace and happiness in the above referred literature; the authors have developed an index of holistic progress and human development, named as the Composite Development Index (CDI). The CDI presents a fresh and comprehensive approach to measure the human development, progress, prosperity, welfare and growth of any country by taking into consideration the following four factors: HDI, ecological footprint, peace and happiness. All these parameters have been given equal weighting factors as the authors consider that all of them carry equal significance. A nation's very high GDP growth with a degraded environment and poor happiness record is not only a facade, but also self-destructing and impoverishing in the long run if the high economic growth is not in harmony with the social and environmental realms. The authors have evaluated the CDI for 126 nations and have ranked them accordingly. Also, a comparative assessment of the countries on the basis of their HDI ranking and their CDI ranking has also been done. The CDI as proposed has the potential to act as a comprehensive and complete index of sustainable development, human welfare and progress and the CDI rankings enlighten the way forward for all the countries of the world (developed or developing) to move in the right direction. The CDI can act as a single point of reference for policy-makers, governments and other development agencies and can pave the way forward for our sustainable future on the planet Earth.

2. Methodology

The HDI is based on merely three parameters (GDP, Literacy and health) and essentially does not represent a complete measure of human progress. It does not include other parameters like environmental impacts of human activities, happiness and peace that are integral to human development and growth of any nation. On the other hand, the Composite Development Index (CDI) incorporates practically all the major dimensions of a country's prosperity and does not rank countries simply on the basis of their high GDP.
The following four parameters have been considered as crucial to determining the human development of any country and have been included in the CDI:

1. Inequality adjusted HDI (IHDI)
2. Scaled Happiness Index
3. Scaled Peace Index
4. Scaled Green Index

All these 4 parameters have been taken from widely accepted and reputed indices from their official reports and websites.

The formula used to calculate the CDI of any country is:

CDI = 0.25 X (IHDI + Scaled Green Index + Scaled Happiness Index + Scaled Peace Index)

All the four parameters of the CDI have been given equal weighting factors in the CDI. This is due to the absence any rational basis, which provides relative importance of various parameters linked to human development and growth.

The value of the CDI would vary between 0.1 to 1 for any country.

2.1 Inequality adjusted HDI (IHDI)

It cannot be denied that the HDI is an apt measure of a country's economic prosperity, education and health of its population. The IHDI goes a step further to show how the achievements in HDI are distributed among a nation's residents. The IHDI connotes the level of human development when inequality is accounted for. The relative difference between IHDI and HDI values is the loss due to inequality in distribution of the HDI within the country.

The absolute values of the IHDI have been accessed from the UNDP's website (HDII, 2018).
Hence, the absolute IHDI values have been used for the evaluation of CDI as the IHDI is an improvement over the conventional HDI. Further, the IHDI values as available from the cited reference vary between 0.25 to 0.88.

2.2 Scaled Green Index

The environmental impacts due to human activities have taken a toll on the Earth. The ecological footprint per capita (EF/capita) helps in the quantitative assessment of the impacts of human activities on earth. It can be used to examine various measures such as the feasibility of resource consumption, distribution of the world's natural resources, waste assimilation and the overall sustainability of a country. The purpose of including the scaled green index in the CDI is to ensure that high human development does not occur at the cost of detrimental impacts to the environment and high material and resource consumption. The sustainability of a nation has been given equal importance as its GDP or IHDI.

The relative ranks of various countries based on their ecological footprint/capita have been taken from the 'Global Footprint Network' website (GFN, 2018).

Scaled Green Index = $(0.1 + 0.9 * (X_g/X_t))$

X_t = Total number of countries considered for the scaled green index calculation
X_g = EF /capita rank of a country (The country with the highest EF/capita will have the X_g value of 1 and that with the lowest EF/capita; $X_g = X_t$)

Hence, the quantitative value of the scaled green index would vary between 0.1 and 1.

2.3 Scaled Happiness Index

The Happiness Index has been based on the comprehensive 'World Happiness Report', 2018 (WHR, 2018). The Happiness Index incorporates the following factors and ranks countries on the basis of their happiness level.

- GDP per capita
- Social support

- Healthy life expectancy
- Freedom to make life choices
- Generosity
- Perceptions of corruption
- Dystopia and residual factors

The scaled happiness index has been included in the evaluation of the CDI because the happiness level of the people of any nation is equally important as its GDP or HDI growth. If a country has a majority of population that is stressed and morose, it will eventually lead to unsustainable growth and internal conflicts, thereby reducing its peace index.

Scaled Happiness Index = $(0.1 + 0.9 * (X_t - X_h) / X_t)$

$X_{t =}$ Total number of countries considered for Scaled Happiness Index calculation
X_h = Relative rank of a country based on Happiness Index (The country with the highest happiness index will have the X_h value of 1 and that with the lowest happiness index; $X_{h = } X_t$)

Hence, the quantitative value of the scaled happiness index would vary between 0.1 and 1.

2.4 Scaled Peace Index

The scaled peace index is based on the 'Global Peace Index' report, 2018 (GPI, 2018). The Peace Index considers the following factors and ranks countries on the basis of their peace:

1. Safety and Security
2. Militarization
3. Ongoing Conflicts

The scaled peace index has been incorporated in the CDI because merely a high HDI or IHDI with great internal dissent and unrest does not hold much water. Also, the Global Peace Index of any country shows the amount of money spent for military expenditure (more than 5% of the GDP for some countries) that could be invested for developmental purposes.

Scaled Peace Index = $(0.1 + 0.9 * (X_t - X_p / X_t))$

$X_{t =}$ Total number of countries considered for the evaluation of scaled peace index.
X_p = Relative rank of a country based on its 'Global Peace Index' (The country with the highest peace index will have the X_p value of 1 and that with the lowest happiness index; $X_{p = } X_t$)

Hence, the quantitative value of the scaled peace index would vary between 0.1 and 1.

3. Results

The CDI has been calculated for 126 nations by calculating the values for all the 4 parameters (i.e. IHDI, scaled green index, scaled happiness index, scaled peace index). Then, the values of all the 4 parameters have been summed up and multiplied by 0.25 so as to get the final value of CDI between 0.1 and 1.

3.1 Inequality adjusted HDI (IHDI)

The absolute values of the IHDI have been used for the computation of the CDI and they have been mentioned in Column (a) of Table 1.

3.2 Scaled Green Index

The scaled green index has been calculated using the formula given in section 2.2. The values of the scaled green index for 126 nations are mentioned in Column (b) of Table 1. Countries like USA and Canada that have a very high EF/capita have a very low scaled green index (very close to the minimum value 0.1). On the other hand, countries with a low EF/capita like India and Zambia have a very high scaled green index (close to 1).

3.3 Scaled Happiness Index

The scaled happiness index has been calculated using the formula given in section 2.3. The values of the scaled happiness index for 126 nations are mentioned in Column (c) of Table 1. Countries like Sweden and Netherlands rank very high on the scaled happiness index (close to the maximum value 1). On the other hand, countries like Angola, Togo and Sudan rank very low on the scaled happiness index (close to 0.1).

3.4 Scaled Peace Index

The scaled peace index has been calculated using the formula given in section 2.4. The values of the scaled peace index for 126 nations are mentioned in Column (d) of Table 1. Countries like Pakistan and Sudan that have a high degree of militarization and ongoing conflicts have a very low scaled peace index (very close to the minimum value 0.1). On the other hand, peaceful countries like Ireland and Canada score very high on the scaled peace index (close to 1).

Discussion

After substituting the values of all the 4 parameters in the formula of CDI, the values and ranks of CDI of all the 126 nations was computed. Switzerland emerged as the nation with the highest CDI (0.767), followed by Ireland (0.757), Norway (0.742) and Finland (0.741).

Further, the CDI and HDI ranks and values of all 126 nations were compared, and the complete comparative assessment is given in Table 2. The top 15 countries on the basis of their CDI and HDI are represented in Fig. 1 and Fig. 2 respectively.
Norway, which has the highest HDI (0.953), has a CDI of 0.742. This is due to its high ecological footprint per capita leading to a very low scaled green index (0.19). Similarly, countries like UK and France rank 24 and 31 as per the CDI ranking due to their scaled green index and scaled peace index.

Surprisingly, countries like Romania, Uruguay and Costa Rica that rank 52nd, 55th and 63rd in the HDI ranking, fare pretty well in the CDI ranking and secure the 13th, 14th and 8th spot respectively out of 126 countries, surpassing even very high HDI countries like Singapore, USA, France and UK. This contrast is explained by the higher scaled green index, scaled happiness index and scaled peace index of Romania, Uruguay and Costa Rica as compared to Singapore, USA, France and UK.

USA was able to secure the 70th rank in the CDI ranking, with a CDI of 0.538. On the other hand, it has a pretty high HDI of 0.924 and ranks 13th as per the HDI ranking. The culprit is the high EF/capita of USA leading to a poor scaled green index of 0.13 and the high degree of militarization leading to a low peace index of 0.33.

Even countries like Switzerland, Ireland and Norway that have bagged the top spots in the CDI ranking have a lot of scope to improve their CDI values. They need to reduce their ecological footprint/capita so that their scaled green index increase, thereby improving their CDI values.

Table 1. CDI Calculations for 126 nations

COUNTRY	IHDI (a)	Scaled Green Index (b)	Scaled Happiness Index (c)	Scaled Peace Index (d)	CDI (e)
India	0.468	0.880319149	0.232692308	0.249079755	0.458
China	0.643	0.411170213	0.503846154	0.381595092	0.485
Japan	0.876	0.305851064	0.688461538	0.950306748	0.705
Thailand	0.636	0.588297872	0.734615385	0.37607362	0.584
Russia	0.738	0.253191489	0.659615385	0.149693252	0.450
Australia	0.861	0.152659574	0.942307692	0.928220859	0.721
UK	0.835	0.30106383	0.890384615	0.685276074	0.678
France	0.808	0.315425532	0.867307692	0.663190184	0.663
Germany	0.861	0.281914894	0.913461538	0.906134969	0.741
Sweden	0.864	0.171808511	0.948076923	0.922699387	0.727
Netherlands	0.857	0.205319149	0.965384615	0.873006135	0.725
Italy	0.771	0.368085106	0.728846154	0.790184049	0.665
Greece	0.753	0.363297872	0.544230769	0.563803681	0.556
USA	0.797	0.128723404	0.896153846	0.33190184	0.538
Canada	0.852	0.133510638	0.959615385	0.966871166	0.728
Mexico	0.609	0.569148936	0.861538462	0.226993865	0.567
Brazil	0.578	0.511702128	0.838461538	0.414723926	0.586
Argentina	0.707	0.415957447	0.832692308	0.635582822	0.648
Egypt	0.493	0.674468085	0.296153846	0.21595092	0.420
Ethiopia	0.331	0.904255319	0.267307692	0.232515337	0.434
Norway	0.876	0.190957447	0.988461538	0.911656442	0.742
Switzerland	0.871	0.291489362	0.971153846	0.933742331	0.767
South Korea	0.773	0.224468085	0.671153846	0.729447853	0.600
Ireland	0.854	0.310638298	0.919230769	0.944785276	0.757
Singapore	0.816	0.214893617	0.803846154	0.955828221	0.698
Denmark	0.86	0.143085106	0.982692308	0.972392638	0.740
Finland	0.868	0.186170213	0.994230769	0.917177914	0.741
Belgium	0.836	0.162234043	0.907692308	0.88404908	0.697
Austria	0.835	0.210106383	0.930769231	0.983435583	0.740
Israel	0.787	0.325	0.936538462	0.193865031	0.561
Slovenia	0.846	0.329787234	0.705769231	0.939263804	0.705

Spain	0.754	0.401595745	0.671153846	0.834355828	0.665
Cyprus	0.769	0.473404255	0.648076923	0.657668712	0.637
Poland	0.787	0.34893617	0.757692308	0.823312883	0.679
Lithuania	0.757	0.234042553	0.711538462	0.801226994	0.626
Slovakia	0.797	0.37287234	0.775	0.878527607	0.706
Latvia	0.759	0.243617021	0.694230769	0.828834356	0.631
Portugal	0.732	0.420744681	0.555769231	0.97791411	0.672
Chile	0.71	0.392021277	0.855769231	0.845398773	0.701
Hungary	0.772	0.439893617	0.601923077	0.906134969	0.680
Croatia	0.756	0.435106383	0.526923077	0.850920245	0.642
Montenegro	0.741	0.454255319	0.532692308	0.679754601	0.602
Bulgaria	0.71	0.497340426	0.423076923	0.850920245	0.620
Romania	0.717	0.554787234	0.7	0.867484663	0.710
Belarus	0.755	0.320212766	0.578846154	0.442331288	0.524
Uruguay	0.689	0.52606383	0.821153846	0.795705521	0.708
Kazakhstan	0.737	0.229255319	0.653846154	0.613496933	0.558
Iran	0.707	0.463829787	0.388461538	0.276687117	0.459
Costa Rica	0.651	0.583510638	0.925	0.779141104	0.735
Turkey	0.669	0.492553191	0.573076923	0.177300613	0.478
Mauritius	0.683	0.449468085	0.682692308	0.889570552	0.676
Panama	0.623	0.607446809	0.844230769	0.72392638	0.700
Serbia	0.667	0.540425532	0.55	0.701840491	0.615
Albania	0.706	0.636170213	0.353846154	0.712883436	0.602
Georgia	0.682	0.698404255	0.873076923	0.436809816	0.673
Sri Lanka	0.664	0.789361702	0.261538462	0.63006135	0.586
Bosnia and Herzegovina	0.649	0.482978723	0.330769231	0.508588957	0.493
Venezuela	0.636	0.487765957	0.463461538	0.210429448	0.449
Azerbaijan	0.681	0.631382979	0.411538462	0.271165644	0.499
The former Yugoslav Republic of Macedonia	0.661	0.506914894	0.486538462	0.519631902	0.544
Armenia	0.68	0.664893617	0.255769231	0.337423313	0.485
Algeria	0.598	0.593085106	0.515384615	0.398159509	0.526
Ecuador	0.603	0.660106383	0.723076923	0.585889571	0.643
Ukraine	0.701	0.530851064	0.203846154	0.160736196	0.399
Peru	0.606	0.617021277	0.625	0.591411043	0.610
Colombia	0.571	0.688829787	0.786538462	0.199386503	0.561
Mongolia	0.639	0.119148936	0.457692308	0.74601227	0.490
Jordan	0.617	0.640957447	0.480769231	0.458895706	0.549
Tunisia	0.573	0.621808511	0.359615385	0.569325153	0.531
Jamaica	0.608	0.722340426	0.676923077	0.503067485	0.628
Turkmenistan	0.575	0.257978723	0.607692308	0.342944785	0.446
Gabon	0.545	0.559574468	0.405769231	0.475460123	0.496

Paraguay	0.522	0.425531915	0.630769231	0.574846626	0.538
Philippines	0.574	0.899468085	0.590384615	0.243558282	0.577
South Africa	0.467	0.459042553	0.394230769	0.309815951	0.408
Indonesia	0.563	0.760638298	0.446153846	0.696319018	0.617
Viet Nam	0.574	0.741489362	0.451923077	0.668711656	0.609
Bolivia (Plurinational State of)	0.514	0.516489362	0.642307692	0.243558282	0.479
Iraq	0.546	0.650531915	0.325	0.480981595	0.501
El Salvador	0.524	0.669680851	0.769230769	0.116564417	0.520
Kyrgyzstan	0.606	0.731914894	0.469230769	0.359509202	0.542
Nicaragua	0.507	0.794148936	0.763461538	0.624539877	0.672
Guatemala	0.467	0.707978723	0.826923077	0.387116564	0.597
Tajikistan	0.562	0.932978723	0.538461538	0.370552147	0.601
Namibia	0.422	0.645744681	0.313461538	0.762576687	0.536
Honduras	0.459	0.746276596	0.584615385	0.348466258	0.535
Bhutan	0.446	0.334574468	0.440384615	0.895092025	0.529
Bangladesh	0.462	0.961702128	0.336538462	0.486503067	0.562
Congo(Republic)	0.469	0.856382979	0.342307692	0.304294479	0.493
Lao People's Democratic Republic	0.445	0.717553191	0.365384615	0.74601227	0.568
Ghana	0.42	0.679255319	0.376923077	0.773619632	0.562
Kenya	0.434	0.913829787	0.284615385	0.320858896	0.488
Zambia	0.388	0.942553191	0.278846154	0.734969325	0.586
Cambodia	0.469	0.82287234	0.307692308	0.46993865	0.517
Angola	0.393	0.770212766	0.180769231	0.541717791	0.471
Myanmar	0.466	0.775	0.25	0.326380368	0.454
Nepal	0.427	0.918617021	0.417307692	0.536196319	0.575
Pakistan	0.387	0.966489362	0.567307692	0.166257669	0.522
Cameroon	0.366	0.842021277	0.428846154	0.265644172	0.476
Tanzania (United Republic of)	0.404	0.79893617	0.117307692	0.718404908	0.510
Nigeria	0.347	0.885106383	0.475	0.182822086	0.472
Rwanda	0.367	0.971276596	0.128846154	0.431288344	0.475
Lesotho	0.359	0.808510638	0.186538462	0.425766871	0.445
Mauritania	0.348	0.612234043	0.273076923	0.298773006	0.383
Madagascar	0.385	0.928191489	0.175	0.790184049	0.570
Uganda	0.37	0.870744681	0.221153846	0.409202454	0.468
Benin	0.326	0.818085106	0.215384615	0.619018405	0.495
Senegal	0.34	0.889893617	0.371153846	0.712883436	0.578
Togo	0.344	0.894680851	0.198076923	0.458895706	0.474
Sudan	0.328	0.851595745	0.209615385	0.155214724	0.386
Afghanistan	0.35	0.97606383	0.163461538	0.105521472	0.399
Haiti	0.304	0.985638298	0.146153846	0.514110429	0.487
Malawi	0.332	0.956914894	0.151923077	0.757055215	0.549

Guinea	0.306	0.803723404	0.192307692	0.46993865	0.443
Congo (Democratic Republic of the)	0.319	0.980851064	0.238461538	0.138650307	0.419
Yemen	0.308	0.923404255	0.123076923	0.127607362	0.371
Mozambique	0.294	0.947340426	0.290384615	0.525153374	0.514
Liberia	0.298	0.865957447	0.140384615	0.652147239	0.489
Mali	0.282	0.784574468	0.319230769	0.204907975	0.398
Burkina Faso	0.288	0.827659574	0.301923077	0.558282209	0.494
Sierra Leone	0.266	0.846808511	0.348076923	0.806748466	0.567
Burundi	0.278	0.990425532	0.1	0.260122699	0.407
Chad	0.249	0.75106383	0.244230769	0.254601227	0.375
South Sudan	0.247	0.779787234	0.111538462	0.111042945	0.312
Central African Republic	0.212	0.875531915	0.105769231	0.144171779	0.334
Niger	0.25	0.72712766	0.226923077	0.293251534	0.374

Table 2. HDI vs CDI Rankings of 126 countries

COUNTRY	CDI	RANK(CDI)	HDI	RANK(HDI)	Difference
Switzerland	0.767	1	0.944	2	1
Ireland	0.757	2	0.938	4	2
Norway	0.742	3	0.953	1	2
Finland	0.741	4	0.92	15	11
Germany	0.741	5	0.936	5	0
Austria	0.740	6	0.908	20	14
Denmark	0.740	7	0.929	11	4
Costa Rica	0.735	8	0.794	63	55
Canada	0.728	9	0.926	12	3
Sweden	0.727	10	0.933	7	3
Netherlands	0.725	11	0.931	10	1
Australia	0.721	12	0.939	3	9
Romania	0.710	13	0.811	52	39
Uruguay	0.708	14	0.804	55	41
Slovakia	0.706	15	0.855	38	23
Slovenia	0.705	16	0.896	25	9
Japan	0.705	17	0.909	19	2
Chile	0.701	18	0.843	44	26
Panama	0.700	19	0.789	66	47
Singapore	0.698	20	0.932	9	11
Belgium	0.697	21	0.916	17	4
Hungary	0.680	22	0.838	45	23

Poland	0.679	23	0.865	33	10
UK	0.678	24	0.922	14	10
Mauritius	0.676	25	0.79	65	40
Georgia	0.673	26	0.78	70	44
Nicaragua	0.672	27	0.658	124	97
Portugal	0.672	28	0.847	41	13
Spain	0.665	29	0.891	26	3
Italy	0.665	30	0.88	28	2
France	0.663	31	0.901	24	7
Argentina	0.648	32	0.825	47	15
Ecuador	0.643	33	0.752	86	53
Croatia	0.642	34	0.831	46	12
Cyprus	0.637	35	0.869	32	3
Latvia	0.631	36	0.847	41	5
Jamaica	0.628	37	0.732	97	60
Lithuania	0.626	38	0.858	35	3
Bulgaria	0.620	39	0.813	51	12
Indonesia	0.617	40	0.694	116	76
Serbia	0.615	41	0.787	67	26
Peru	0.610	42	0.75	89	47
Viet Nam	0.609	43	0.694	116	73
Albania	0.602	44	0.785	68	24
Montenegro	0.602	45	0.814	50	5
Tajikistan	0.601	46	0.65	127	81
South Korea	0.600	47	0.903	22	25
Guatemala	0.597	48	0.65	127	79
Sri Lanka	0.586	49	0.77	76	27
Zambia	0.586	50	0.588	144	94
Brazil	0.586	51	0.759	79	28
Thailand	0.584	52	0.755	83	31
Senegal	0.578	53	0.505	164	111
Philippines	0.577	54	0.699	113	59
Nepal	0.575	55	0.574	149	94
Madagascar	0.570	56	0.519	161	105
Lao People's Democratic Republic	0.568	57	0.601	139	82
Sierra Leone	0.567	58	0.419	184	126
Mexico	0.567	59	0.774	74	15
Ghana	0.562	60	0.592	140	80
Bangladesh	0.562	61	0.608	136	75

Colombia	0.561	62	0.747	90	28
Israel	0.561	63	0.903	22	41
Kazakhstan	0.558	64	58	0.8	63.2
Greece	0.556	65	0.87	31	34
Malawi	0.549	66	0.477	171	105
Jordan	0.549	67	0.735	95	28
The former Yugoslav Republic of Macedonia	0.544	68	0.757	80	12
Kyrgyzstan	0.542	69	0.672	122	53
USA	0.538	70	0.924	13	57
Paraguay	0.538	71	0.702	110	39
Namibia	0.536	72	0.647	129	57
Honduras	0.535	73	0.617	133	60
Tunisia	0.531	74	0.735	95	21
Bhutan	0.529	75	0.612	134	59
Algeria	0.526	76	0.754	85	9
Belarus	0.524	77	0.808	53	24
Pakistan	0.522	78	0.562	150	72
El Salvador	0.520	79	0.674	121	42
Cambodia	0.517	80	0.582	146	66
Mozambique	0.514	81	0.437	180	99
Tanzania (United Republic of)	0.510	82	0.538	154	72
Iraq	0.501	83	0.685	120	37
Azerbaijan	0.499	84	0.757	80	4
Gabon	0.496	85	0.702	110	25
Benin	0.495	86	0.515	163	77
Burkina Faso	0.494	87	0.423	183	96
Congo(Republic)	0.493	88	0.457	176	88
Bosnia and Herzegovina	0.493	89	0.768	77	12
Mongolia	0.490	90	0.741	92	2
Liberia	0.489	91	0.435	181	90
Kenya	0.488	92	0.59	142	50
Haiti	0.487	93	0.498	168	75
China	0.485	94	0.752	86	8
Armenia	0.485	95	0.755	83	12
Bolivia (Plurinational State of)	0.479	96	0.693	118	22
Turkey	0.478	97	0.791	64	33
Cameroon	0.476	98	0.556	151	53
Rwanda	0.475	99	0.524	158	59
Togo	0.474	100	0.503	165	65

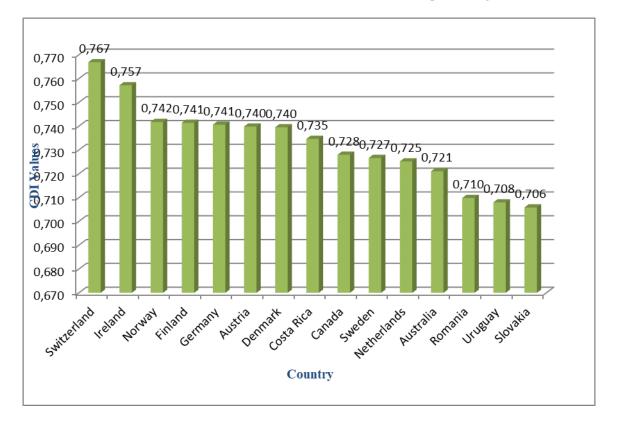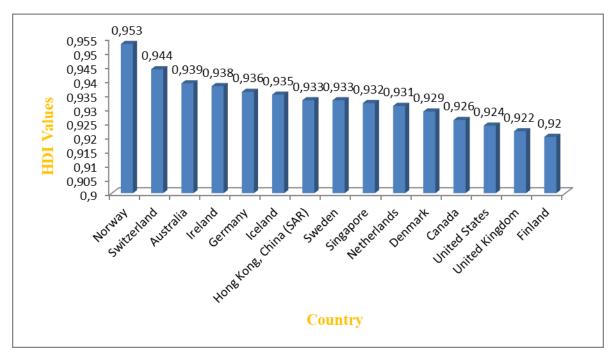|					
Nigeria	0.472	101	0.532	157	56
Angola	0.471	102	0.581	147	45
Uganda	0.468	103	0.516	162	59
Iran	0.459	104	0.798	60	44
India	0.458	105	0.64	130	25
Myanmar	0.454	106	0.578	148	42
Russia	0.450	107	0.816	49	58
Venezuela	0.449	108	0.761	78	30
Turkmenistan	0.446	109	0.706	108	1
Lesotho	0.445	110	0.52	159	49
Guinea	0.443	111	0.459	175	64
Ethiopia	0.434	112	0.463	173	61
Egypt	0.420	113	0.696	115	2
Congo (Democratic Republic of the)	0.419	114	0.457	176	62
South Africa	0.408	115	0.699	113	2
Burundi	0.407	116	0.417	185	69
Ukraine	0.399	117	0.751	88	29
Afghanistan	0.399	118	0.498	168	50
Mali	0.398	119	0.427	182	63
Sudan	0.386	120	0.502	167	47
Mauritania	0.383	121	0.52	159	38
Chad	0.375	122	0.404	186	64
Niger	0.374	123	0.354	189	66
Yemen	0.371	124	0.452	178	54
Central African Republic	0.334	125	0.367	188	63
South Sudan	0.312	126	0.388	187	61

Fig.1. Top 15 nations in the CDI Ranking

Fig.2. Top 15 nations in the HDI Ranking

4 The Way Forward

The CDI, as presented above, is a much more comprehensive and rational measure of human development and progress as compared to the conventional HDI and GDP. The following actions are proposed in order to leverage the CDI:

A. Governments and policy makers across the globe need to be persuaded to adopt the proposed CDI as an indicator of holistic development of their country, in place of the GDP or HDI.

B. The countries need to analyze the reasons for their current CDI ranking so as to identify the scope of improvement in their CDI. The rankings reveal that even the developed superpowers cannot be indifferent and ignorant towards the CDI ranking because of their current low CDI.

C. In order to improve the CDI, all countries need to frame policies so as to improve all the four development parameters associated with the CDI, i.e., HDI, peace, happiness, and environmental sustainability. Policies need to be focused on demilitarization, self-reliance, communal harmony, job satisfaction, job creation, more efficient resource utilization, reducing ecological footprint, etc. so as to ensure a high CDI rank.

D. The academic institutions, NGOs, and the private sector need to act as agents of change and catalysts in the process of sustainability, peace and happiness at the grass root level so as to help achieve the goal of a high CDI.

5 Conclusions

It has been established that GDP should not be treated as an indicator of human welfare and attainment of a high GDP must not entirely influence a country's national policies and goals (Costanza et al, 2009; Stiglitz et al, 2010). This paper presents a new indicator of human development that measures the holistic progress of any country named as CDI. The CDI is not a perfect measure of human development and progress, but it is more rational and comprehensive than the HDI or GDP. An ambiguity-free and simple methodology to quantitatively evaluate the CDI has also been discussed. The CDI is based on four well established and widely accepted factors: IHDI, Peace Index, Happiness Index and Ecological Footprint, that have been named as the IHDI, scaled peace index, scaled happiness index and scaled green index respectively. At the same time, the CDI values of 126 nations have been evaluated. On the basis of the CDI and HDI values, a comparative assessment and relative ranking of all the 126 countries has been done.

The trends in the CDI values and ranks are unexpected and astonishing. Switzerland emerged as the country with the highest CDI with a CDI of 0.767. A country like USA with an HDI rank of 13 and HDI of 0.924 has a CDI ranking of 70 and a CDI value of 0.538, ranking much behind the countries like Zambia, Sierra Leone, Senegal and Nepal which have an HDI score below 0.60. The top 15 countries on the basis of the HDI and CDI have also been presented graphically. Thus, it can be concluded that a high HDI does not ensure a high CDI value as the CDI is much more comprehensive. Further, an obsession with a high HDI or GDP growth would divert attention from other critical developmental issues like environmental sustainability, peace and happiness.

The CDI provides an architecture to build a positive relationship between all the countries of the world and harmony across peoples all around the world. Worldwide efforts to improve the CDI are the need of the hour so as to ensure our sustainable and peaceful future on the planet Earth. Let the era of the CDI begin!!

6 Scope of Future Work

In the future, this work can be expanded for all the remaining countries of the world, as and when the data for all the four parameters is available. Inclusion of more factors in the CDI may also be considered as its implementation begins in countries around the world. As pointed out in the methodology, equal weighting factors were used for different parameters for CDI evaluation. If future research in social sciences provides relative importance of various developmental parameters, suitable weighting factors may be applied accordingly in the CDI evaluation. Policy instruments need to be developed that are aimed for CDI improvement so that the overall well-being of any country increases.

Abbreviations:

CDI: Composite Development Index
GDP: Gross Domestic Product
HDI: Human Development Index
HPI: Holistic Progress Index
IHDI: Inequality adjusted Human Development Index
NGOs: Non-Governmental Organizations
UN: United Nations

References

Abrhám, J.; Britchenko, I.; Jankovic, M.; Garškaitė-Milvydienė, K. 2018. Energy security issues in contemporary Europe, *Journal of Security and Sustainability Issues* 7(3): 387–398. https://doi.org/10.9770/jssi.2018.7.3(1)

Bilan, Y., Mishchuk, H., Pylypchuk, R. 2017. Towards sustainable economic development via social entrepreneurship, *Journal of Security and Sustainability Issues* 6(4): 691-702 http://doi.org/10.9770/jssi.2017.6.4(13)

Cherchye, L., Ooghe, E., and Van Puyenbroeck, T. 2008. Robust human development rankings, *Journal of Economic Inequality* 6(4): 287-321.

Comim, F. 2016. "Beyond the HDI? Assessing alternative measures of human development from a capability perspective", 2016 UNDP Human Development Report Background Paper, http://hdr.undp.org/sites/default/files/comim_template_0.pdf , accessed on 23rd August, 2018

Costanza, R., Erickson, J., Fligger, K., Adams, A., Adams, C., Altschuler, B., Balter, S., Fisher, B., Hike, J., Kelly, J., Kerr, T., McCauley, M., Montone, K., Rauch, M., Schmiedeskamp, K., Saxton, D., Sparacino, L., Tusinski, W., Williams, L., 2004. Estimates of the Genuine Progress Indicator (GPI) for Vermont, Chittenden County and Burlington, from 1950 to 2000 , *Ecological Economic*s 51 (1–2), 139–155.

Costanza, R., Hart, M., Posner, S., Talberth, J., 2009. Beyond GDP: The Need for New Measures of Progress., THE PARDEE PAPERS / No. 4 / January 2009, The Frederick S. Pardee Center for the Study of the Longer-Range Future at Boston University https://www.bu.edu/pardee/files/documents/PP-004-GDP.pdf , accesed on 25th December, 2018

Doessel, D.P., and Gounder, R. 1994. Theory and measurement of living levels: Some empirical results for the human development index, *Journal of International Development* 6(4): 415–435

Dudzevičiūtė, G.; Prakapienė, D. 2018. Investigation of the economic growth, poverty and inequality inter-linkages in the European Union countries, *Journal of Security and Sustainability Issues* 7(4): 839-854. https://doi.org/10.9770/jssi.2018.7.4(19)

Fukuda-Parr, S. 2003. "The Human Development Paradigm: Operationalizing Sen's Ideas On Capabilities, *Feminist Economics* 9:301-317
'Global Footprint Network', GFN, http://data.footprintnetwork.org/#/ , accessed in September, 2018

'Global Peace Index (GPI), 2018, Institute for Economics and Peace, http://visionofhumanity.org/app/uploads/2018/06/Global-Peace-Index-2018-2.pdf , accessed on 14th October, 2018

Harkness, S. (2004), "Social and Political Indicators of Human Well- Being," Research Paper, 2004/33, Helsinki: United Nations University: World Institute for Development Economics Research (WIDER)

Harttgen, K., and Klasen, S. 2010. "A Household-Based Human Development Index," Human Development Research Papers, 2010/22, New York: United Nations Development Programme
HDR: Human Development Reports; http://hdr.undp.org/en/content/human-development-index-hdi

Hicks, D.A. 1997. The inequality-adjusted Human Development Index: A Constructive Proposal, World Development 25(8): 1283-1298.

Hirschowitz, R. and Orkin, M. 1997. Inequality in South Africa: Findings from the 1994 October Household Survey, S*ocial Indicators Research* 41(1-3): 119-136.

Human Development Indices and Indicators (HDII), 2018 Statistical update; http://hdr.undp.org/sites/default/files/2018_human_development_statistical_update.pdf, accessed in October, 2018

Jahan, S. 2002. Measuring living standards and poverty: The human development index as an alternate measure. Working paper of the programme on Global Labor Standards and Living Wages, University of Massachusetts. www.umass.edu/peri/pdfs/glw_jahan.pdf

John F. Helliwell, Richard Layard and Jeffrey D. Sachs, 'World Happiness Report (WHR)', 2018, https://s3.amazonaws.com/happiness-report/2018/WHR_web.pdf , accessed on 17th October, 2018

Koroneos, Ch. J.; Rokos, D. 2012. Sustainable and Integrated Development–A Critical Analysis, *Sustainability* 4: 141–153. https://doi.org/10.3390/su4010141

Krishna Mazumdar. 2003. A New Approach to Human Development Index, *Review of Social Economy* 61(4): 535-549, https://doi.org/10.1080/0034676032000160895

Kubiszewski, I., Costanza, R., Franco, C., Lawn, P., Talberth, J., Jackson, T., Aylmer, C. 2013. Beyond GDP: Measuring and achieving global genuine progress, *Ecological Economic*s 93 (2013) 57–68, Elsevier

Kuznets, S. 1934. National Income, 1929–1932.

Lawn, Ph. A. 2005. An Assessment of the Evaluation Methods used to calculate the Index of Sustainable Economic Welfare (ISEW), Genuine Progress Indicator (GPI), and Sustainable Net Benefit Index (SNBI), *Environment, Development and Sustainability* 7: 185–208.

Marcuss, D., Kane, R.E. 2007. US national income and product statistics born of the Great Depression and World War II. Bureau of Economic Analysis: Survey of Current Business 87(2), 32–46.

McCulla, S.H., Smith, S., 2007. Measuring the Economy: A Primer on GDP and the National Income and Product Accounts.

Melas, V.; Lisin, E.; Tvaronavičienė, M., Peresadko, G.; Radwański, R. 2017. Energy security and economic development: renewables and the integration of energy systems, *Journal of Security and Sustainability Issues* 7(1): 133–139. http://dx.doi.org/10.9770/jssi.2017.7.1(11)

Moran, D., Wackernagel, M., Kitzes, J., Goldfinger, S., Boutaud, A. 2008. Measuring sustainable development — Nation by nation, *Ecological Economics* 64: 470 – 474

Noorbakhsh, F. 1998. The Human Development Index: Some Technical Issues And Alternative Indices, *Journal of International Development*, J. Int. Dev. 10, 589±605, John Wiley & Sons, Ltd.

Ogwang, T. 2000. Inter-country inequality in human development indicators, *Applied Economics Letters* 7(7): 443-446

Osberg, L., and Sharpe, A. 2003). Human Well-being and Economic Well-being: What Values Are Implicit in Current Indices?, Centre for the Study of Living Standards Research Report 2003/04, Ottowa: Centre for the Study of Living Standards.

Panigrahi, R., and Sivramkrishna, S. 2002. An adjusted Human Development Index: Robust country rankings with respect to the choice of fixed maximum and minimum indicator values, *Journal of Human Development* 3(2): 301-311

Paul, S. 1996. A modified human development index and international comparison, *Applied Economics Letters* 3(10): 677-682.

Prakash, R. 2011. Is the concept of a green economy a useful way of framing policy discussions and policymaking to promote sustainable development?, *Natural Resource Forum* 35(1): 63-72, United Nations, https://doi.org/10.1111/j.1477-8947.2011.01347.x

Prakash, R. 2013. Looking beyond the GDP: quantitative evaluation of the "Holistic Progress Index" (HPI)", *Journal of Security and Sustainability Issues* 2(4): 57–64 http://dx.doi.org/10.9770/jssi.2013.2.4(6)

Rees, W. 1992. Ecological footprints and appropriated carrying capacity: what urban economics leaves out, *Environment and Urbanisation* 4.

Rees, W. 2017. **E**cological Footprints and Appropriated Carrying Capacity: What Urban Economics Leaves Out, *Urbanization* 2(1): 66-77 https://doi.org/10.1177/2455747117699722

Ślusarczyk, B.; Kot S. 2018. Solution for sustainable development: provisions limiting the consumption of disposable plastic carrier bags in Poland, *Journal of Security and Sustainability Issues* 7(3): 449–458. https://doi.org/10.9770/jssi.2018.7.3(7)

Smaliukiene, R. 2018. Sustainability issues in the military: genesis and prospects, *Journal of Security and Sustainability Issues* 8(1): 19-32. https://doi.org/10.9770/jssi.2018.8.1(2)

Smith, P. 1993. Measuring human development, *Asian Economic Journal* 7(1): 89–106.

Stiglitz, J. 2009. GDP Fetishism. Available on the Internet: http://www.project syndicate.org/commentary/stiglitz116/English

Stiglitz, J.E., Sen, A., Fitoussi, J.P., 2010. Mismeasuring Our Lives: Why GDP Doesn't Add Up. The New Press, New York.

Suleimenova, M. S.; Kulazhanov, T.K.; Akhmetova, S. O.; Daribayev, Z.E.; Moldagazyyeva, Z. Y. 2018. Food security and ecological safety of megalopolis: a case study analysis, *Journal of Security and Sustainability Issues* 7(3): 495–511. https://doi.org/10.9770/jssi.2018.7.3(10)

Taner, M., Sezen, B., Mıhcı, H., Year. 2011. An Alternative Human Development Index Considering Unemployment, 6(1): 45-60, *South East European Journal of Economics and Business*, The Journal of University of Sarajevo, https://doi.org/10.2478/v10033-011-0005-z

Wackernagel, M., Monfreda, C., Moran, D., Wermer, P., Goldfinger, S., Deumling, D., Murray, M., 2005. National footprint and biocapacity accounts.The underlying calculation method. Global Footprint Network www.footprintnetwork.org

Wackernagel, M., Rees, W., 1996. Our Ecological Footprint: Reducing Human Impact on the Earth. New Society Publishers.

Wackernagel, M., Schulz, B., Deumling, D., Callejas Linares, A., Jenkins, M., Kapos, V., Monfreda, C., Loh, J., Myers, N., Norgaard, R., Randers, J., 2002. Tracking the ecological overshoot of the human economy. Proceedings of the National Academy of Science 99, 9266–9271.

Wilkinson, R.G., Pickett, K., 2009. The Spirit Level: Why Greater Equality Makes Societies Stronger. Bloomsbury Press, New York.

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