# Equity profile Sudan

This analysis is based on a methodology developed from 2010 and 2020[[1]](#footnote-1) [[2]](#footnote-2) [[3]](#footnote-3).It uses international data sources to identify global wellbeing references, identifies the levels replicable to all and estimates the deficit from those by country, time-period, sex and age group.

This new way of looking at a country’s performance on ecology, economy and wellbeing within the feasible and sustainable parameters, can stimulate further subnational analysis and more precise and useful elements to drive local, national and international policies towards equity.

**Methodology**

The only global health objective agreed by all countries is the constitution of the World Health Organization, which aims at the “*best feasible level of health for all*”. With international data - from 1960-2020- we identified such “best feasible level of health” and selected countries with good health (life expectancy above world average) with “globally feasible” economic (GDP and wealth pcy < world average) and ecologic conditions (bio capacity < world average and ecological and carbon footprint < sustainable threshold) sustainable in time, hence safeguarding intergenerational equity.

Using those *healthy, replicable and sustainable* (HRS) models[[4]](#footnote-4), we adjusted mortality rates by age and sex published by the UN Population Division every five years. We call the excess mortality above that from the HRS models, the *burden of health inequity*. The analysis also allows setting the “*dignity threshold*” (below which no country has achieved that best feasible health) and the “*upper threshold*” (above which wellbeing does not improve). Those thresholds frame the *equity curve* between both and the level of *redistribution required* for those under the dignity threshold (in need of net support) or from those above the upper threshold (ethically responsible for net contribution).

Taking into account the negative impact on third countries by excess income pc or excess carbon emissions pc, we estimated the *Sustainable and Equitable Wellbeing (SEW) Index[[5]](#footnote-5).* The methodology we hereby propose challenges XXth century concepts such as high income-development models, constant GDP growth, poverty, ODA and the human development index. The hereby suggested “*equity lenses*” provide a useful tool to identify *alternative wellbeing models*, subnational analysis and policies towards territorial and fiscal equity and individual and collective conscious responsibility based on the ethical principle of equity.

Figure 1 Global equity curve between dignity and excess thresholds allowing best feasible level of health for all



Our analysis reveals that the best levels of wellbeing (through proxy life expectancy) can be achieved within the equity curve, which accommodates all countries, and within them, all peoples above the dignity threshold and below the upper threshold. In 2020 the equity scope was from 4,000-18,000 GDP pc CV, below which no country could achieve best feasible levels of health (right to health) and above which wellbeing did not improve any further while no country was ecologically sustainable and the excess income prevented others from the right to health.

## Comparison with neighbour countries and other with similar natural and economic means

The first attempt to assess a situation is to compare with others in similar situations and identify the potential to improve. The following table compare the ecological, economic and wellbeing indicators (including the burden of health inequity) with the closes countries (geographically and with historical and cultural links) to Sudan:

Table 1 Comparative analysis with neighbouring countries

The above table shows how Sudan has a bio capacity between the two neighbour countries, Egypt and Chad, and economic power (estimated though GDP CV) lower than both. It uses natural resources (measured by the ecological footprint) at a rate lower than both. The level of life expectancy at birth is between the two neighbour countries.

Table 2 Comparative analysis with countries of similar natural and economic means

The countries with closest levels of GDP CV pcy (proxy of average income, subject to subnational inequities) and bio capacity pcy, are Burkina Faso and Ethiopia. Sudan has a life expectancy at birth between the two mentioned countries.

Table 3 Comparative analysis with the international average and the HRS reference indicators

The table above shows the relation of the ecologic, economic and health main indicators of Sudan with the international average and with the Healthy-Replicable-Sustainable standards.

It reveals that the bio capacity of Sudan is 68% of the world average, hence being replicable at global level. The ecological footprint of Sudan is 44% of the international average and 75% of the recycling threshold, hence ecologically sustainable. As regards the balance with its own natural resources, the ecological footprint of Sudan is 109% of its average bio capacity pcy, therefore it is non-sustainable at national level. The level of CO2 emissions pcy is 6% of the international level and 17% of the ethical threshold, therefore preventing global warming.

As regards the economic indicators, Sudans GDP CV pc is 7% of the international average (hence economically replicable) and 20% of the HRS reference. Its cumulative wealth pcy is 1% of the international average and 2% of the HRS reference.

In terms of health, the life expectancy in Sudan is 7.57 years below the international average (7.99 in women and 7.15 below in men) and 11.64 years below the HRS level (13.28 below in women and 10.00 below in men) with a proportional sex difference of 5.47%, lower than the world’s average.

## HRS indicators 1961-2020

### Ecologic indicators:

The following graphs represent the annual average levels of the nature’s recycling capacity in hectares pcy (bio cap), carbon emissions and ecological footprint in Sudan. These indicators are compared with the international average and the recycling threshold above which the level is not replicable (bio capacity pcy) or not sustainable (ecological and carbon footprints), leading to nature’s depletion and (in the case of CO2 emissions) global warming.

Figure 2 Bio capacity pcy vs. world average 1961-2020

Figure 3 Ecological footprint pcy vs world average and recycling threshold 1961-2020

Figure 4 CO2 emissions pcy vs world average and ethical threshold 1960-2020

As the graphs above show, Sudan has a bio capacity pcy replicable at global level, regarding its ecological footprint it is ecologically sustainable at global level and its present level of CO2 emissions is preventing global warming above 1.5 degrees during this century. The use of natural resources is however non-sustainable at national level.

### Economic indicators:

The graphs below the annual average levels of economic flows measured by GDP constant value (CV)(no data for Purchasing Power Parity (PPP) pcy)

Figure 5 GDP CV pcy vs international average, dignity and excess thresholds 1961-2020

The above figure shows the trend of the GDP CV pc in Sudan in relation with the levels of the international average, the HRS reference (below which no country in 60 years has achieved the feasible best level of health for all –hence named “dignity threshold”-) and the upper limit (symmetrical level above which wellbeing does not increase further while it hampers others’ reach of the dignity level and is not compatible with respecting planetary boundaries –hence named “excess threshold”-). The overall GDP of Sudan is $37044425441, *0.0453%* of the world’s GDP (while being *0.5487%* of the world’s population), which translates in GDP pc $779pcy, as mentioned above, 7% of the international average and 20% of the HRS reference.

 Figure 6 GDP PPP pcy vs equity thresholds 1986-2020

The graphs above show that the level of GDP CV and PPP pcy during the study period (1961-2020 for CV and 2000-2020 for PPP) in Sudan is replicable globally considering the level of global economic resources.

Figure 7 ODA flow pcy (provided/received) 1961-2020

Figure 8 Required ethical redistribution 1961-2020

Figure 9 ODA as percentage of required ethical redistribution

The figure above shows the levels of ODA pcy. In relation with reception from required international redistribution of $ 3132 pcy to enable global economic and health equity, Sudan received an annual average during 2016-2020 of $ 16.45 pcy ,0.53% of the level required.

### Health indicators:

The graphs below represent the level of life expectancy at birth evolving over time from 1961 until 2020, and comparing the levels of Sudan with those of the international average and the HRS reference.

Figure 10 Life expectancy by sex and time periods vs. international average and HRS reference, 1961-2020

The graph above shows the relation of life expectancy in Sudan, between 1961-2020; with the international average and the HRS reference. Such gap is today 7.99 below the international average in women and 7.15 below in men, and 13.28 years below in women and 10.00 below in men than the HRS reference.

Figure 11 Healthy life expectancy vs international average and HRS standard, 1996-2020

The estimates of the World Health Organization, of the healthy life expectancy (HALE), accounting for disability as well, reflect that the trend of HALE in Sudan, in relation with the international and HRS average. At present, the estimated level of healthy life expectancy in Sudan is 94% of the international average and 89% of the HRS level.

Figure 12 Life expectancy gap by sex, vs international average 1961-2020

Figure 13 LE % lower in men than in women, vs international average 1961-2020

What the graphs above show is the trend in the difference between life expectancy between men and women in Sudan. It stands today at 3.65 years lower in men, which is lower than the world % difference (at present some 6%).

## Burden of health inequity

### Burden vs. HRS reference:

As mentioned in the methodology, we selected the country (Sri Lanka) which has maintained the ecological sustainability, economic replicability and the health above average as the reference to compare mortality rates by sex, age group and time period and estimated, through adjust mortality rates the excess mortality from those feasible standards.

Figure 14 nBHiE ref HRS by sex and time period 1961-2020

The above graph represents the excess mortality in Sudan, (with 20% GDP CV pc of the HRS reference), that is, the net burden of health inequity (nBHiE). It increased from 1961 till 2000 and decreased slowly in the last two decades. It is today of 92876 annual excess deaths in women and 85996 in men, total of 178872 annual deaths above the globally feasible HRS standards.

Figure 15 nBHiE by sex and age group 2016-2020

The figure above shows how the excess mortality in reference to HRS levels is higher in under-fives, more in boys than in girls, and throughout all adult age groups.

Figure 16 rBHiE by sex and time period vs international average, 1961-2020

The share of all deaths that was in excess in Sudan when compared with the feasible mortality rates in the HRS reference, allows comparison in time and with other countries and the international reference as it is not influenced by the size and/or shape of the demographic pyramid. It evolved from 1961 and it is today of 66.98% in women and 53.40% in men.

Figure 17 rBHiE by sex and age group 2016-2020

The figure above shows how the excess mortality in the last 2016-2020 period is over 80% in under 5s, of 70-80% in women of 15 to 50 year old women, 60-70% in men from 15 to 40 years old, and lower in older age groups.

### Burden vs. best SEW reference:

While the minimum aspiration of feasible health for all is the HRS reference, which uses 40% of the world’s average resources per person, the comparison with the best level of sustainable and equitable wellbeing (see below), Costa Rica, challenges to higher levels of wellbeing within the equity curve and void of negative impact from excess income or CO2 emissions.

Figure 18 nBHiE ref best SEW, by sex and time period 1961-2020

The above figure reveals how the comparison of mortality rates by sex, age group and time period between Sudan and the best SEW reference (with 6.55% of its GDP CV pc). The trend reflects socioeconomic and ecologic conditions over the last 60 years in Sudan and in the best SEW country (Costa Rica). It decreased from year 2000 and stands today at 101205 in women and 105187 in men, totalling 206125 excess deaths (*0.9185%* of the world’s total burden ref. best SEW vs. being *0.5487%* of the population).

Figure 19 nBHiE vs best SEW reference by age and sex, 2016-2020

The above figure represents the age distribution of the excess mortality in reference to the best SEW reference. It reflects excess mortality children under 5, again more in boys than in girls, and in adult age groups, higher in 65-80 year old.

Figure 20 rBHiE by sex and time period vs international average, 1961-2020

The figure above shows the share of excess mortality ref. best SEW in relation to the total number of deaths, that is, the rBHiE. It decreased from 1991 until today’s level of 68.78% (174% of the world’s level-close to 40%-), 72.99% in women and 65.32% in men.

Figure 21rBHiE ref best SEW by sex and age group vs international average, 1916-2020

The above figure represents the age distribution of the share of excess mortality in reference to the best SEW reference and reveals share of excess deaths of 80-90% in under 15 year old, 70-80% in women from 15 to 55 years, around 60% in men of 15-49 years of Age and lower in older age groupos.

## Sustainable and Equitable Wellbeing (SEW) index

Figure LYL on others by excess emissions and excess income, 1961-2020

Figure 23Sustainable and equitable wellbeing index, 1961-2020

This last figure of our analysis of the equity profile in Sudan reveals the sustainable and equitable index, that is, the average life expectancy at birth after deducting the damage on other countries through excess income (in the present generations) and through excess CO2 emissions (in the coming generations). We estimated one week life lost per annual GDP pc 1000$ above the excess threshold and two life days lost per annual excess CO2 mTon above the ethical threshold[[6]](#footnote-6) [[7]](#footnote-7). With 0.00 impact through excess carbon emissions and 0.00 by excess income, it stands today at 64.88 life years, and ranks 120 in the world, 50 positions above the Human development Index (which does not limit CO2 emissions or excess GDP pc income).

In summary, the equity profile of Sudan, reveals that with 68% of the world average bio capacity pcy, its ecological footprint is 75% of the global recycling threshold (sustainable) and however 109% of its national recycling capacity (non-sustainable). The level of CO2 emissions pcy is 17% of the ethical threshold, therefore preventing global warming. Sudan ’s GDP CV pc is 7% of the international average and 20% of the HRS reference. Life expectancy is 7.57 years below the international average (7.99 in women and 7.15 below in men) with a proportional sex difference of 5.47% higher in women, lower than the world’s average. The present annual excess mortality in Sudan, in relation to HRS reference (feasible for all), is of 178872 (92876 in women and 85996 in men), meaning 60.19% of all deaths (66.98% in women and 53.40% in men). When compared with the best level of sustainable and equitable wellbeing, the present annual excess mortality rises to 206125, 68.78% of all deaths. The Sustainable and Equitable Wellbeing index, that is, life expectancy at birth after deducting the damage on other countries through excess income (in the present generations) and through excess CO2 emissions (in the coming generations) stands today at 64.88 life years, and ranks 120 in the world.

1. https://www.sciencedirect.com/science/article/pii/S0033350617301610 [↑](#footnote-ref-1)
2. https://oxfordre.com/publichealth/view/10.1093/acrefore/9780190632366.001.0001/acrefore-9780190632366-e-62?rskey=fNaAhA&result=2 [↑](#footnote-ref-2)
3. http://www.peah.it/2021/04/9658/ [↑](#footnote-ref-3)
4. From 1960-2010 the countries which met all criteria constantly were Albania, Armenia, Belize, Colombia, Costa Rica, Cuba, Grenada, Saint Lucia, Saint Vincent, Georgia, Paraguay, Sri Lanka, Tonga and Vietnam, from 1960-2015 they were reduced to Armenia, Colombia, Costa Rica, Paraguay, Sri- Lanka and Tonga and from 1960-2020 only Sri Lanka remains. [↑](#footnote-ref-4)
5. The country with best SEW index, within the equity curve is Costa Rica. [↑](#footnote-ref-5)
6. <http://www.peah.it/2021/04/9658/> [↑](#footnote-ref-6)
7. <http://www.peah.it/2018/07/5498/> [↑](#footnote-ref-7)