Methodology and Technical Notes

ChildFund Alliance World Index

2024 Edition

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This report outlines the methodology used to calculate the 2024 edition of ChildFund Alliance Index on Women's and Children's Rights (CFA World Index). The Index ranks 157 countries from 2015 to 2023 combining 30 different indicators. CFA World Index — together with the 3 sub-indexes *Context*, *Children* and *Women* — aims at inquiring the implementation of human rights for children and women at the country, regional area and world level.

We revised and improved the methodology introduced for the 2022 edition of WeWorld Index. Again, we track the absolute performance of territories and assess their strengths and weaknesses in each feature composing the Index. We calculate scores for 30 indicators, grouped in 15 dimensions, 3 sub-indexes and the overall index on an intuitive 0–100 scale, providing an absolute and relative benchmark with clear best and worst scenarios. In the following sections we detail the process followed to select data and compose the Index.

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1. Indicators selection

1.1. Data collection

The indicators are chosen to be part of the Index based on their relevance concerning Human Rights implementation from the perspective of children and women. To guarantee statistical integrity, we select indicators that lack as few observations as possible. Compared to the previous edition of the Index we changed 10 out of 30 indicators.[1]

Data for the 30 selected indicators come from various sources. We retrieved 26 indicators from the WorldBank database, the remainder directly from the source. For a detailed list of the indicators, their definitions and sources refer to Tables 2 to 4. All data used are the most recent available as of June 30, 2024.

1.2. Missing values imputation

Missing values imputation covers a key step in the calculation of the Index. The absence of data may be attributed to several factors, including a lack of coverage by the data source, incomplete reporting by the country to international organisations, or outdated data. On the one hand, one tries not to over-modify the available data sample, on the other hand, in order to obtain a composite index value, it is necessary to fill in all missing data.

We impute missing data before calculation, trying to balance the two objectives mentioned. The data sample to be used in the calculation for each territory and year (2015–2023) under consideration was determined as follows:

i. if present we take the original observation;
ii. if the observation is missing from the sample, a linear interpolation is performed to fill in the missing value from the neighbouring observations or, if also missing, the last available observation is propagated forward and backwards for a maximum of 5 years; [2]
iii. when a territory still lacks more than 6 indicators we exclude it from the calculation for the present year, otherwise the missing indicators are imputed from the area average for the indicator.[3]

1.3. Data transformations

Some transformations were necessary before normalising the indicators to the same scale. Some indicators needed either to be capped by setting a clear cut-off value or

[1] Specifically, we replaced indicators 2, 3, 4, 12, 14, 15, 21, 23, 26, 27. Indicator 13 is the old indicator 14.

[2] The interpolation is performed only in the presence of missing values preceded and followed by a valid observation. Example: if the data for 2018 and 2019 are present, but all subsequent data are missing, the last observation is simply propagated forward.

[3] Area averages are calculated by weighting the available data based on the population of each territory in the area.

to be transformed to reduce the effect of extreme values that may affect the normalisation. In this second scenario, we address skewed distributions using a log transformation or a square root transformation. This methodology allows us to retain the distinctive variations in performance between countries while creating a more balanced distribution that is less extreme.

1.3.1. Capped indicators

We impose a top cut-off on three indicators:

- indicator 2 is capped at 200 %;
- indicator 16 is capped at 10 %;
- indicator 24 is capped at 100 %.

We considered larger values of these indicators unrepresentative for aggregation purposes.

1.3.2. Log transformation

The logarithm transformation reduces the right side of the distribution when the indicator's range of values is wide or positively skewed. We transformed according to the following function indicators 1, 8, 11, 12, 19, 21, 30:

$$x' = \ln(x + 1) \tag{1}$$

where x is the raw data and x' is the transformed data. The addition of a positive constant ensures that we can take the logarithm of all values within the distribution, including zeros, while preserving almost the same relative differences between countries.

1.3.3. Square root transformation

Square root transformation has the same objective as the previous one, but has less impact on data distribution. It is important to note that these extreme values should not be considered erroneous, but preserved as a distinguishing feature of the countries they describe. We transformed according to the following function indicators 2, 20, 27 and 29:

$$x' = \sqrt{x} \tag{2}$$

where x is the raw data and x' is the transformed data.

2. Index calculation

2.1. Normalisation

All indicators are normalised using the min-max transformation with boundaries set at the indicator level. We establish these boundaries, reported in Table 5, in two possible ways:

- theoretical best and worst values;
- maximum and minimum values recorded across the time series from 2005 to 2023.

This type of normalisation allows for tracking the absolute trend and comparing territories not only within a single year but also over time.

In this manner, we can translate each indicator on a positively oriented 0–100 scale, according to the following transformations:

$$x' = \begin{cases} 100 \cdot \dfrac{x - x_{\min}}{x_{\max} - x_{\min}} & \text{, if } x \text{ is positively oriented} \\ 100 \cdot \left(1 - \dfrac{x - x_{\min}}{x_{\max} - x_{\min}}\right) & \text{, if } x \text{ is negatively oriented} \\ 100 \cdot \left(1 - \left|\dfrac{x - x_{\min}}{x_{\max} - x_{\min}}\right|\right) & \text{, if } x \text{ is double oriented} \end{cases} \tag{3}$$

where x is the indicator value, $x_{\min}$ and $x_{\max}$ are its normalisation boundaries and x' is the normalised indicator score.

2.2. Aggregation

The Index of each territory is computed by aggregating the indicators' scores in a hybrid fashion, which consists of three sub-steps of aggregation. First, we calculate the dimensions scores by taking the unweighted arithmetic mean of the two indicators within each dimension. Then, to avoid full compensability we employed the geometric mean cross dimensions and sub-indexes. In this way, a deficiency in one feature cannot be fully or partially compensated for by surpluses in another. Specifically, dimensions scores D_i, sub-indexes scores S_j and the final index I are computed as follows:

$$D_i = \frac{x_1 + x_2}{2} \tag{4a}$$

$$S_j = \sqrt[5]{D_1 \cdot D_2 \cdot D_3 \cdot D_4 \cdot D_5} \tag{4b}$$

$$I = \sqrt[3]{S_1 \cdot S_2 \cdot S_3} \tag{4c}$$

where x_1 and x_2 are the scores of the two indicators within each dimension, D_i is one of the five dimensions within each sub-index and S_j is one of the three sub-indexes that form the final index I of a territory.

2.3. Areas and world scores

To assess areas and world performance on the Index we first compute the population-weighted averages for each indicator; then, we aggregate these values with the same procedure outlined above for actual countries. All the countries for which we have data are taken into consideration to compute indicator values for areas and the world, even the ones excluded from the Index because of too many missing values. In this way, we obtain regional and world scores for each feature of the Index.

2.4. Human Rights Implementation Groups

To get an immediate overview of the performance of each territory we divide them into six tiers based on score s obtained in the Index according to the intervals reported in Table 1. We provide tiers for *Context*, *Children* and *Women* Sub-indexes scores as well. This division allows us to easily compare groups between years since the underlying scale remains the same.

Table 1: Intervals adopted to group territories.

Human Rights Implementation	Interval
Advanced	$s \geq 85$
Strong	$75 \leq s < 85$
Moderate	$65 \leq s < 75$
Basic	$55 \leq s < 65$
Minimal	$45 \leq s < 55$
Limited	$s < 45$

These tiers are employed in calculating the total children and women population in each group for every year taken into exam.

2.5. Years left

Comparing values calculated for the different time steps, we can assess a rough projection of the variation rate of the Index and the Sub-indexes at the world level. We compute the average variation rate between 2015 and 2023 and then assess the number of years still needed to reach a score value of 100 from the present situation.

It is important to note that this method assumes the variation rate as constant over time and, especially, cannot provide an estimate if the variation rate is negative.

3. Final remarks

The Index aims to assess the multifaceted aspects of women's and children's inclusion in society by evaluating the implementation of fundamental human rights across dif-

ferent territories. However, it is undoubtedly difficult to fully capture the complexity of these concepts for different reasons.

First of all the indicators we chose in many of the dimensions we try to grasp are not perfect and do not measure certain aspects of the phenomenon. It is therefore crucial to further investigate relationships and correlations among these indicators. Secondly, the arbitrary choices made in the normalisation and aggregation process determine the outcome. Lastly, country performance is ultimately dependent upon the quality and availability of data published by other sources.

Despite the mentioned weaknesses — common to all composite indices — the Index can serve as a reference to assess the relative performance of territories and identify specific areas of strength and weakness. Moreover, the scoring on a 0–100 scale, as opposed to the previously employed z-score normalisation, provides an intuitive benchmark to track over time relative and absolute variations of each of the features under consideration.

A. Indicators information

The following tables provide all the relevant data concerning definition, sources and normalisation process for the indicators employed in the construction of the Index.

Table 2: Indicators summary.

Sub-index	Dimension	Indicator	Name
Context	**Environment**	**1**	CO_2 emissions per capita
		2	Level of water stress
	Housing	**3**	People using safely managed drinking water services
		4	People using safely managed sanitation services
	Conflicts and wars	**5**	Global Peace Index
		6	Refugees per country of origin
	Democracy and safety	**7**	Global Democracy Index
		8	Intentional homicide rate
	Access to information	**9**	People with access to electricity
		10	Individuals using internet
Children	**Children's health**	**11**	Under-five mortality rate
		12	Adolescent mortality rate
	Children's education	**13**	Lower secondary completion rate
		14	Youth not in education, employment or training
	Children's human capital	**15**	People covered by at least one social protection benefit
		16	Government expenditure on education
	Children's economic capital	**17**	Unemployment rate
		18	Poverty headcount ratio at $6.85 a day (2017 PPP$)
	Violence against children	**19**	Children out of school
		20	Adolescent fertility rate
Women	**Women's health**	**21**	Lifetime risk of maternal death
		22	Life expectancy at birth, female
	Women's education	**23**	Educational attainment (upper secondary), female
		24	Tertiary school enrollment (gross), female
	Women's economic opportunities	**25**	Vulnerable employment, female
		26	Labor force participation rate
	Women's decision-making participation	**27**	Women in ministerial level position
		28	Women in senior and middle management positions
	Violence against women	**29**	Intimate partner violence, female
		30	Intentional homicide rate, female

Table 3: Indicators unit, update and source with link.

Indicator	Unit	Source	Last update
1	tonne	Climate Watch	2020
2	%	FAO	2020
3	%	UNICEF, WHO	2022
4	%	UNICEF, WHO	2022
5	score (5-1)	Vision of Humanity	2023
6	%	UNHCR	2023
7	score (0-10)	Economist Intelligent Unit	2022
8	per 100000 people	UNODC	2021
9	%	IEA, World Bank	2022
10	%	ITU	2022
11	per 1000 live births	UN IGME	2022
12	per 1000 people ages 15-19	UN IGME	2022
13	% of relevant age group	UNESCO	2023
14	% of youth population	ILO	2023
15	%	ILO	2023
16	% GDP	UNESCO	2023
17	%	ILO	2023
18	%	World Bank	2023
19	% of primary school age	UNESCO	2023
20	per 1000 women ages 15-19	UN Population Division	2022
21	%	WHO	2020
22	years	UN Population Division	2022
23	% of female ages 25+	UNESCO	2023
24	%	UNESCO	2023
25	% of female employment	World Bank, ILO	2022
26	female to male ratio (%)	World Bank, ILO	2023
27	%	Inter-Parliamentary Union	2022
28	%	ILO	2023
29	%	IHME	2023
30	per 100000 female	UNODC	2021

Table 4: Indicators definition.

Indicator	Definition
1	Carbon dioxide emissions are those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring.
2	Freshwater withdrawal as a proportion of available freshwater resources is the ratio between total freshwater withdrawn by all major sectors and total renewable freshwater resources, after taking into account environmental water requirements.
3	Percentage of people using drinking water from an improved source that is accessible on premises, available when needed and free from faecal and priority chemical contamination. Improved water sources include piped water, boreholes or tubewells, protected dug wells, protected springs, and packaged or delivered water.
4	Percentage of people using improved sanitation facilities that are not shared with other households and where excreta are safely disposed of in situ or transported and treated offsite. Improved sanitation facilities include flush/pour flush to piped sewer systems, septic tanks or pit latrines: ventilated improved pit latrines, compositing toilets or pit latrines with slabs.
5	Quantification of the absence of violence or the fear of violence to assess a nation's level of peace. This lack of violence is defined as Negative Peace. A higher GPI represents a higher level of violence in a country.
6	Refugees are people who are recognized as refugees under the 1951 Convention Relating to the Status of Refugees or its 1967 Protocol, the 1969 Organization of African Unity Convention Governing the Specific Aspects of Refugee Problems in Africa, people recognized as refugees in accordance with the UNHCR statute, people granted refugee-like humanitarian status, and people provided temporary protection. Asylum seekers are excluded. Country of origin generally refers to the nationality or country of citizenship of a claimant.
7	The Democracy Index is based on 60 indicators, grouped into five categories: electoral process and pluralism, civil liberties, functioning of government, political participation and political culture.
8	Intentional homicides are estimates of unlawful homicides purposely inflicted as a result of domestic disputes, interpersonal violence, violent conflicts over land resources, intergang violence over turf or control, and predatory violence and killing by armed groups. Intentional homicide does not include all intentional killing; the difference is usually in the organization of the killing.
9	Access to electricity is the percentage of population with access to electricity. Electrification data are collected from industry, national surveys and international sources
10	Internet users are individuals who have used the Internet (from any location) in the last 3 months. The Internet can be used via a computer, mobile phone, personal digital assistant, games machine, digital TV etc.
11	Under-five mortality rate is the probability per 1,000 that a newborn baby will die before reaching age five, if subject to age-specific mortality rates of the specified year.
12	Probability of dying between age 15-19 years of age expressed per 1,000 adolescents aged 15, if subject to age-specific mortality rates of the specified year.
13	Lower secondary education completion rate is measured as the gross intake ratio to the last grade of lower secondary education (general and pre-vocational). It is calculated as the number of new entrants in the last grade of lower secondary education, regardless of age, divided by the population at the entrance age for the last grade of lower secondary education.
14	Share of youth not in education, employment or training (NEET) is the proportion of young people who are not in education, employment, or training to the population of the corresponding age group: youth (ages 15 to 24); persons ages 15 to 29; or both age groups.
15	Share of the population effectively covered by a social protection system, including social protection floors such as child and maternity benefits, support for persons without a job, persons with disabilities, victims of work injuries and older persons.
16	General government expenditure on education (current, capital, and transfers) is expressed as a percentage of GDP. It includes expenditure funded by transfers from international sources to government. General government usually refers to local, regional and central governments.
17	Unemployment refers to the share of the labor force that is without work but available for and seeking employment. Definitions of labor force and unemployment differ by country.
18	Poverty headcount ratio at $6.85 a day is the percentage of the population living on less than $6.85 a day at 2017 international prices.
19	Children out of school are the percentage of primary-school-age children who are not enrolled in primary or secondary school. Children in the official primary age group that are in preprimary education should be considered out of school.
20	Adolescent fertility rate is the number of births per 1,000 women ages 15-19.
21	Life time risk of maternal death is the probability that a 15-year-old female will die eventually from a maternal cause assuming that current levels of fertility and mortality (including maternal mortality) do not change in the future, taking into account competing causes of death.
22	Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.
23	Percentage of population ages 25 and over that attained or completed upper secondary education.
24	Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Tertiary education, whether or not to an advanced research qualification, normally requires, as a minimum condition of admission, the successful completion of education at the secondary level.
25	Vulnerable employment is contributing family workers and own-account workers as a percentage of total employment.
26	Labor force participation rate is the proportion of the population ages 15 and older that is economically active: all people who supply labor for the production of goods and services during a specified period. Ratio of female to male labor force participation rate is calculated by dividing female labor force participation rate by male labor force participation rate and multiplying by 100.
27	Women in ministerial level positions is the proportion of women in ministerial or equivalent positions (including deputy prime ministers) in the government. Prime Ministers/Heads of Government are included when they hold ministerial portfolios. Vice-Presidents and heads of governmental or public agencies are excluded.
28	Female share of employment in managerial positions conveys the number of women in management as a percentage of employment in management. Employment in management is defined based on the International Standard Classification of Occupations.
29	Share of women, aged 15 years and older, who experienced physical or sexual violence from an intimate partner in the past year.
30	Intentional homicides, female are estimates of unlawful female homicides purposely inflicted as a result of domestic disputes, interpersonal violence, violent conflicts over land resources, intergang violence over turf or control, and predatory violence and killing by armed groups. Intentional homicide does not include all intentional killing; the difference is usually in the organization of the killing.

Table 5: Specifications for the normalisation of indicators.

Indicator	Inverted	Best type	Worst type	Best value	Worst value	Transformation	Capped
1	yes	best	worst	0.0216	45.9	log	no
2	yes	best	theoretical	0.0272	200	sqrt	yes
3	no	theoretical	worst	100	3		no
4	no	theoretical	worst	100	1.45		no
5	yes	theoretical	theoretical	1	5		no
6	yes	best	worst	7.75e-06	34.8	log	no
7	no	theoretical	theoretical	10	0		no
8	yes	best	worst	0	108	log	no
9	no	theoretical	worst	100	0.792		no
10	no	theoretical	worst	100	0		no
11	yes	best	worst	1.88	198	log	no
12	yes	best	worst	0.792	40.8	log	no
13	double	theoretical parity	worst	100	6.74		no
14	yes	theoretical	worst	0	69.3		no
15	no	theoretical	worst	100	0.891		no
16	no	theoretical	worst	10	0.126	log	yes
17	yes	theoretical	worst	0	37.7		no
18	yes	theoretical	worst	0	99.2		no
19	yes	theoretical	worst	0	65	log	no
20	yes	best	worst	0.867	206	sqrt	no
21	yes	best	worst	0.00149	9.11	log	no
22	no	best	worst	88.6	42.9		no
23	no	theoretical	worst	100	0		no
24	no	theoretical	worst	100	0.174		yes
25	yes	theoretical	worst	0	99.4		no
26	double	theoretical parity	worst	100	6.92		no
27	double	theoretical parity	worst	50	0	sqrt	no
28	double	theoretical parity	worst	50	1.18		no
29	yes	best	worst	2.36	51.7	sqrt	no
30	yes	best	worst	0	19.8	log	no

B. Descriptive statistics of the Index

The following table provides for each feature of the Index descriptive statistics based on the sample of all countries over 2015–2023, consisting of 1458 total counts.

Table 6: Descriptive statistics for each feature of the Index.

	Mean	Standard deviation	Minimum	Maximum
CFA World Index	62.5	16.6	23.1	91.3
Context Sub-index	64.8	14.8	22.3	92.7
Children Sub-index	63.6	18.1	25.3	93.9
Women Sub-index	59.9	18.3	19.3	91.1
Environment	68.3	18.8	4.69	98.6
Housing	57.6	28.8	5.72	100
Conflicts and wars	85.1	9.39	31.9	97.7
Democracy and safety	61.6	15.9	24.1	95.3
Access to information	71.4	25.7	3.52	99.8
Children's health	63.4	21.4	15.3	96.7
Children's education	72.3	16.9	27.8	97.4
Children's human capital	56.6	20	17.8	95.4
Children's economic capital	70.5	18.5	24.5	97.7
Violence against children	60.5	20.8	9.24	97.5
Women's health	77.3	18.6	15.2	97.4
Women's education	46.6	28.5	1.9	97.4
Women's economic opportunities	64.4	17.7	12.3	93.2
Women's decision-making participation	60.8	17.1	3.4	95.6
Violence against women	68.3	14.1	31.8	97.1