

Development inequalities from a broader perspective: a proposed index











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Economic and Social Commission for Western Asia

Development inequalities from a broader perspective: a proposed index



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Key messages

- Development inequalities have emerged as a critical challenge of our times. A proper, comprehensive framework is thus needed to measure them.
- The Development Inequalities Index (DII) encompasses the basic human development inequalities, economic livelihood inequalities, environmental inequalities and governance inequalities. Both vertical and horizontal (gender) inequalities – of both outcomes and opportunities – at different stages of individuals' lives are included.
- DII provides meaningful insight regarding countries' developmental experience beyond income inequality measures and DCI scores.
- Results show governance inequalities are the primary source of inequalities for most countries worldwide, even as environmental and human development inequalities dominate in a handful of countries.

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Introduction

Income distribution provides only a partial and unidimensional view of the inequality in human experiences. Overlapping deprivations and inequalities in other fundamental social and political capabilities require a multidimensional analytical framework that aims, following Sen,¹ at enhancing equity in broader human capabilities and self-realization. This framework is not concerned merely with the desirability of equality, but also with the set of dimensions along which it is sought. In other words, the relevant question is equality of what?²

In this paper, we introduce a novel multidimensional inequality measurement as a tool for global and regional policy advocacy and national policymaking. The aim is to go beyond using inequality as a factor to discount human development achievements in health, education and income and propose a new Development Inequalities Index (DII) that regards social inequalities as a distinct societal challenge, and inequality reduction, as noted by Sen, as a worthy development end goal of its own. DII transcends existing treatments by imposing a structure on the analysis of multidimensional inequalities – isolating horizontal and vertical inequalities in human development, environmental sustainability and governance – and reflecting their cumulative burden through an aggregation approach. The DII framework is an extension of the Development Challenges Index (DCI) developed by ESCWA and aims to go beyond considering only the average shortfalls in achievements to addressing multidimensional inequalities.

The paper is structured as follows: section 1 reviews the extant literature and builds the analytical framework to make the case for our proposed DII; section 2 describes the structure of DII; section 3 presents the main findings, focusing on the regional and global results; and section 4 provides a brief conclusion. Statistical robustness and sensitivity tests as well as country-level results are provided in the annex.

1 As described in Comim, F., Qizilbash, M. and Alkire, S. (2008). The capability approach: Concepts, measures and applications.

2 United Nations Economic and Social Commission for Western Asia (ESCWA) (2019). Rethinking Inequality in Arab Countries.

1. Analytical framework

Since the introduction of the Human Development Index (HDI) in 1990, efforts have been made to move beyond income inequality by introducing measures of the inclusivity of development across various social indicators. The argument is that, just as income growth can be hampered by extreme inequality, improvements in any domain including health, education, environmental sustainability and governance can be held back or made less effective by increasing inequalities. As the 2019 Human Development Report lamented, despite progress in the various dimensions of human development, many people have been left behind and inequalities remain widespread across most capabilities.³ The ESCWA World Development Challenges Report⁴ introduced the Development Challenges Index which revealed that there are still significant shortfalls from achievements in three key areas - qualityadjusted human development, environmental sustainability and governance. This underscores a need to study the distribution and the degree of inequality in these areas. The COVID-19 pandemic has further exacerbated deprivations and inequalities, not only in health and education access, but also critically in the areas of income, wealth and access to livelihood opportunities.

Certain forms of inequalities of course matter more to some societies at some points in time than others. For example, gender-based inequality is among the largest development challenges in many Arab countries despite progress over the last two decades. The International Labour Organization estimates that women still earn around 20 per cent less than men globally.⁵ We believe that inequality measurement should include both vertical inequalities (between differently situated individuals or households) and horizontal inequalities (between distinct groups based on race, gender, urban-rural residence, religion or other characteristics). Within horizontal inequalities, in several cases we highlight gender gaps, since they are found to be large across many dimensions of socioeconomic attainment. The fact all countries have similar proportions of males and females in their populations at near 50 per cent each underpins the significance and cross-country comparability of gender gaps.

Socioeconomic inequalities (vertical and horizontal) have emerged as a leading challenge to human development achievements

³ United Nations Development Programme (UNDP) (2019). Human Development Report.

⁴ ESCWA (2022). World Development Challenges Report. Available at https://www.unescwa.org/publications/world-developmentchallenges-broader-lens.

⁵ International Labour Organization (ILO) (2020). Women in Business and Management: Understanding the gender pay gap.

and sustainable growth.⁶ Inequalities in opportunities, in particular, play an important role in curtailing and discouraging some individuals' lifetime achievements.

Inequality in opportunities has to do with the initial conditions that give some individuals and groups more advantageous positions in their lives and careers, leading to a divergence in fundamental outcomes such as life expectancy and access to basic services such as healthcare, education, and water, sanitation and hygiene (WASH). Such initial conditions can also violate individuals' human rights by exposing them to discrimination, abuse or lack of access to justice.⁷ Inequality in outcomes can result from inequality in efforts or luck, but crucially also from inequality in initial endowments and constrained socioeconomic mobility.

Consistent with Sen's capability approach, overcoming inequalities in opportunities is fundamental to achieving human development goals. Inequalities in opportunities are among the constraints on people's choices and freedoms. A growing consensus holds that societies seeking social and economic justice, or equity in living standards, should promote equality in opportunities by compensating for inequalities arising from circumstances beyond individuals' control. Simultaneously, societies should let individuals bear the consequences of choices or efforts within their control while recognizing that not all people convert outcomes into well-being in the same way.⁸ Any level of inequality in outcomes is viewed as more acceptable if it is reached from a level playing field offering ample opportunities for personal advancement.

Inequalities in opportunities and outcomes are interrelated, as living standards where individuals are born can affect their future economic participation, their luck and their outcomes, which in turn can affect their children's opportunities.9 Individuals' childhood outcomes also translate into opportunities in adulthood, and efforts exerted at various points in life have complementary effects on each other's lifetime impacts. The association is thus bidirectional and complex. The best way to reduce future inequalities in opportunities is to address inequalities in outcomes today.¹⁰ In this paper we treat inequalities in both outcomes and opportunities as fundamental for analysing human development.

On the measurement side, several approaches have previously been advanced to quantify the multiple facets of socioeconomic inequality.¹¹ For instance, the Gender Inequality Index of the United Nations Development Programme (UNDP) measures the loss in achievements as a result of gender disparities in the dimensions of

- 7 United Nations (2021). Inequality Bridging the Divide.
- 8 Adriana Conconi and Mariana Viollaz (2018). In The Age of Perplexity: Rethinking the World We Knew.
- 9 Ragui Assaad and others (2017). Inequality of Opportunity in Wages and Consumption in Egypt.
- 10 Atkinson, A. B. (2015). Inequality. In *Inequality*. Harvard University Press.
- 11 See for example Alberti, V. and others (2021). Monitoring multidimensional inequalities in the EU. Publications Office of the European Union, Luxembourg; and OECD (2018). A broken social elevator? How to promote social mobility.

⁶ See for example Stiglitz, Joseph E. (2012). The Price of Inequality: How Today's Divided Society Endangers our Future, 1st edition. New York: W. W. Norton & Company; Oxfam (2014). Time to end extreme inequality; Piketty, Thomas (2014). Capital in the Twenty-first Century. Cambridge, MA: Harvard University Press; Atkinson, Anthony B. (2015). Inequality What Can Be Done? Cambridge: Harvard University Press; OECD (2015). In it together: Why less inequality benefits all. OECD publishing; World Bank (2016). Poverty and shared prosperity 2016: taking on inequality. The World Bank; IMF (2017). Fiscal Monitor, October 2017: Tackling Inequality. International Monetary Fund.

health, empowerment and labour market activity. Other indices focus on achievement gaps in health and education, either between geographic regions or between the rich and the poor. The Health Equity Monitor of the World Health Organization (WHO)¹² uses health data disaggregated by relevant inequality dimensions (i.e. demographic, socioeconomic or geographical factors) in order to identify who is being left behind. Likewise, Gini indices of inequality in educational attainment across various groups have been estimated.13 In relation to the multidimensionality of inequality, the UNDP inequality-adjusted human development index (IHDI) measures joint inequalities in health, education and income. Other studies have focused on inequalities in outcomes and opportunities across a wide range of health and education indicators.¹⁴ Some have also advocated for the use of a dashboard of indicators for inequalities in health, education, environmental sustainability and governance – for example the Organisation for Economic Co-operation and Development's Framework for Measuring Well-Being and Progress¹⁵ or the European Union's Multidimensional Inequality Monitoring Framework.¹⁶

We build on this body of knowledge by proposing a Development Inequalities Index (DII) composed of three equally weighted pillars: inequalities in basic human development, inequalities in environmental sustainability and inequalities in governance, encompassing eighteen inequality indicators in total. The resulting index has a structure and components with a natural interpretation and theoretical grounding based on the Development Challenges Index.¹⁷ Specific indicators were chosen based on their theoretical relevance, consistency with the well-validated Development Challenges Index, and empirical accuracy and coverage.

The basic human development inequalities pillar is made up of three key human development dimensions capturing health, education, and income and financial inclusion inequalities. The second pillar, environmental inequalities, comprises two subdimensions, carbon emissions inequalities and environmental health inequalities. The final pillar, governance inequalities, consists of three subdimensions: inequalities in civil liberties, inequalities in power distribution and inequalities in participation. DII thus captures both vertical and horizontal inequalities at various stages of individuals' lives, and contains elements of both inequalities in outcomes and opportunities. It can be thought of as a crosscutting summary of the experience of diverse socioeconomic groups at different points in their lives. The Index pinpoints the domains of particular importance for countries in various development phases.

17 ESCWA (2022). World Development Challenges Report. Available at https://www.unescwa.org/publications/world-developmentchallenges-broader-lens.

¹² World Health Organization (2022). Inequality monitoring in sexual, reproductive, maternal, newborn, child and adolescent health: a step-by-step manual.

¹³ Thomas, V., Wang, Y. and Fan, X. (2001). Measuring education inequality: Gini coefficients of education (vol. 2525). World Bank Publications.

¹⁴ See for example ESCWA and Economic Research Forum (ERF) (2019). Rethinking Inequality in Arab Countries.

¹⁵ Durand, M. (2015). The OECD better life initiative: How's life? and the measurement of well-being. Review of Income and Wealth, 61(1), 4–17.

¹⁶ Alberti, V. and others (2021). Monitoring multidimensional inequalities in the European Union. Publications Office of the European Union, Luxembourg.

A. Inequalities in human development

In the domain of human development inequalities, we focus on the aspects of well-being captured by the three HDI dimensions: health, education, and income and financial inclusion. First, most countries have witnessed significant improvements in health outcomes, yet inequalities persist. For instance, life expectancy is strongly associated with socioeconomic status. Individuals born into rich families have higher life expectancies than those born into poor families, who are more likely to be affected by undernourishment during the early stages of life and an unhealthier environment during childhood such as inferior air quality and living conditions at home, a less healthy diet and lower access to preventive and curative medical services.¹⁸

Horizontal inequalities in health are also substantial. Infant mortality is higher among boys than girls in most parts of the world. This has been explained by sex differences in genetic and biological makeup, with young boys being biologically weaker and more susceptible to diseases and premature death.¹⁹ On the other hand, social and cultural factors in some countries act to favour boys compared to girls in terms of children's nutrition, health and developmental outcomes. Inequalities in health outcomes between urban and rural areas are also stark in many countries, albeit countries differ in their urbanization shares, so these gaps are not covered by DII.

In access to education, years of schooling and the attainment of education and quality learning, where global progress has been made, many countries exhibit large domestic gaps. Education is an essential human right that countries have committed to supporting since they signed the 1948 Universal Declaration of Human Rights. Education is also a key driver for attaining most of the Sustainable Development Goals by 2030, in the areas of gender equality, healthy families, poverty reduction, sustainable consumption, resilient cities and peaceful societies. Yet for education to have a positive impact in advancing these goals, it is necessary to first ensure equality in opportunity for learning.²⁰

Gender gaps in education are usually at the expense of girls, even though some countries see boys at a disadvantage. Despite progress, more girls than boys remain out of school. Of today's girls, 16 million will never access education. Among adults, women account for two thirds of the 750 million individuals lacking basic literacy skills.²¹ Just two in three countries have achieved gender parity in primary education enrolment, one in two countries in lower secondary enrolment, and one in four in upper secondary enrolment. Beside this poor worldwide record at providing access to education to girls, another quarter of countries have a disparity against boys in upper secondary enrolment, with no change since 2000.22

¹⁸ Amparo Castelló-Climent and Rafael Doménech, R. (2008). Human capital inequality, life expectancy and economic growth.

¹⁹ Roland Pongou (2013). Why is infant mortality higher in boys than in girls? A new hypothesis based on preconception environment and evidence from a large sample of twins.

²⁰ Manos Antoninis and others (2016). Inequality in education: the challenge of measurement.

²¹ United Nations Educational, Scientific and Cultural Organization (UNESCO) (2021). Education and gender equality.

²² United Nations Educational, Scientific and Cultural Organization (UNESCO) (2019). Global Education Monitoring Report – Gender Report: Building bridges for gender equality.

Finally, income and wealth differences between socioeconomic classes and between genders remain substantial. Since the 1990s, income inequality has risen in many developed and middle-income countries.²³ Even though some countries have seen improvements since the turn of the century and over a billion people have been lifted out of extreme poverty, income remains increasingly concentrated at the top. The world's richest 10 per cent currently take home 52 per cent of global income. The poorest half of the global population earn a measly 8 per cent.²⁴

Gender inequalities of income are also quite stark. On average, women's gross national income (GNI) per capita is \$10,000 less than that of men – \$24,458 for men compared to \$14,441 for women.²⁵ Informally employed women earn on average only 47 per cent as much as informally employed men.²⁶ In the formal sector, women earn only 79 per cent as much as men.²⁷ Of all world regions, this income gender gap is the largest in Arab and South Asian countries. Horizontal gender gaps combined with vertical inequality and low minimum incomes lead to particularly large gaps between the highestskilled men and elementary-skilled women.

Turning to wealth inequality, global trends over the past decades reveal that multimillionaires have seized a disproportionate share of the growth in global private wealth. The wealthiest 1 per cent of individuals have captured 38 per cent of all additional private wealth accumulated since the mid-1990s, whereas the bottom 50 per cent have captured just 2 per cent of it.²⁸ In the Arab region, the real wealth of the region's 37 billionaires in 2020 was equivalent to the real wealth of the region's poorest 110 million adults, or 46 per cent of the region's adult population.²⁹

Wealth inequality has social and political ramifications. Rising inequality has created discontent, deepened political divisions and may even catalyse violent conflict.³⁰ As economically privileged groups accrue political power and thereby manage to hoard socioeconomic and political opportunities and ally against the less advantaged, social mobility and democratization are also reduced.³¹

Gender inequality is also evident in wealth through differences between the two genders in access to financial services, such as bank account ownership. Women are more likely than men to be unbanked. This is the case even in economies that have successfully increased bank account ownership and have a small share of unbanked adults.³² In 2021, there was a gender gap in global account ownership of 4 percentage points, with 78 per cent of men owning an account compared to only 74 per cent of women. In developing economies, 74 per cent of men but only 68 per cent of women owned an account

²³ United Nations Department of Economic and Social Affairs (DESA) (2020). World Social Report.

²⁴ World Inequality Lab, World Inequality Report 2022, 2021.

²⁵ ESCWA calculations based on data from UNDP Human Development Report (2020).

²⁶ International Labour Organization (2021). Global wage report 2020–21: Wages and minimum wages in the time of COVID-19.

²⁷ Ibid.

²⁸ World Inequality Lab, World Inequality Report 2021, 2022.

²⁹ Khalid Abu-Ismail and Vladimir Hlasny (2020). Wealth Inequality and Closing the Poverty Gap in Arab Countries.

³⁰ United Nations Development Programme (UNDP) (2019). Human Development Report.

³¹ Ibid.

³² Ibid.

in 2021, indicating an even broader average gap of 6 percentage points.³³

B. Inequalities in environmental sustainability

In the sphere of environmental inequalities, we look at vertical inequalities in carbon emissions and horizontal inequalities in environmental health.

In 1990, people living in developed countries polluted more than the rest of the world and within county inequalities were on average lower worldwide than nowadays. In fact, most global carbon inequality (63 per cent) was due to differences between countries.³⁴ However, 30 years later, the situation has changed and within-country emissions inequalities now account for almost two thirds of inequality in global emissions, outstripping between-country inequalities and bringing large implications for the world's climate strategies.³⁵ Moreover, in several rich countries, the poorest half of the population's per capita emissions have decreased since 1990, unlike emissions of wealthier groups. In fact, the current level of emissions of the poorest half of the population are close to per-capita 2030 climate targets in Germany, France, the United States and the United Kingdom. In these countries, policies

should aim to lower emission levels of the top half of the population and especially the top 10 per cent.³⁶ This is also the case for low income and developing countries; although they will see some population groups' emissions levels increase in the following years, they should focus their efforts on reducing the emissions of the wealthiest.³⁷

For environmental health inequalities, we focus on gender inequalities in exposure to air pollution and inadequate water, sanitation and hygiene. Air pollution has been discussed in developmental literature mostly in relation to climate change. However, it also impacts individuals' health, capabilities and achievements. Globally, both ambient air pollution and household air pollution have been described as major environmental risk factors posing significant hazards to human well-being. According to WHO, almost all of the global population (99 per cent) inhale polluted air.³⁸

Global estimates hold that air pollution accounts for 7 million premature deaths worldwide with a higher mortality rate for men.³⁹ Household air pollution alone, by contrast, affects women more, since women are the primary caregivers and in most countries are responsible for preparing meals. This pollution presents major acute and chronic health risks, causing around four million global deaths annually with the

³³ Demirgüç-Kunt, A. and others (2022). The Global Findex Database 2021: Financial inclusion, digital payments, and resilience in the age of COVID-19. World Bank Group.

³⁴ Chancel, L. and others (2022). World Inequality Report 2022, World Inequality Lab. Available at https://wir2022.wid.world/www-site/uploads/2022/03/0098-21_WIL_RIM_RAPPORT_A4.pdf.

³⁵ Ibid.

³⁶ UNDP (2021). How large are inequalities in global carbon emissions – and what to do about it? Available at https://hdr.undp.org/content/how-large-are-inequalities-global-carbon-emissions-and-what-do-about-it.

³⁷ Ibid.

³⁸ WHO (2022). Air quality database. Available at https://www.who.int/publications/m/item/who-air-quality-database-2022.

³⁹ Dhimal, M. and others (2021). Impact of air pollution on global burden of disease in 2019. Processes, 9(10), 1719.

mortality rate of women around 50 per cent higher than men.⁴⁰

Gender inequalities also exist in access to water, sanitation and hygiene. Despite constant investments throughout the years and ongoing improvements, these factors remain a major global risk factor for disease contraction, incapacitation and premature death. Lack of access disproportionally affects women and girls, due to biological as well as cultural factors. Women face a higher risk of contracting diseases and illnesses associated with poor menstrual hygiene when clean water and toilets are unavailable.⁴¹ Absence of safe drinking water and sanitation during child delivery also endangers the health of mothers and newborns.⁴² Therefore, improving access to water, sanitation and hygiene and providing expectant mothers with basic services and awareness of the importance of hygiene is vital in order to reduce maternal mortality rates and meet goals to end avoidable child deaths.43

C. Inequalities in good governance

In the sphere of governance inequalities, we focus on three dimensions: inequalities in civil liberties, inequalities in power distribution and inequalities in participation. Large inequalities endure in individuals' ability to exercise civil liberties. Civil liberties include but are not limited to access to justice, private property rights, freedom of movement and freedom from forced labour. These liberties interact with social class in countries worldwide as poverty is associated with the erosion of civil and political rights and liberties. Many social groups based on language, ethnicity, religion, race or caste also face restrictions in their civil liberties as compared to other more privileged groups.

Societies also suffer from inequalities in power distribution. In fact, there is a strong correlation between political inclusion across social groups and levels of income.44 Exclusion due to socioeconomic status has continuously grown since the 1970s.⁴⁵ For instance, the Varieties of Democracy data on power distribution by socioeconomic position reveals that in all countries wealthy people have a very strong hold on political power, while people of average and lower incomes have substantially less influence. Liberal democracies are typically better than other political regimes at guaranteeing the capacity of all groups to influence the political process, including women and people in different socioeconomic positions. However, even in democracies, groups such as women, minorities and the poor

- 43 World Bank (2012). World development report on gender equality and development.
- 44 Lührmann, A. and others (2017). Democracy at Dusk?
- 45 Lührmann, Anna and others (2018). V-Dem Annual Democracy Report 2018. Democracy Facing Global Challenges. V-Dem Institute, University of Gothenburg.

⁴⁰ WHO (2018). Household air pollution and health. Available at https://www.who.int/news-room/fact-sheets/detail/household-air-pollution-and-health.

⁴¹ Mahon, T., Fernandes, M. (2010). "Menstrual hygiene in South Asia: a neglected issue for WASH (water, sanitation and hygiene) programmes" (PDF). Gender & Development. 18 (1): 99–113. doi:10.1080/13552071003600083. ISSN 1355-2074. S2CID 70965338.

⁴² Ali, T. and others (2006). Frequency and determinants of vaginal infection in postpartum period: A cross-sectional survey from low socioeconomic settlements, Karachi, Pakistan, J. Pak Med Assoc, No. 56, pp. 99–103. See also: Darmstadt, G. and others (2009). Impact of clean delivery-kit use on newborn umbilical cord and maternal puerperal infections in Egypt, J. Health Popul Nutr, vol. 27, No. 6, pp. 746–54.

are systematically disadvantaged in their access to political power. This political exclusion reduces the degree of liberal and electoral democratic rights and freedoms in countries.⁴⁶

Finally, inequalities also exist in political participation. Groups that are disadvantaged socioeconomically are more likely to be underrepresented in national governments. For instance, Giger and others (2012)⁴⁷ find that in western democracies, relatively poorer citizens are underrepresented by parties and ruling governments. This underrepresentation applies to women as well, who not only suffer from restricted liberties and limited political power in some countries, but are also often denied access to public services, jobs and business opportunities.

⁴⁶ Lührmann, Anna and others (2018). V-Dem Annual Democracy Report 2018. Democracy Facing Global Challenges. V-Dem Institute, University of Gothenburg.

⁴⁷ Giger, N., Rosset, J., and Bernauer, J. (2012). The poor political representation of the poor in a comparative perspective. Representation, 48(1), 47–61.

2. Methodology and data sources

Based on the three areas of inequality introduced in the previous section, table 1 presents the entire framework of the proposed DII, including its pillars, dimensions and individual indicators, and how they are combined into a single index.

The human development inequalities pillar is the weighted average of indicators over three dimensions: health inequalities, education inequalities and income and financial inclusion inequalities. The health inequalities dimension is the simple average of two standardized indicators: (horizontal) gender inequality in mortality rates of children under the age of 5, and (vertical) inequality in life expectancy in the population. The former proxies for inequality in early-life opportunities for healthy living, and the latter measures health outcomes as a function of cumulative health experiences throughout people's lifetimes. The former is calculated by taking the absolute value of the difference between the mortality rates of girls and boys under the age of 5, while the latter is taken from IHDI data.

The education inequalities dimension is the simple average of two standardized indicators: (horizontal) gender gap in expected and actual educational attainment, and (vertical) inequality in educational attainment. The former consists of two gender-gap indicators: the standardized difference (in absolute value) between female and male expected years of schooling, and between female and male actual years of schooling. These indicators (with weights of 1/36 each) proxy for inequality in expected opportunities and inequality in actual educational outcomes, and are taken from IDHI data. The third, vertical inequality indicator (with a weight of 1/18) stands for vertical inequality of outcomes, and is taken from IDHI data.

The income and financial inclusion inequalities dimension is a simple average of standardized indicators over two sub-dimensions: (1) income inequalities, which is the simple average of (horizontal) gender inequality in income and vertical inequality in income, and (2) financial inclusion inequalities, which is the simple average of (horizontal) gender inequality in bank account ownership and Gini index of (vertical) wealth inequality. Income inequalities stand for inequalities in economic outcomes, while bank account and wealth inequalities stand for inequalities in opportunities for financial access and economic mobility. Gender inequality in income is calculated as the difference in absolute value between the natural logarithm of the estimated female GNI and male GNI per capita, while vertical inequality in income is taken directly from IHDI data. Gender inequality in account ownership is calculated as the difference in absolute value between the shares of females and males who report having an account at a bank or another type of financial institution or report personally using mobile money services in the past year.⁴⁸ Lastly, wealth Gini is computed using data on mean and median personal wealth under an assumed

lognormal distribution. The wealth Gini coefficient is calculated by the formula $\Phi(u) \ge 2$ – 1 where Φ is the standard normal cumulative distribution function with mean 0 and standard deviation 1, and u is the square root of the natural logarithm of the ratio of mean wealth to median wealth. The data for mean and median wealth per adult are taken from the Credit Suisse Research Institute's 2021 Global Wealth Databook. Our wealth Gini coefficient has a minimum value of 0.41 and a maximum value of 0.92.⁴⁹ Health, education and income data were taken from the UNDP Human Development Reports (UNDP HDR) data centre,⁵⁰ with the exception of female and male mortality rates under the age of 5 which come from WHO.⁵¹ Data on bank account ownership are taken from the Global Findex Database 2021 of the World Bank.⁵² These are standard sources of internationally comparable statistics on social development, whose values have been validated, and which have nearuniversal coverage for countries worldwide for two points in time (2010 and 2020).

Pillar (weight)	Dimension (weight)	Indicator (weight)
	Health inequalities $(1/9)$	Gender inequality in under 5 mortalities (1/18)
	neatti mequantes (1/3)	(Atkinson) Inequality in life expectancy (1/18)
		Gender inequality in expected years of schooling (1/36)
Human development	Education inequalities (1/9)	Gender inequality in mean years of schooling (1/36)
		(Atkinson) Inequality in education (1/18)
		Gender inequality in GNI per capita (1/36)
	Income and financial inclusion	(Atkinson) Inequality in income (1/36)
	inequalities (1/9)	Gender inequality in bank account ownership (1/36)
		Wealth Gini coefficient (1/36)

Table 1. Composition of the Development Inequalities Index

⁴⁹ This approximation is viewed as more consistent, and is available for more country-year observations, than the Gini coefficient estimated by Credit Suisse Research Institute (2021), which ranges from 0.31 to 1.11.

⁵⁰ See https://hdr.undp.org/data-center.

⁵¹ See https://www.who.int/data/gho/data/themes/topics/topic-details/GH0/child-mortality-and-causes-of-death.

⁵² See https://www.worldbank.org/en/publication/globalfindex/Data.

Pillar (weight)	Dimension (weight)	Indicator (weight)				
	Climate change inequalities (1/6)	Inequality in CO2 emissions (1/6)				
Environmental inequalities (1/3)	Environmental health	Gender inequality in mortalities attributed to air pollution (1/12)				
	inequalities (1/6)	Gender inequality in mortalities attribute to lack of WASH (1/12)				
	Inequalities in civil liberties	Social group equality in respect for civil liberties (1/18)				
	(1/9)	Social class equality in respect for civil liberties (1/18)				
Governance inequalities (1/3)	Inequalities in nower	Power distributed by social group (1/18)				
	distribution (1/9)	Power distributed by socioeconomic position (1/18)				
	Inequalities in participation	Representation of disadvantaged social groups (1/18)				
	(1/3)	Exclusion by gender (1/18)				

The environmental inequalities pillar is the weighted average of two dimensions: climate change inequalities which includes one indicators on vertical inequality in CO₂ emissions (ratio of top 10 per cent's share to bottom 50 per cent's share of CO₂ emissions), and environmental health inequalities which includes two indicators on gender inequality in air pollution-related deaths and gender inequality in WASH-related deaths (the standardized difference, in absolute value, between female and male mortality rates attributed to household and ambient air pollution, and between female and male mortality rates attributed to unsafe water and

The governance inequalities pillar is the weighted average of indicators over three dimensions: inequalities in civil liberties, inequalities in power distribution and inequalities in political participation. The inequalities in civil liberties dimension is the simple average of two standardized indicators: social group equality in respect for civil liberties and social class equality in respect for civil

sanitation and lack of hygiene). The inequalities in CO₂ emissions indicator was taken from the World Inequality database,⁵³ while the two environmental health indicators were taken from the WHO Global Health Observatory.⁵⁴

⁵³ See https://wid.world/data/.

⁵⁴ See https://www.who.int/data/gho/data/indicators.

liberties. The inequalities in power distribution dimension is the simple average of two standardized indicators: power distribution by social group and power distribution by individuals' socioeconomic position. The third dimension, inequalities in participation, is the simple average of two standardized indicators: representation of disadvantaged social groups and exclusion by gender. Data for all of the governance indicators were taken from the Varieties of Democracy database.

DII applies equal weighting to the three pillars, the underlying dimensions in each pillar, and the two types of inequalities within each dimension (when applicable), and the indicators within each type of inequality (also when applicable).

Minimum and maximum values for all inequality indicators are reported in table 2.

Starting with the raw data on inequalities, all indicators were standardized using a min-max transformation:

$$\frac{value - min}{max - min}$$

The min and max values were selected based on the smoothed Kernel distribution of the observed frequencies of the indicators. For instance, if the Kernel distribution shows several outliers represented by a long tail, we truncated the data to generate a less skewed distribution. As with HDI and DCI, DII and its related sub-indices are reported on a scale from 0 to 1, with 1 representing maximum degree of inequality. Some values were subtracted from 1 to measure inequalities rather than equalities (which was the case with most of the governance indicators).

Indicator	Minimum value	Maximum value
Gender inequality in mortality rates under the age of 5 (difference per 1,000 live births)	0	15
Vertical inequality in life expectancy (percentage)	2.4	30
Gender inequality in expected years of schooling (difference in years)	0	3
Gender inequality in mean years of schooling (difference in years)	0	3.2
Vertical inequality in education (percentage)	0.7	50.1
Gender inequality in income (difference in log scale)	0	2
Vertical inequality in income (percentage)	4.4	60
Gender inequality in bank account ownership (difference in percentage)	0	33

Table 2. Minimum and maximum values for the inequality indicators

Indicator	Minimum value	Maximum value
Wealth inequality	0.41	0.92
Vertical inequality in CO2 emissions (ratio)	1	14.06
Gender inequality in mortalities attributed to air pollution	0	100
Gender inequality in mortalities attributed to lack of WASH	0	8
Social group equality in respect for civil liberties	-2.865	3.511
Social class equality in respect for civil liberties	-2.489	3.366
Power distributed by social group	-2.76	3.291
Power distributed by socioeconomic position	-2.787	3.007
Representation of disadvantaged social groups	-2.563	2.95
Exclusion by gender	0	1

Starting with the list of countries evaluated for DCI,⁵⁵ DII is computed for 159 countries worldwide, and for two points in time: 2010 and 2020. Country coverage is subject to data availability. Missing values were replaced, when possible, by the closest available years. The values for the inequality in CO₂ emissions indicators were imputed for Barbados and Fiji by running a linear regression of inequality in CO₂ emissions on CO₂ emissions per capita and income inequality. The values for the bank account ownership indicator were imputed for the following countries: Barbados, Cabo Verde, Cuba, Eswatini, Fiji, Guyana, Papua New Guinea, Sao Tome and Principe and Suriname. Details on the imputation can be found in annex 1. In cases where a country was not included in a source database and imputation was not possible, the country was removed from our sample in both years. This was the case for Djibouti, Libya, Seychelles and Vanuatu.

Similar to DCI, DII scores are distributed among five categories: very low, low, medium, high and very high. Scores below 0.2 are considered very low inequality, scores between 0.2 and 0.3 low, scores between 0.3 and 0.45 medium, scores between 0.45 and 0.55 high, and scores above 0.55 very high.

55 Khalid Abu-Ismail and others (2021). Development Challenges Index. ESCWA technical paper.

Properties of DII

DII draws on existing measures of multidimensional inequality but differs from them in several respects, and has a number of notable advantages. It is useful to review some of the properties and relative merits of our approach, and the majorization criteria or distributional properties.⁵⁶ In particular, it is important to assess whether DII satisfies the requirements for multidimensional measures of inequality.

The fundamental requirements for multidimensional inequality measures include normalization; i.e. if all individuals have the same attributes, then complete equality prevails and the degree of inequality is normalized to zero; replication invariance, i.e. replicating the population without changing the distribution of attributes does not change the value of inequality; and scale invariance, i.e. an equal proportional increase of all attributes, to all individuals, does not affect the measurement of multidimensional inequality. These requirements are met by DII. First, Gini and Atkinson inequality measures satisfy these properties by design. The UNDP IHDI, which is the source of our vertical inequality components, is based on a distribution-sensitive class of composite indices⁵⁷ drawing on the Atkinson family of inequality measures.58 Inequality in each dimension of IHDI is estimated by the Atkinson inequality measure based on the assumption that a society has a certain level of aversion to inequality.

Second, our environmental and horizontal human development inequality components also meet these requirements, given their simple derivation as the relative gap (calculated as a difference or ratio) between achievements of different groups. Third, governance inequality indicators are based on expert surveys; hence the following: (1) if all individuals have the same attributes, experts will choose answers reflecting this extreme case of no inequality and the standardized inequality indicators will therefore be equal to zero; and (2) replicating the population without changing the distribution, or increasing all attributes for all individuals by the same proportion, does not change the perception of inequality. Fourth, the equal weighting and the linear aggregation of the overall index preserve the characteristics of individual components.

Nevertheless, some advanced desirability properties are not satisfied by DII. For example, our macro-level inequality measure does not satisfy decomposability, specifically that the overall inequality should be expressible as a function of the subgroup means, population sizes and inequality values. Compared to existing household-based inequality indices, DII uses more macro-level data derived from various surveys (and its components are thus based on diverse samples) rather than microlevel data on individual households sampled in a single survey. While this hinders disaggregation, it also avoids the need for assumptions regarding the correspondence between households' diverse attributes and

⁵⁶ Lugo, M. A. (2007). Comparing multidimensional indices of inequality: Methods and application. In *Inequality and Poverty* (vol. 14, pp. 213–236). Emerald Group Publishing Limited.

⁵⁷ Foster, J. E., Lopez-Calva, L. F. and Szekely, M. (2005). Measuring the distribution of human development: methodology and an application to Mexico. *Journal of Human Development*, *6*(1), 5–25.

⁵⁸ Atkinson, A. B. (1970). On the measurement of inequality. Journal of economic theory, 2(3), 244–263.

their well-being. The focus in DII is instead on selecting the components and weights of the index according to normative criteria based on the capability approach. Additionally, the majorization criteria are not relevant in indices based on macro-level data since majorization or dominance criteria are related to the distribution of attributes among individuals (or households). In sum, DII satisfies the basic set of desirability requirements even though it is not conducive to full subgroup analysis for which finer grain data would be needed. DII results also exhibit statistical robustness to choices over indicators used and their standardization and weights, and to perturbations in raw data (described in the annex).

3. Results

Increases in income do not necessarily lead to inequality reduction, especially in lower-income countries where a weaker association is found as shown in figure 1. The association between per capita income and DII score is negative, but its funnel shape indicates that for high-income countries (where the relationship between the two measures is more robust), improvements in income are indeed associated with lower inequalities. Some exceptions exist however with some countries appearing as distinct outliers with medium and high inequality levels despite high incomes. On the other hand, the dispersion and unclear relationship in lowerincome countries implies that a slight increase in low per capita incomes is not expected to be accompanied by improvements in the different facets of inequality. Interestingly, while countries from most world regions appear on both sides of the linear fitted line, Arab countries are consistently and significantly above the fitted line, implying high inequalities compared to their income levels. It is also notable that some of these are high-income countries (log incomes exceeding 10, equivalent to nearly \$22,000), yet their DII scores fall within the medium and high inequalities categories.

Figure 2 shows the index's association with the UNDP IHDI. Given that the indices have a number of common indicators (albeit with opposite signs), a strong negative association between them is expected. Still, we find significant outliers in countries such as Pakistan, India, Turkmenistan and Oman, which appear to be penalized more harshly by DII. Rwanda, known for its efforts in advancing gender equality, is an outlier on the other side. Many Arab countries exhibit higher inequality on DII than on IHDI.

Plotting DII against other development measures also shows the importance of this index in measuring countries' progress. In fact, even when moving beyond the traditional measures of economic growth and taking into account different pillars of development, almost all countries show good dynamics and progress over time. For instance, while most of the countries included in our dataset (132 out of 159) score higher on DCI than DII, 76 of them witnessed an increase in their DII scores between 2010 and 2020 compared to 27 on DCI. Therefore, efforts should be made to ensure that improvements on development achievements are coupled with inequality reductions.

This confirms that merely looking at achievements cannot provide the full picture. Consideration must go beyond averages to distributions in order to ensure that no one, especially the most vulnerable groups, is left behind by "average improvements". It is therefore important to bring about dynamics of improvements on both the achievements (or challenges) and inequalities fronts. It is equally important to avoid the scenario of high-income countries improving their achievements while experiencing rapidly increasing inequalities.



Figure 1. Association between GNI per capita and DII

Source: Authors' calculations.



Figure 2. Association between DII and IHDI

Source: Authors' calculations.

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Figure 3 also shows a strong association between DCI and DII. While this association does not imply a unidirectional causality, it is notable that the correlation is strongly positive at very low and low levels of inequalities, but starts flattening at medium and high levels. This means that countries may need to attain a certain level of progress, after which additional improvements in inequalities and achievements may be mutually reinforcing.



Figure 3. Association between DII and DCI, 2020

Source: Authors' calculations.

Notes: The dotted line shows the fitted least squared deviations line among the 159 countries.



Figure 4. DII: Regional scores and contributions of the dimensions, 2020

Source: Authors' calculations.

Figure 4 zooms in on the performance across different world regions. In line with DCl, Europe and Central Asia and North America are the top performing world region with low Dll scores; hence, none of the world regions as a whole is within the very low inequalities group. As for the worst performer, and while Sub-Saharan Africa ranks first in terms of its development challenges, South Asia faces the highest inequality levels with a score of 0.505 (high inequalities).

In most world regions as well as the world at large, the highest inequalities are found in the governance pillar, with the exception of South Asia and Sub-Saharan Africa. In South Asia, the highest share of inequalities comes from the environmental pillar, while in Sub-Saharan Africa, inequalities in the human development aspects dominate. This is very similar to DCI findings, which further shows the need not only to strengthen institutions and democratic space, but also to ensure equality in terms of representation as well as service distribution. This appears to be very much the case also in the more developed regions, especially Europe and Central Asia where the governance component is responsible for 45 per cent of the score.

Figure 5 shows that all but one of the twenty countries with the lowest levels of inequalities are from Europe and Central Asia (the exception being Japan), and are led by Scandinavian countries - Norway and Denmark. By contrast, fourteen of the twenty countries with the highest DII scores are from Sub-Saharan Africa and the others are from the Arab Region (Mauritania, Sudan and Yemen, the latter being the most unequal country globally) and elsewhere in the world (Haiti, India and Pakistan). Many of the worst performers on DII are among the worst performers on DCI as well, again showing the importance of working on reducing inequalities as a starting point to reduce development gaps and shortfalls.

Figure 5. Lowest and highest DII scores, 2020

A. Lowest DII scores

Cyprus 0.190 Luxembourg 0.187 Lithuania 0.186 Czechia 0.184 Greece 0.183 Switzerland 0.181 Sweden 0.181 Ireland 0.179 Malta 0.178 Belgium 0.176 Slovenia 0.171 Spain 0.171 Japan 0.164 Germany 0.163 Italy 0.163 Iceland 0.161 Finland 0.159 Netherlands 0.151 Denmark 0.147 Norway 0.133

B. Highest DII scores



Source: Authors' calculations.

Finally, figure 6 shows the countries that score higher on DII than DCI. Most of the countries that score higher on DII come from the upper end of the human development challenges distribution, with eight out of ten being in the high and very high development challenges groups. This is not surprising since the countries with poor scores on DCI have the most room to improve on DII. This group includes very highly challenged countries such as Liberia, Tanzania and Venezuela, while other countries appear within the same group as a result of their low inequality levels (as measured by DII), such as Cuba, which has been improving mainly in the education component. On the other hand, oil-rich countries are among the countries with the lowest DII rankings relative to their DCI rankings. These countries include Qatar and the United Arab Emirates, which have the largest gaps in their ranks. This suggests that oil-rich countries and other countries with relatively low development challenges have not adequately addressed their inequality challenges and have a long way to catch up on this front. Other countries such as Philippines, which suffers from rising inequality levels, especially in the wealth, environment and governance components, also join the same group.



Figure 6. Largest rank deteriorations and improvements from DCI to DII, 2020



B. Largest rank improvements

Source: Authors' calculations.

4. Conclusion

Starting with the observation that development encompasses multiple dimensions of capabilities, and that their distribution in society matters for our assessment of countries' progress, we have proposed a new development inequalities index (DII) to measure inequalities in various spheres and stages of life across different socioeconomic groups. This index transcends existing approaches by encompassing inequalities in both socioeconomic opportunities and outcomes, of both vertical and horizontal nature.

Our analysis shows that DII provides meaningful insight regarding countries' development

beyond income inequality measures, IHDI or even DCI scores, introducing caveats to the conclusions from these other widely accepted measures. We also find that many countries exhibit higher inequality on DII than on other unidimensional inequality indicators. Oil-rich countries for example have much worse DII rankings than DCI rankings.

Governance inequalities are the primary source of inequalities for most countries globally, and environmental and human development inequalities dominate in a handful of countries.

Annex 1. Imputing missing wealth values

The following countries have no data for bank account ownership: Barbados, Cabo Verde, Cuba, Denmark, Eswatini (Kingdom of), Fiji, Guyana, Iceland, Papua New Guinea, Sao Tome and Principe and Suriname.

Missing values can be imputed in simple ways such as by using means or medians of existing data to replace missing values, which suffer from biases, or subjective expert judgement, which could also suffer from biases. However, for DII more advanced prediction and estimation techniques can be used, and in this case we have used five different regression-based models.

These models include both parametric and non-parametric ones. The parametric model is a multilinear regression, which is one of the most popular statistical learning models for estimation and prediction. The mainstream assumptions for parametric regressions were applied: independence of errors, no multicollinearity between independent variables and no significant outliers. We applied the model in three different forms, one with all independent variables suggested by the authors, one with a limited subset⁵⁹ and one with a higher dimension regression.⁶⁰

Non-parametric and supervised machine learning models were also employed, in the form of decision tree and random forest models. When growing trees, multiple hyperparameters were considered, including: Minimum number of observations when splitting a node, minimum number of observations in a terminal node, maximum depth of the tree (levels of the tree, root node is the first level), complexity of the tree (defining the necessity of a pruning process), etc.

The last algorithm was the random forest model, which is essentially composed of multiple individual independent decision trees. In general, random forests are more accurate than decision tree algorithms and are more effective when dealing with missing data and more efficient in resolving the overfitting problem. Each tree runs independently and without any interaction with the other trees. The predictions of those trees are then aggregated to produce the results. When growing a random forest, multiple hyperparameters were considered, including: The number of

⁵⁹ Only statistically significant independent variables are considered in the regression, and the selection is based on a student's t-test. The omitted variables do not appreciably affect the response variables (dependent variables). The step-by-step iterative construction of the regression model involves adding or removing attributes in succession and testing for statistical significance after each iteration. Each time statistical significance is measured, the model iteratively removes and add variables (both forward and backward selection are used).

⁶⁰ The premise of such a model is to use the resultant principal component (after performing a principal component analysis performed on regressors) as new regressors, thus reducing the dimension of the problem. In that way, the independent variables are orthogonal and ensure that the computations are easier and more stable.

trees to grow, the number of randomly selected attributes as candidates at each split and the characteristics of trees to be grown.

In the non-parametric supervised machine learning models, a number of steps were taken to avoid overfitting and to test the ability of the models to generalize and give good predictions for new observations. First, the data was split into training and test sets, with the model built on the training set and tested on the test set. The test set was selected through an iterative cross-validation, based on randomly selected datasets sequentially selected using a bootstrap method. The predictive power of the model was finally assessed by computing the average performance metric on all the K test sets. The complexity of some models was controlled. To do so, a regularization parameter was added to the objective (loss) function to penalize complex and deeper models. Finally, the main hyper-parameters of the models were tuned to optimize the performance metrics (R2, MSE, etc.) using a grid search technique (with some assumptions about the range of possible hyperparameters, this was limited to not use all combinations). The range was subjectively set based on the authors' experience. This hyper-parameter tuning step was coupled with k-fold cross-validation to ensure that the optimization was independent from the underlying data split.

The random forest model was the best-performing model (highest R-squared and lowest mean squared error). Therefore, it was used to predict values to replace the nine missing values.

Models	MLR (Multiple Linear Regression)	Stepwise MLR	PCA (Principal Component Analysis) + regression	Decision tree	Random forest
Performance metric, R ²	31.3	32.5	31.3	63.7	87.5
Performance metric, <i>MSE</i>	0.023	0.025	0.026	0.014	0.005

Table A1.1 Results of the R-squared matrix for all models and first run

Annex 2. Robustness and sensitivity checks

The robustness of DII has been assessed by evaluating the impact of changes in indicator weights on countries'/regions' scores and rankings. While the choice of pillars and indicators as well as the structure of the framework represent additional factors that may affect countries' scores, we evaluate only a handful of alternative scenarios of interest. One dilemma when constructing DII was whether to include gender inequality in life expectancy at birth instead of mortality rates of children under the age of five. To settle this dilemma, an additional scenario was included in the robustness checks, with the gender gap in mortality indicator replaced by the gender gap in life expectancy at birth.

The impact of weight changes was measured using the Euclidean distance of results across alternative scenarios. This statistic provides the pairwise cross-model distances between the sets of ranks (or actual scores) of countries or regions under a pair of alternative scenarios. The lower the distance between the ranks under two scenarios, the higher the similarity between the two sets. After computing the Euclidean distances for the scores/rankings of the countries or regions, the distances are summed across all alternative scenarios (in this case we have a total of 264 scenarios with alternative sets of indicator weights), and the scenario with the lowest sum of Euclidean distances against all other scenarios was deemed the most robust.

Based on this check, the base scenario was found to be the best in terms of countries' and regions' rankings and scores. Moreover, the regions' rankings under our base scenario are preserved in 225 out of the 264 scenarios. Table A2.1 shows the sets of regional rankings and the number of scenarios n in which each of these sets of rankings is preserved.

To test the joint covariance and redundancy of the indicators, we check the pairwise correlation coefficients for all indicators in DII to assess whether different components potentially capture equivalent information and hence are redundant. The results show that most of the correlations are low to moderate, with the exception of very few coefficients exceeding 0.7. This appears to be theoretically non-concerning, since it occurs between vertical inequality in education and horizontal (and vertical) inequality in health, and between vertical and horizontal inequality in education (and in health) as well as between health and water, sanitation and hygiene inequalities and between different governance components.

Arab Region	East Asia and Pacific	Europe and Central Asia	Latin America and the Caribbean	North America	South Asia	Sub- Saharan Africa	Sum of Euclidian distances	n
3	4	7	5	6	1	2	190 350	225
3	4	6	5	7	1	2	1 124 266	11
3	4	7	5	6	2	1	1 125 036	11
4	2	7	5	6	1	3	1 837 296	6
4	3	7	5	6	1	2	614 412	6
3	4	6	5	7	2	1	814 544	4
2	5	6	4	7	3	1	509 448	1

Table A2.1 Region rankings, and the count of model scenarios (n) where these were obtained

Source: Authors' calculations.

Table A2.2 Variable correlation matrix (p-values in parentheses)

	health_horizontal	health_vertical	expected_schooling_horizontal	mean_schooling_horizontal	education_vertical	income_horizontal	income_vertical	wealth_horizontal	wealth_vertical	pollution_horizontal	wash_horizontal	co2_vertical	liberties_horizontal	liberties_vertical	participation_horizontal	participation_vertical	power_horizontal
health_vertical	0.949 (0.000)																
expected_schooling_horizontal	0.171 (0.031)	0.117 (0.141)															
mean_schooling_horizontal	0.641 (0.000)	0.665 (0.000)	0.384 (0.000)														
education_vertical	0.732 (0.000)	0.791 (0.000)	0.084 (0.293)	0.708 (0.000)													
income_horizontal	-0.061 (0.448)	0.036 (0.657)	0.016 (0.842)	0.134 (0.092)	0.229 (0.004)												
income_vertical	0.354 (0.000)	0.383 (0.000)	-0.021 (0.789)	0.138 (0.083)	0.285 (0.000)	-0.164 (0.039)											
wealth_horizontal	0.396 (0.000)	0.446 (0.000)	0.085 (0.285)	0.408 (0.000)	0.545 (0.000)	0.292 (0.000)	0.215 (0.007)										
wealth_vertical	0.283 (0.000)	0.330 (0.000)	-0.116 (0.145)	0.137 (0.085)	0.313 (0.000)	0.077 (0.334)	0.511 (0.000)	0.267 (0.001)									
pollution_horizontal	0.496 (0.000)	0.504 (0.000)	-0.034 (0.669)	0.305 (0.000)	0.274 (0.001)	-0.071 (0.373)	0.207 (0.009)	0.108 (0.176)	0.204 (0.010)								
wash_horizontal	0.758 (0.000)	0.751 (0.000)	0.228 (0.004)	0.677 (0.000)	0.663 (0.000)	-0.030 (0.708)	0.191 (0.016)	0.346 (0.000)	0.191 (0.016)	0.322 (0.000)							
co2_vertical	0.093 (0.244)	0.144 (0.071)	-0.126 (0.115)	0.054 (0.500)	0.083 (0.301)	0.022 (0.786)	0.540 (0.000)	0.090 (0.257)	0.450 (0.000)	0.180 (0.023)	0.030 (0.703)						

	health_horizontal	health_vertical	expected_schooling_horizontal	mean_schooling_horizontal	education_vertical	income_horizontal	income_vertical	wealth_horizontal	wealth_vertical	pollution_horizontal	wash_horizontal	co₂_vertical	liberties_horizontal	liberties_vertical	participation_horizontal	participation_vertical	power_horizontal
liberties_horizontal	0.240 (0.002)	0.286 (0.000)	-0.004 (0.960)	0.203 (0.010)	0.308 (0.000)	0.359 (0.000)	0.329 (0.000)	0.229 (0.004)	0.291 (0.000)	0.133 (0.096)	0.140 (0.078)	0.339 (0.000)					
liberties_vertical	0.460 (0.000)	0.517 (0.000)	0.009 (0.912)	0.327 (0.000)	0.448 (0.000)	0.210 (0.008)	0.419 (0.000)	0.302 (0.000)	0.322 (0.000)	0.371 (0.000)	0.328 (0.000)	0.319 (0.000)	0.742 (0.000)				
participation_horizontal	0.481 (0.000)	0.536 (0.000)	0.052 (0.518)	0.417 (0.000)	0.543 (0.000)	0.460 (0.000)	0.263 (0.001)	0.412 (0.000)	0.296 (0.000)	0.199 (0.012)	0.374 (0.000)	0.245 (0.002)	0.636 (0.000)	0.685 (0.000)			
participation_vertical	0.260 (0.001)	0.222 (0.005)	0.036 (0.656)	0.163 (0.040)	0.132 (0.098)	0.031 (0.695)	0.082 (0.307)	0.127 (0.112)	0.153 (0.054)	0.248 (0.002)	0.096 (0.230)	0.126 (0.115)	0.331 (0.000)	0.446 (0.000)	0.378 (0.000)		
power_horizontal	0.316 (0.000)	0.335 (0.000)	0.032 (0.690)	0.230 (0.004)	0.246 (0.002)	0.269 (0.001)	0.247 (0.002)	0.166 (0.037)	0.246 (0.002)	0.252 (0.001)	0.154 (0.053)	0.337 (0.000)	0.692 (0.000)	0.642 (0.000)	0.569 (0.000)	0.242 (0.002)	
power_vertical	0.318 (0.000)	0.356 (0.000)	-0.027 (0.739)	0.240 (0.002)	0.327 (0.000)	0.341 (0.000)	0.244 (0.002)	0.308 (0.000)	0.296 (0.000)	0.200 (0.011)	0.212 (0.007)	0.249 (0.002)	0.634 (0.000)	0.710 (0.000)	0.671 (0.000)	0.508 (0.000)	0.664 (0.000)

Source: Authors' calculations.

The poor relationship between DII and the Atkinson inequality measure (figure A2.1) shows that although income is a means to better health and education achievements, it is essential to include multiple dimensions of inequality. Reduced income inequality can indeed improve other dimensions of inequality as depicted by the (slightly) positive association. However, there are still two major caveats. First, income inequality (as measured by the Atkinson income inequality or other widely used indicators such as the Gini coefficient) only captures vertical inequality and does not control for other types of inequalities (such as gender inequality) which are often caused by social and cultural constraints and cannot be reduced significantly by targeting the poorest groups. Second, improving income distribution alone is not a sustainable solution. For example, wealth inequalities are a major driver of income and human capital inequalities, and thus reducing wealth and other inequalities creates better opportunities for future generations to enjoy more equitable outcomes.





Source: Authors' calculations and UNDP data.

Annex 3. DII: Country level results

DII rank	Country	DII	Human development inequalities index	Environmental inequalities index	Governance inequalities index	DII rank minus DCI rank
			Very high ine	equalities		
1	Yemen	0.656	0.695	0.462	0.813	-3
2	Central African Republic	0.650	0.705	0.721	0.524	0
3	Chad	0.641	0.719	0.511	0.694	-2
4	Angola	0.610	0.637	0.582	0.612	-23
5	Eswatini (Kingdom of)	0.594	0.484	0.697	0.599	-19
6	Haiti	0.582	0.647	0.446	0.652	5
7	Congo (Democratic Republic of the)	0.580	0.657	0.548	0.535	4
8	Guinea	0.579	0.686	0.505	0.545	-7
9	Pakistan	0.578	0.668	0.539	0.527	-20
10	Côte d'Ivoire	0.564	0.760	0.522	0.410	-32
			High inequ	ualities		
11	Mauritania	0.550	0.609	0.314	0.726	-22
12	Sudan	0.547	0.597	0.369	0.676	-8
13	Benin	0.540	0.712	0.583	0.326	-22
14	Zambia	0.539	0.535	0.600	0.482	0
15	Cameroon	0.530	0.625	0.465	0.501	-3
16	Zimbabwe	0.528	0.458	0.612	0.513	6
17	Congo	0.525	0.450	0.565	0.561	6
18	Uganda	0.512	0.564	0.464	0.507	-5

Table A3.1 DII and its components, 2020

DII rank	Country	DII	Human development inequalities index	Environmental inequalities index	Governance inequalities index	DII rank minus DCI rank
19	India	0.511	0.487	0.584	0.461	-45
20	Lesotho	0.508	0.545	0.657	0.321	7
21	Mozambique	0.502	0.587	0.546	0.374	12
22	Nigeria	0.496	0.672	0.354	0.461	0
23	Togo	0.495	0.658	0.445	0.383	15
24	Papua New Guinea	0.495	0.525	0.393	0.567	-10
25	Burkina Faso	0.494	0.542	0.579	0.362	-11
26	Ethiopia	0.494	0.604	0.465	0.413	-5
27	Malawi	0.485	0.506	0.475	0.474	-16
28	Bangladesh	0.476	0.457	0.359	0.613	-19
29	Tajikistan	0.476	0.392	0.295	0.742	-1
30	Syrian Arab Republic	0.474	0.401	0.329	0.693	13
31	Turkmenistan	0.474	0.403	0.324	0.695	19
32	Afghanistan	0.470	0.669	0.219	0.522	11
33	Qatar	0.469	0.299	0.372	0.737	-59
34	Sierra Leone	0.466	0.612	0.413	0.374	2
35	Burundi	0.463	0.508	0.404	0.477	29
36	Namibia	0.461	0.458	0.530	0.396	-23
37	Botswana	0.459	0.424	0.579	0.373	-30
38	Iraq	0.458	0.498	0.314	0.561	1
39	Cambodia	0.453	0.396	0.339	0.624	0
40	China	0.452	0.203	0.545	0.608	-36
			Medium ine	qualities		
41	Philippines	0.447	0.337	0.489	0.514	-40
42	Niger	0.445	0.566	0.437	0.331	14
43	Bahrain	0.442	0.334	0.276	0.717	-10
44	Gabon	0.441	0.486	0.417	0.419	-13

DII rank	Country	DII	Human development inequalities index	Environmental inequalities index	Governance inequalities index	DII rank minus DCI rank
45	Madagascar	0.439	0.434	0.316	0.568	29
46	Liberia	0.436	0.645	0.263	0.399	39
47	Oman	0.434	0.349	0.387	0.567	-28
48	Lao People's Democratic Republic	0.434	0.469	0.344	0.488	22
49	Guatemala	0.425	0.387	0.273	0.615	1
50	Nepal	0.424	0.425	0.526	0.320	5
51	Gambia	0.421	0.584	0.346	0.334	5
52	Ghana	0.421	0.518	0.439	0.307	-14
53	Kenya	0.419	0.458	0.399	0.400	-3
54	Myanmar	0.418	0.406	0.348	0.500	-1
55	Senegal	0.414	0.576	0.359	0.306	-6
56	Mali	0.412	0.592	0.180	0.464	37
57	United Arab Emirates	0.409	0.249	0.364	0.615	-60
58	Dominican Republic	0.408	0.392	0.254	0.576	-31
59	Viet Nam	0.407	0.309	0.495	0.418	-31
60	Honduras	0.406	0.392	0.253	0.574	16
61	Egypt	0.405	0.412	0.285	0.516	12
62	Nicaragua	0.404	0.344	0.285	0.583	24
63	Türkiye	0.401	0.353	0.287	0.564	-31
64	Saudi Arabia	0.401	0.311	0.257	0.633	-6
65	Mexico	0.400	0.298	0.409	0.493	-22
66	Morocco	0.400	0.521	0.258	0.421	-16
67	Indonesia	0.399	0.316	0.404	0.477	-30
68	Thailand	0.396	0.258	0.421	0.508	-23
69	South Africa	0.394	0.406	0.452	0.325	18
70	Rwanda	0.392	0.440	0.329	0.408	18

DII rank	Country	DII	Human development inequalities index	Environmental inequalities index	Governance inequalities index	DII rank minus DCI rank
71	Paraguay	0.392	0.313	0.289	0.576	-7
72	Kuwait	0.387	0.345	0.319	0.496	0
73	Tanzania (United Republic of)	0.386	0.444	0.400	0.315	33
74	Colombia	0.384	0.301	0.270	0.581	-32
75	Uzbekistan	0.380	0.257	0.330	0.552	25
76	Iran (Islamic Republic of)	0.377	0.246	0.325	0.560	22
77	El Salvador	0.376	0.343	0.271	0.514	6
78	Lebanon	0.370	0.220	0.366	0.524	-1
79	Brazil	0.361	0.348	0.304	0.432	-4
80	Azerbaijan	0.361	0.232	0.261	0.590	20
81	Fiji	0.361	0.294	0.399	0.390	-17
82	Peru	0.357	0.295	0.350	0.425	-23
83	Suriname	0.353	0.382	0.313	0.364	21
84	Guyana	0.353	0.377	0.330	0.351	43
85	Kazakhstan	0.348	0.205	0.335	0.504	11
86	Bolivia (Plurinational State of)	0.344	0.413	0.240	0.379	18
87	Mongolia	0.342	0.277	0.455	0.295	29
88	Panama	0.338	0.316	0.312	0.387	-21
89	Venezuela (Bolivarian Republic of)	0.337	0.356	0.313	0.342	64
90	Sao Tome and Principe	0.334	0.334	0.284	0.385	25
91	Malaysia	0.334	0.212	0.318	0.472	-23
92	Algeria	0.330	0.444	0.201	0.347	15
93	Bhutan	0.329	0.466	0.279	0.242	20

DII rank	Country	DII	Human development inequalities index	Environmental inequalities index	Governance inequalities index	DII rank minus DCI rank		
94	Cabo Verde	0.326	0.337	0.374	0.267	6		
95	Russian Federation	0.324	0.181	0.306	0.486	11		
96	Sri Lanka	0.321	0.209	0.338	0.417	-5		
97	Jordan	0.318	0.346	0.218	0.392	-16		
98	Bosnia and Herzegovina	0.316	0.280	0.236	0.431	35		
99	Kyrgyzstan	0.315	0.225	0.309	0.411	30		
Low inequalities								
100	Chile	0.299	0.205	0.356	0.337	-26		
101	Georgia	0.297	0.195	0.367	0.330	-15		
102	Maldives	0.296	0.290	0.210	0.389	3		
103	Ecuador	0.294	0.298	0.208	0.375	7		
104	Ukraine	0.291	0.176	0.249	0.449	9		
105	Tunisia	0.291	0.413	0.244	0.217	-5		
106	Barbados	0.286	0.293	0.256	0.309	-13		
107	Singapore	0.284	0.180	0.365	0.307	-37		
108	Trinidad and Tobago	0.280	0.321	0.226	0.294	23		
109	Korea (Republic of)	0.276	0.200	0.332	0.296	-26		
110	North Macedonia	0.275	0.211	0.226	0.387	8		
111	Jamaica	0.273	0.281	0.227	0.311	8		
112	Romania	0.268	0.183	0.276	0.344	1		
113	United States	0.267	0.209	0.274	0.317	-18		
114	Costa Rica	0.267	0.268	0.268	0.264	-11		
115	Mauritius	0.265	0.263	0.257	0.275	-7		
116	Montenegro	0.263	0.158	0.298	0.334	8		
117	Albania	0.260	0.220	0.188	0.371	5		

DII rank	Country	DII	Human development inequalities index	Environmental inequalities index	Governance inequalities index	DII rank minus DCI rank		
118	Argentina	0.259	0.279	0.210	0.288	3		
119	Bulgaria	0.256	0.151	0.240	0.378	15		
120	Serbia	0.254	0.183	0.214	0.364	20		
121	Hungary	0.253	0.135	0.243	0.380	3		
122	Moldova (Republic of)	0.249	0.184	0.207	0.355	29		
123	Armenia	0.240	0.202	0.237	0.280	16		
124	Croatia	0.238	0.171	0.186	0.356	3		
125	Uruguay	0.224	0.240	0.199	0.234	1		
126	Belarus	0.224	0.105	0.274	0.294	46		
127	Israel	0.224	0.167	0.218	0.287	-11		
128	Canada	0.221	0.140	0.205	0.318	-12		
129	Latvia	0.216	0.162	0.250	0.236	2		
130	Cuba	0.211	0.202	0.128	0.303	44		
131	Poland	0.209	0.160	0.214	0.254	11		
132	Estonia	0.205	0.154	0.203	0.258	-1		
133	Slovakia	0.205	0.114	0.180	0.322	10		
134	United Kingdom	0.205	0.132	0.170	0.312	-17		
135	Australia	0.201	0.119	0.209	0.273	-8		
136	Austria	0.200	0.149	0.219	0.233	-14		
137	Portugal	0.200	0.155	0.194	0.250	1		
Very low inequalities								
138	New Zealand	0.193	0.152	0.189	0.240	-11		
139	France	0.193	0.146	0.171	0.264	-8		
140	Cyprus	0.190	0.151	0.185	0.232	1		
141	Luxembourg	0.187	0.116	0.263	0.181	-4		
142	Lithuania	0.186	0.150	0.195	0.211	14		
143	Czechia	0.184	0.148	0.201	0.202	14		

DII rank	Country	DII	Human development inequalities index	Environmental inequalities index	Governance inequalities index	DII rank minus DCI rank	
144	Greece	0.183	0.148	0.166	0.236	14	
145	Switzerland	0.181	0.140	0.202	0.202	-14	
146	Sweden	0.181	0.157	0.172	0.214	-10	
147	Ireland	0.179	0.116	0.202	0.220	-8	
148	Malta	0.178	0.142	0.135	0.256	7	
149	Belgium	0.176	0.145	0.194	0.188	3	
150	Slovenia	0.171	0.099	0.182	0.233	18	
151	Spain	0.171	0.167	0.155	0.190	9	
152	Japan	0.164	0.113	0.214	0.164	4	
153	Germany	0.163	0.130	0.217	0.143	0	
154	Italy	0.163	0.150	0.159	0.179	20	
155	lceland	0.161	0.114	0.130	0.238	18	
156	Finland	0.159	0.130	0.173	0.172	2	
157	Netherlands	0.151	0.133	0.136	0.185	5	
158	Denmark	0.147	0.130	0.171	0.140	0	
159	Norway	0.133	0.121	0.165	0.114	2	
Region							
Arab Re	egion	0.434	0.456	0.301	0.546	-	
East Asia and Pacific		0.416	0.231	0.481	0.535	-	
Europe and Central Asia		0.253	0.183	0.232	0.345	-	
Latin America and the Caribbean		0.361	0.326	0.311	0.447	-	
North America		0.262	0.202	0.267	0.317	-	
South Asia		0.505	0.494	0.537	0.484	-	
Sub-Saharan Africa		0.489	0.582	0.445	0.440	-	
World		0.418	0.359	0.426	0.468	-	

Note: Positive numbers reflect a higher score on DII than DCI, while negative numbers reflect a lower score.

The present paper aims to assess inequality across multiple dimensions. To do so, we introduce an innovative multidimensional inequality measurement that can be applied as a tool for global and regional policy advocacy and national policymaking. The aim is to go beyond using inequality as a factor to discount human development achievements in health, education and income and propose a new Development Inequalities Index (DII) that regards social inequalities as a distinct societal challenge, and inequality reduction as a worthy development end goal of its own. DII transcends existing treatments by imposing a structure on the analysis of multidimensional inequalities – isolating horizontal and vertical inequalities in human development, environmental sustainability and governance – and reflecting their cumulative burden through an aggregation approach. The DII framework is an extension of the Development Challenges Index and aims to go beyond considering the averages to addressing multidimensional inequalities.

Our analysis shows that DII provides meaningful insight regarding countries' developmental experience beyond income inequality measures, IHDI or even DCI scores, introducing caveats to the conclusions from these other widely accepted measures. We also find that many countries exhibit higher inequality on DII than on other unidimensional inequality indicators. Oil-rich countries for example have much worse DII rankings than DCI rankings. Finally, governance inequalities are the primary source of inequalities for most countries globally, and environmental and human development inequalities dominate in a handful of countries.

