



What is Inclusive Development? Introducing the Multidimensional Inclusiveness Index

Christoph Dörffel¹ · Sebastian Schuhmann¹

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Abstract

Despite decreasing global poverty, feelings of increasing inequalities drive growing dissatisfaction with development outcomes. Inclusive development benefiting larger parts of societies will be perceived as more legitimate. Yet, there is neither a thorough agreement on what constitutes inclusive development nor a convenient measurement tool. The purpose of this paper is to address both these shortcomings in the literature. We derive a notion of inclusive development that is human-based and acknowledges all factors important for well-being. With the introduction of the Multidimensional Inclusiveness Index (MDI), we address the conceptual drawbacks of prominent approaches like the Human Development Index (HDI), Inequality-Adjusted Human Development Index and Inclusive Development Index (IDI) and extend the available data sample (by 50% compared to the HDI). The MDI consists of two subindices—one on development equity and development achievements each—and is calculated in three versions for up to 171 countries for the years 1960–2018. By applying principal component analysis, we rely on the structure of the underlying data for the aggregation of the 14 variables into the subindices. The subindices are aggregated by geometric mean. We show that regional development patterns are captured and major political events reflected in MDI country trends. Despite correlations resulting from data similarities, the MDI provides new insights when compared to HDI, IDI and gross domestic product. All three MDI versions display increasing global averages over time. These positive trends are largely driven by improvements in the achievements dimension. Despite optimistic trends in recent years, equity considerations deserve a stronger emphasis in development concepts.

Keywords Index · Multidimensional · Inclusiveness · Inclusive development

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✉ Sebastian Schuhmann
sebastian.schuhmann@uni-jena.de

Christoph Dörffel
christoph.doerffel@uni-jena.de

¹ University of Jena, Carl-Zeiss-Str. 3, 07743 Jena, Germany

1 Introduction

Probably the most widely accepted global policy framework for thinking about the issue of inclusive development is the United Nations' Agenda 2030. The agenda and the Sustainable Development Goals (SDGs) specified therein, provide a detailed set of frameworks, targets, indicators and means for galvanizing global action in support of development that delivers more sustainable and more inclusive¹ outcomes (United Nations, 2015). However, the SDGs range widely from aspects of planetary sustainability (i.e., the environment) to social and economic issues like reduction of poverty or inequalities. Specific policy choices remain rather unspecified (but are left up to policy makers to formulate).

One important merit of the SDGs is that they have brought a number of new development objectives to the political agenda. This suggests that development is grasped on a broader, more inclusive scale and that other variables are targeted rather than only those which are income-related. There has been agreement that income has no intrinsic value for human well-being;² and that it is rather an intermediate means to promote other relevant factors. Development strategies focused on economic growth can be too myopic to encompass all areas of human life, especially when income growth is generated at the cost of other critical factors. While economists have been concerned themselves with development for centuries, suggestions and advances for broader development concepts and human-centered approaches of well-being have only recently started to receive comprehensive attention in academia and politics. Despite the accomplishments of the Social Indicator Movement from the 1960s that aimed to promote matters which increase quality of life (McGillivray, 1991), income growth has remained the dominating development objective. We argue in this chapter that this needs to be furtherly complemented by other objectives.

To measure inclusive human development outcomes, the most acknowledged analytical framework is the Human Development Index (HDI) which comprises the dimensions of income, schooling and health. Another, more recent approach is the Inclusive Development Index (IDI). Both indices have been used for empirical studies, e.g. by Gupta et al. (2015) to analyze the determinants of productive employment in the European Union. They found that high levels of inclusiveness and sustainability (measured by the HDI and IDI) can be explained by higher labor productivity, an efficient sectoral structure of employment and better social safety nets for workers. The same indices have been used by Rauniyar and Kanbur (2009) to investigate the relationship between wealth and development using different development indicators. Prada and Sanchez-Fernandez highlight that the selection and weighting method of indicators for wealth within a composite indicator is extremely important for the ranking which the indicator will produce. Furthermore, the IDI has been used by Dreher (2006) to analyze differences in inclusive development between G20 and non-G20 countries. They find evidence that Group of 20 (G20) countries succeed at improving peoples' inclusiveness more so than non-G20 countries. Furthermore, the HDI has been used in empirical studies, e.g. by Solt (2019) to analyze the nexus between human development, inequality and poverty. They stress the importance of inequality and additional dimensions of poverty to conceive patterns of human development.

¹ A definition and discussion of the term inclusiveness will be provided in the Sect. 2.1.

² We relate to the understanding of human well-being as a "broad concept which is not confined to the utility derived from the consumption of goods and services, but is also related to people's functioning and capabilities" (United Nations Economic Commission for Europe, 2014, p. 5).

While both indices analyze important aspects of inclusive development, they still have shortcomings. Based on only three dimensions, the HDI does not capture the inequality dimension (as noted e.g. by Samans et al., 2015). Therefore, the United Nations Development Programme (UNDP) has published an Inequality-adjusted Human Development Index in addition to the basic form HDI since 2010.³ Other dimensions are still unconsidered by the HDI, such as indicators for environmental quality, hence, it does not capture inclusive development in its full scope. A more technical problem has been named by McKinley (2010), namely that the HDI suffers from redundancies because of correlations between the the subdimensions.⁴ This can be problematic as the variables deliver little additional information with respect to each other and can cause bias with some information being weighted too heavily. Finally, there has been an interpolation of missing data and changing methods used for the HDI calculation which makes it difficult to compare index scores across multiple years. The IDI on the other hand, comprises an increased number of variables and explicitly includes indicators for environmental quality and fiscal sustainability (World Economic Forum, 2017). However, the IDI's limitation is its data availability which prevents analysis in panel settings.

We try to resolve this by taking a middle ground and creating the Multidimensional Inclusiveness Index (MDI), which extends the number of dimensions included in the HDI (e.g. environment), takes inequality into account (as the Inequality-adjusted Human Development Index (IHDI)) but is also available for a larger set of countries and a longer timeframe than the HDI, IHDI and IDI. We include data on environmental, productivity and demographic development and inequality. Our MDI data set covers up to 171 countries and the timeframe from 1960 to 2018. Similarly to Anand et al. (2013) who distinguish between income growth and income inequality, we disentangle the development achievements and equity dimensions. Therefore, we aim to evaluate their impact on inclusive development distinctly. Methods used by Dörffel et al. (2021), Heckman et al. (2013) and Gygli (2019) as well as Ngepah (2017) guided us in the creation of the MDI. We use the statistical principal component analysis (PCA) method to derive variable weights to aggregate variables into the resulting index. This method is a data-driven method to deal with the underlying correlation structure of the variables to represent the original variables as best as possible after aggregation into a single index.

Due to its aggregated nature and larger set of variables, it may be challenging to derive specific policy advice from the MDI. Nevertheless, it can give researchers the chance to empirically assess the factors that influence inclusive development as well as its subdimensions and serve as a starting point to identify important policies. A first attempt was made by Estes (2014) who look at the main drivers of inclusive development. Additionally, researchers can assess the impact of inclusive development on other, e.g. growth or political, outcomes.

In Sect. 2, we provide a discussion of inclusive development as this motivates the set-up for the MDI. Furthermore, we provide a brief discussion of the HDI and IDI as previous development measures. In Sect. 3, we introduce the MDI and explain the construction of its

³ Between 1991 and 1994, the Human Development Reports included an income-distribution adjusted HDI which considered income inequalities for the calculation of the income-related part of the HDI. Only since 2010, inequalities with respect to education and health have also been considered.

⁴ Surely, there are countries where the correlation is less distinct. One can think the health and income dimensions in Cuba or South Africa.

three versions in detail. An overview over the index data and several illustrations highlighting the usefulness of the MDI will be presented in Sect. 4. Section 5 concludes.

2 Measuring Inclusive Development

2.1 Defining Inclusive Development

The concept of inclusive development still lacks a clear-cut definition. We claim that inclusive development comprises of both a fair distribution⁵ and preferable development returns. As Anand and Sen (2000) argue, development should be human-centered. The reason for this being that humans are both the end as well as the means of development (Anand and Sen, 2000). All development measures and policies are to serve humans and their quality of life. Therefore, looking only at gross domestic product (GDP) and its growth rates does not show the whole picture of inclusive development (Kakwani and Son, 2008; Porter and Stern, 2014; Talmage and Knopf, 2017). Examining income levels and stocks of (material) wealth does not allow inferences about a human's individual preferences and to what extent they are satisfied. Therefore, they can only be intermediate goals with instrumental value.

Scott and Talmage (2017) define inclusiveness as a “community outcome that results from methods of inclusion that utilize diversity as a resource.” In this light, inclusiveness shows the scale of “inclusion of all individuals and groups, specifically individuals or groups who were previously not included or excluded” (Scott and Talmage, 2017). This goes along with the appreciation of diversity in personal characteristics and life plans. The term inclusive suggests that individuals have equal access to the social, political and economic mainstream as well as chances to assert their preferences. This normative aspiration requires all parts of society to benefit from development.

Thereby, inclusive development is related to equality but both concepts are not the same. A society with a highly unequal distribution that impairs access to and participation in that society can hardly be perceived as inclusive. Material inequalities may be justified, however, as long as they represent different preferences among members of a society. These inequalities do not impact the individuals' life fulfillment. When considering goods and means for the satisfaction of basic human needs, individual preferences are more homogenous, especially when the point is meeting minimum thresholds to secure human survival.⁶ Here, vast inequalities are harder to justify. On the other hand, a just distribution in a society will not necessarily ensure a high level of inclusiveness. When all individuals are equally poor, they are still constrained in pursuing their life plans.

Inclusive development has a consistent relationship to sustainable development. In the “Brundtland Report” (World Commission on Environment and Development, 1988), sustainable development is defined as development that “meets the needs of the present

⁵ The definition about a fair distribution is highly normative. It cannot be the objective of an economic analysis to assess the fairness of a distributional outcomes. However, we can assess that there is a general agreement about an income distribution fulfilling certain criteria for being perceived as fair. One of these criteria is that differences in income are justified on the ground of differences in skills and effort rather than the outcome of rigid structural discrimination of certain members of society. Recently, increasing opposition can serve as an indicator of increasing discontent about decreasing fairness of distributional outcomes.

⁶ Examples for these goods are accommodation, food required for basic nutrition, basic education like reading skills, clothes, access to basic medical care etc.

without compromising the ability of future generations to meet their own needs.” This highlights the importance of intertemporal considerations and protecting the environment in a prospective way. As per the definition of the United Nations (2005), this addresses economic, social and environmental dimensions. All three dimensions are mutually reinforcing and intertwined.

As a result of previous considerations, scholars have been driven by the attempt to introduce development approaches that also address non-monetary aspects of well-being. Probably the most famous and pioneering example to measure inclusiveness is the HDI introduced in the United Nations’ Human Development Report in 1990. It is based on the so-called capabilities approach, which claims that every person must be provided with the freedom and capabilities to pursue the life they want to live (Sen, 1999; Seth and Villar, 2017). If policies, for whatever reason, marginalize or contribute to the persistence of existing marginalization of persons or groups, then there are individuals who are denied the capability to lead the life they desire. It is argued that certain variables—in a variety of dimensions including income, wealth, utilities, liberties, primary goods (Sen, 1999, p. 129)—allow people to increase their functionings (doings and beings) and that the ability to choose between alternatives (capabilities) has an intrinsic value for their well-being. Essentially, the capability approach claims for equality at least with regards to basic freedoms to achieve and capabilities for the necessary functionings in particular (Sen, 1999). The HDI captures basic functionings and capabilities to choose these functionings. However, we argue that the HDI does not fully operationalize claims for equality of the capability approach. The IHDI resolves this, yet lacks in data availability.

As the pro-poor growth literature suggests, and 40 years after the emergence Social Indicator Movement, by the early 2000’s, most of the discussions on inclusive development are still centered around addressing mostly economic growth dimensions. Emphasis is placed on the importance of growth that benefits poorer parts of society (Sagar and Najam, 1998). Land and Michalos (2018) show that between 1988 and 2008 income growth had been the highest in the lower and middle components of the global income distribution and below average in the richer world. Chen and Ravallion (2010., 2013) point out that this improvement was mostly driven by the astonishing catch-up process in India and China. From 1981 to 2005, the percentage of people living on \$1.25 or less per day declined from about 60% to about 40% in South Asia, in East Asia from almost 80% to under 20%, while in Africa it remained at around 50%.

With the inclusive growth approach, Lakner and Branko (2013) puts an emphasis on the distributional outcomes of growth by turning the focus to the growth process itself, i.e. the extent to which large parts of the society are enabled to access and participate in the economic mainstream. Yet, inclusive growth addresses solely income-related dimensions.

To capture inclusive development, non-income dimensions must be acknowledged. Ravallion and Chen (2003) trace the evolution from growth to inclusive development in two steps: First, by anticipating intra-society inequalities and, second, by including non-income dimensions like social participation and environmental protection. The African Development Bank (2013) highlights that inclusive growth comes through poverty reduction enabled by economic, social, spatial and political inclusion. According to the World Bank, a growth strategy can only be successful when benefitting equity, equality of opportunities and social protection (World Bank and Commission on Growth and Development, 2008). Yet, social dimensions have dominated growth strategies and a more profound acknowledgment of ecological dimensions seems required as the poorer members of society are more opposed to environmental systems (Feenstra et al., 2015).

As the societies develop and face new challenges, the concepts for inclusive development need to be adjusted accordingly. This is an “adaptive learning process, which responds to change and new risks of exclusion and marginalization” (Gwartney et al., 2001). Given the current dissatisfaction with development yields,⁷ claims for more inclusive development have prevailed. One such claim is premised on what the Inclusive Growth and Development Report (World Economic Forum, 2017) characterizes as secular stagnation, particularly of Western societies. In the authors’ view, there are three drivers of this stagnation: (i) rising within-country inequality; (ii) structural fiscal challenges due to long-term demographic changes and simultaneously growing debt issues in many western countries; and (iii) (expected) employment disruptions and income distribution shocks due to information-fueled technological disruptions. Addressing these problems is crucial as “people do not isolate the different aspects of their lives. Instead, they have an overall sense of well-being” (United Nations, 1990). Therefore, an index that represents this holistic development perspective is needed.

From these observations, we conflate that inclusive development comprises both aspects of process-inherent participatory empowerment as well as outcome-related attainments. In the past decades, there has been much progress with respect to development outcomes, especially economic growth. Nevertheless, distributional concerns have become a pressing problem in many countries. The focus of policy debates has lately shifted towards the promotion of equal access to assets that are required for wealth creation (Nordhaus and Tobin, 2018). Assigning single variables to either the process or outcome dimension can be somewhat ambiguous. We therefore draw the distinction between a distributional and absolute development achievements dimension which is more feasible.

To conclude the discussion, we suggest this definition: Inclusive development is societal progress (development) that incorporates participatory empowerment of citizens and promotes human well-being related outcomes in accordance with sustainability of societal foundations (institutions and environment). Although we have the concept of capabilities in mind, we relate our definition to (measurable and operationalizable) development outcomes rather than to subjective indicators of human well-being, e.g. level of happiness, or quality of life, which are closer to the concept of capabilities. In this way, we aim to measure and operationalize capabilities closely.

2.2 Previous Propositions to the Measurement of Inclusive Development

Inclusive development is multidimensional and complex. Our aim is to create a composite development index that allows comparisons between different countries and times. This requires consideration of various heterogeneous characteristics, especially in high and low income countries.⁸ Also, the sophistication of certain variables constitutes a bottleneck manifested by limited data availability. A convincing index for inclusive development on the global scale is still a gap in the literature despite growing political debates and academic attention for the topic.

This section provides a discussion of two earlier attempts of development indices, namely the HDI and the IDI by the World Economic Forum (WEF). The HDI was the

⁷ Culminating in populist movements in many parts of the world accompanied by anti-globalization and anti-trade sentiments.

⁸ As defined by the World Bank.

early attempt of a comprehensive index for comparison of development across countries addressing non-income aspects. It is calculated from three indices, one for income, health and education each ranging on a unit-free [0, 1] scale. The advantages and disadvantages in the choice of variables and computation method for the indices and HDI itself have been discussed extensively by their authors and others (see Klasen, 2010; McKinley, 2010; Samans et al., 2015). This has led to several adjustments in the HDI calculation since its establishment.

From the beginning, the HDI contained p.c. Gross National Income (GNI) as income variable. Income is therefore perceived as an intermediary target and “proxy measure for the choices people have in putting their capabilities to use“ (United Nations, 1990) that were not sufficiently depicted by the other two variables. To address the assumedly decreasing marginal utility of income, the HDI uses the natural logarithm of p.c. GNI. The HDI health variable is the average expectation of life in years. Until 2008, the education indicator was calculated from the share of population with basic literacy skills and the share of gross enrollment. In 2009, this was replaced by an education index comprising the average years of schooling for a 25-year-old person and expected years of schooling for newborns (United Nations Economic Commission for Europe, 2014).

The choice and adjustment of all variables included indicates that the HDI was originally developed to measure achievements in the satisfaction of basic human capabilities. For the calculation of the indices, the authors selected (lower and) upper boundaries. All data beyond those boundaries were curtailed. Consequentially, the country scores are determined by the choice of the boundaries which, in turn, appears to be arbitrary. The dilemma of the HDI is that it fails to address the heterogeneous nature of capabilities and demands for subjective well-being in various categories of countries. People in high income countries may have more refined needs so other capabilities matter more than they do in low income countries. To make the comparison of countries based on the HDI more convincing, it may be useful to think about new categories or the assignment of new variables. This seems necessary as basic capabilities have been increasingly served in large parts of the developing world over the past decades.⁹ Even when choosing other variables for the three incumbent categories, the HDI does not address environmental sustainability. Applying Ravallion and Chen (2003)’s logic, the HDI in its basic version can be regarded as a development index but does not qualify as a comprehensive inclusiveness measurement. To address more specific matters, the UNDP included other indices into the Human Development Reports of the recent years: since 2010 the already mentioned Inequality-adjusted HDI, since 2011 the Multidimensional Poverty Index (MPI), since 2014 the gender development index and since 2019 the gender social norms index. The IHDI stands out in that it is very close to the concept of inclusive development used for the MDI. However, all indices mentioned have rather limited data availability. As for the MPI, gender development index and the gender social norms index, they are focused on more specific aspects of development outcomes and, thus, must rather not be considered as comprehensive development indices but useful tools to address the HDI shortcomings.

A second approach was delivered by the WEF. The IDI¹⁰ captures intra-society concerns on a comparative basis presenting cross-sectional data as well as data on five-year

⁹ Mainly with the exemption of African states.

¹⁰ As an amendment of the WEF’s Inclusive Growth and Development Report 2015 (Sen, 1992), the current IDI was first established in the WEF’s The Inclusive Growth and Development Report 2017 (World Economic Forum, 2017).

changes. The WEF claims that a reassessment of national performance is needed which is based on a larger set of objectives. The IDI which comprises 12 variables which are grouped into three domains:

1. Growth and Development

- GDP p.c.
- Labor productivity
- Healthy life expectancy
- Employment

2. Inclusion

- Net income Gini
- Poverty rate¹¹
- Wealth Gini
- Median income

3. Intergenerational Equity and Sustainability

- Adjusted net savings¹²
- Carbon intensity of GDP
- Public debt
- Dependency ratio (non-working age/working age population).

The IDI summarizes these National Key Performance Indicators. All quantitative data indicators are converted to a [1, 7] scale using a linear min-max transformation. Thereby, it is possible to aggregate the data from the indicator up to the index level. For outliers, a benchmark is applied to reduce the bias on the arithmetic mean of the whole sample. Thereby, the order of, and the relative distance between, country scores is preserved to allow for unbiased comparison. Because of its comprehensive formulation, the IDI enables a better assessment of inclusive development outcomes across different institutional setting (Dreher, 2006).

However, the WEF IDI has certain weaknesses that confine the validity and persuasiveness. Those weaknesses are related to the construction set-up as well as the choice of variables. First, the definition of (upper and lower) boundaries is not comprehensible. This complicates the interpretation of the differences in the country scores for single variables. Neither is it transparent whether all National Key Performance Indicators are weighted equally during the aggregation. Second, despite the large number of sub-indicators, the IDI omits factors on education and, thereby, fails to consider factors critical for inclusive development. Therefore, it cannot fully capture cognitive capacities that are important for human capital, social interaction and the development, denomination and preservation of individual preferences. The data on median income and income Gini as well as GDP p.c. and labor productivity are highly correlated.¹³ Including both variables in each case translates

¹¹ The Poverty rate has different definitions for “advanced” and “emerging” economies (relative and absolute poverty).

¹² Adjusted net savings are defined as “net national savings plus expenditure on education and minus depletion of energy, minerals, and forests, and damage by particulate emissions. Carbon damage has been excluded from the calculation” (World Economic Forum, 2018).

¹³ The Pearson correlation coefficients of the variables concerned are 0.60 and 0.90 respectively.

into a bias in the overall index (Ngepah, 2017). Another bias could arise from the variables savings and debt that comprise similar information. Due to its aggregation method, one cannot distinguish between the contributions of the three subdimensions, especially the development and equity dimensions, which prevents a detailed analysis about the performance of countries in these dimensions. Third and most importantly, the data availability of the IDI does not allow rigorous empirical usage and the analysis of development trends. It offers cross-section data for 2017 and 2018 plus respective five-year trends.¹⁴ This time-frame is too short to conduct meaningful analyses of long-term development.

The previously discussed indices are, to our knowledge, the most prominent attempts for developing an index on inclusive development. However, there has been a list of other authors offering alternative approaches that have not been widely accepted in the literature. Nardo et al. (2005) constructs an inclusive growth index, including a substantial set of economic and socioeconomic variables, e.g. on human capabilities and inequality measures. Anand et al. (2013) deliver another measurement for inclusive growth - as the product of growth rates and equity. Thereby, they are able to disentangle the development and inclusiveness (distributional) outcomes. We claim that both dimensions matter for social mobility and inclusive development. Hence, it is useful to disentangle both dimensions to gain a better understanding of development patterns.¹⁵ Looking also at more subjective social and political factors of human well-being, another attempt is Fairhead et al. (2012) Weighted Index of Social Progress. This index comprises among others indicators of violations of political rights and cultural cohesion and access to social security systems. Since 2014, the Social Progress Imperative (Prada and Sánchez-Fernández, 2019) has been publishing the Social Progress Index.¹⁶ It comprises three subindices—one on the (satisfaction of) basic human needs, foundations on well-being and opportunities. Some of the chosen indicators (tolerance and inclusion, personal freedom and choice) connected to subjective well-being are hard to operationalize and compare across countries and time. Therefore, although this index does capture inclusive development, with our approach we are able to capture inclusive development based on (mostly) economic factors and the scale to which people are able to realize their life ambitions with regards to and/or by the means of material terms while allowing for broad comparisons over between countries and over time. Woldegiorgis (2020) extends the IDI with more indicators that are especially relevant for the African context to analyze patterns and drivers of inclusive development in on the African continent.

The growing number and heterogeneity of contributions with regards to the measurement and index construction for development matters showed the urgency of a common understanding and identification of a general set relevant factors (United Nations Economic Commission for Europe, 2014). Those also serve as a useful guideline for the following presentation of the MDI.

¹⁴ As of late 2021, the WEF seems to already have discontinued the IDI. No Inclusive Development Report or IDI has been published in 2019 or 2020.

¹⁵ Not least because we may expect trade offs between economic development and equality as suggested by the Kuznet's curve which, however, has been severely criticized for suggesting a deterministic relation (Seth and Villar, 2017), lack of empirical evidence (e.g. see Georgescu and Herman, 2019) and should, therefore, be treated with caution.

¹⁶ The Social Progress Index was adopted by the European Commission in 2016 as an alternative development measurement to make development comparable across the set of European countries.

3 The Multidimensional Inclusiveness Index

Given the shortcomings of earlier development indices and the growing relevance of the matter, there is an evident need for a convincing index which measures inclusive development comprehensively for a long timeframe and, thereby, improves the problem of the data availability as well as allows a better comparison of results across countries and time periods. It is important to note that the MDI is designed to compare countries' performance with each other and over time. The MDI will be a useful contribution to solve those two questions that have been identified as two main challenges in the present context (United Nations Economic Commission for Europe, 2014). Our approach embraces the selection of the IDI indicators but is conceptually affiliated to works that differentiate explicitly between absolute achievements and equity (see Anand et al., 2013; Kelley, 1991).

3.1 Subindices and Selection of Variables

For taking a perspective on inclusive development, we must consider a large number of factors that matter for fulfilling individual life goals. We face a trade-off between being parsimonious, i.e. keeping the construction and interpretation of results simple and communicable, and including a larger number of indicators increasing the richness of information (Abson et al., 2012). We include a variety of variables that are representative and meaningful. Data availability is still a major constraint for the selection of variables.

We construct the MDI as the product of two subindices, one on development equity and achievements each: $MDI = I_E \times I_A$, where MDI denotes the aggregated Multidimensional Inclusiveness Index, I_E denotes the Equity Index and I_A the Achievements Index. This specification allows us to capture inclusive development for which distributional outcomes as well as development achievements matter. It also enables us to disentangle the distinct impact of the subindices on the overall index.¹⁷ The selection of this setup is based on the normative judgement of assigning both dimensions equal weighting. We rely on the theoretic comprehension discussed in the previous chapter and the work by Anand et al. (2013) who suggest a similar approach.

The following two sections describe our rationale for variable selection and a description of the data. The section thereafter provides an explanation of the three different versions of the MDI that we offer to researchers.

3.1.1 Equity Dimension

As discussed in Sect. 2.1, inclusive development is related to equality. Since data on distributional outcomes are scarce, we are somewhat limited in our choices. Like most studies that address inclusive growth, we include income inequality (measured by the national income Gini) into our Equity Index. This is the most important variable because income has shown high correlation with people's life satisfaction (Desai, 1991). We are confident that this variable is an expressive proxy for the equity income distribution which is a crucial determinant for human well-being. It is also the income inequality measure with the

¹⁷ We acknowledge that both subindices can interrelate, theoretically as well as empirically there are arguments about a correlation between economic growth and inequality within countries (Samans et al., 2015).

most data available. However, we recognize limitations that come with the Gini index, including the fact that it fails to reflect the share of people living in absolute poverty.

To cover additional aspects of equity, we include data on national distributions for wealth, education and health. Unlike income and wealth, the latter two have an intrinsic value for human well-being. Including these data gives genuine insight. Our elaboration is in line with the United Nations' HDI as three of them (excluding wealth) correspond to the dimensions covered in the HDI.

Data on the distribution of development outcomes are not comprehensively available.¹⁸ For the income Gini, the Standardized World Income Inequality Database (SWIID) offers the most comprehensive data (Stiglitz et al., 2009). The Wealth Gini has been estimated in the Credit Suisse Global Wealth Reports since 2010 (Deaton, 2008). Data on both education inequality and health inequality have been provided by the UNDP in the Human Development Reports since 2010 (United Nations Development Programme, 2020). These inequality measures use the Atkinson inequality index method.¹⁹

3.1.2 The Achievements Dimension

To measure development achievements, we employ the WEF IDI set-up as a conceptual basis for the selection of variables in the achievements index. However, we choose to (i) resign from the structure of the three subdimensions and (ii) adjust the selection of variables.

First, we include GDP p.c. as a proxy for income per person.²⁰ Income is required to cover the expenses for the satisfaction of basic human needs. This indirect measure has drawbacks, e.g. a conversion is complicated given that an assumedly decreasing marginal return of income for human well-being. This could lead to insignificant effects of income increases above a certain level. Second, it was argued that income will only translate into higher human well-being when it exceeds a certain minimum. Below this threshold, income can only serve to satisfy basic human needs which can hardly be considered as human well-being (Samans et al., 2015). Another problem of income as indicator for human well-being is that people differ with regard to their preferences and requirements to assert individual functionalities. Some people have more expensive preferences and requirements. The same real income can result in distinct satisfaction of needs. This is the case both within and between countries as well as across time. Acknowledging these problems (of conversion), we nevertheless conclude that monetary income matters for human well-being.

Matching the distributional data in the equity dimension, we add the corresponding variables for development achievements in the wealth, health and education area. The selected variables here are gross domestic savings (as fraction of GDP), life expectancy at birth, and human capital.

Following the World Economic Forum (2017), we include labor productivity and the employment ratio. Labor productivity is measured by the output per worker and captures

¹⁸ Many sources provide incomplete data; often the data are available for a short timeframe only.

¹⁹ In their computation, Atkinson inequality measures contain an inequality aversion parameter which depending on choice assigns different weights to observations. This approach can be reasonable if it renders social norms shared by the population. However, it is highly normative.

²⁰ Using GDP as an income proxy has its advantages and disadvantages, as discussed in Kakwani and Son (2008, pp. 54–78) and Draper (2018, p. 199). GDP remains a commonly used variable as income proxy. We chose GDP p.c. over GNI p.c. because of data availability.

how technically advanced a country is; arguably an indicator for development achievements. The employment ratio indicates the fraction of the population that is formally employed. Employment is a main source of income but also serves other purposes like allowing people access to social capital or increasing subjective well-being (Winkelmann, 2009).²¹

We include measurements capturing sustainability outcomes. We address the conventional three dimensions of sustainability by selecting adjusted net savings as proxy for financial sustainability and the dependency ratio as proxy for demographic sustainability. Since environmental sustainability is exceptionally important and an increasingly pressing issue in our times, we include carbon intensity of GDP (CO₂ emissions per \$ of GDP) and natural resource depletion in percent of the GNI, i.e. how much of a nation's income is generated by depleting existing natural resources as proxies for environmental sustainability.²²

We retrieve data on GDP p.c., gross domestic savings, life expectancy at birth, labor productivity, employment ratio, adjusted net savings, dependency ratio, carbon intensity of GDP and natural resource depletion from the World Development Indicators (WDI) database of the World Bank (2016). As a proxy for educational achievements, we use the human capital index from the Penn World Tables 9.1 (Frazer, 2006) which approximates the average years of schooling in the population.

Our variable selection is not immune to criticism. For the choices of the variable selection, we face a trade-off between completeness (how well does our measure represent inclusive development?) and exactness (how exact can we trace changes in the data to its underlying causes?). Compared to other development indices, we include a large set of variables, especially in the equity dimension²³ and, thereby, the MDI satisfies requirements for completeness in measuring inclusive development. Thus, we are willing to accept diminished exactness. Additional variables could also be included, e.g. public debt, alternative measures for environmental performance like the carbon footprint as applied by Blancard and Hoarau (2013) or gender equality.²⁴ Including them would mean more completeness and less exactness. Furthermore, data constraints impeded our efforts. While sometimes data were not available at all, in other cases the underlying definition were uncertain and, therefore, obstructed an unbiased comparison. We are aware that the selection and omission of variables necessarily involves value judgements. However, we are confident that, given the aforementioned problems, we present an appropriate compromise between covering relevant domains and keeping the index construction operationalizable.

²¹ Despite our focus on economic variables, we acknowledge this merit of employment for human well-being.

²² Alternatives are: Total greenhouse gas emissions (in kilotons) or the share of renewable energy production/consumption of total energy production/consumption. We decide against the first because the kt amount of emissions from countries is non-informative because of different country sizes. Scaling it by population size or GDP leads to a variable similar to the one that is already included (CO₂ emissions per \$ of GDP). We decide against the second, because the data provided by the International Energy Agency includes nuclear energy in the category of renewable energy. This may not be in line with the general understanding of environmental sustainability.

²³ For a much longer time-frame than the Inequality-Adjusted HDI.

²⁴ Which, we claim, is partly reflected in the equity dimension. Higher rates of gender inequalities translate into higher inequality for the overall society. Another reason not to include variables for gender equality was to have conceptual congruence between the equity plus and the achievements index, each covering four variables that relate to each other, e.g. having one income equity and one income achievements variable, etc.

3.2 MDI Versions: Basic, Equity Plus and Achievements Plus

Because of data limitations in both the equity and the achievements dimension, we decide to offer three versions of the MDI which differ with regards to the variables included: The MDI basic (abbr. as MDI), MDI equity plus (abbr. as MDI_{E+}) and MDI achievements plus (abbr. as MDI_{A+}).

The MDI basic has the largest sample but is based on the narrowest set of variables. The set of variables contains the income Gini in the equity dimension and GDP p.c., savings, life expectancy and human capital in the achievements dimension.

$$MDI = I_E \times I_A = I_E(Gini_{income}) \times I_A \begin{pmatrix} GDPp.c. \\ savings/GDP \\ life\ expectancy \\ human\ capital \end{pmatrix}$$

The MDI equity plus provides an extension in the equity dimension, i.e. we include more variables to measure the Equity Index. Those are wealth Gini, health inequality and education inequality.

$$MDI_{E+} = I_E \times I_A = I_{E+} \begin{pmatrix} Gini_{income} \\ Gini_{wealth} \\ Atkinson_{health} \\ Atkinson_{education} \end{pmatrix} \times I_A \begin{pmatrix} GDPp.c. \\ savings/GDP \\ life\ expectancy \\ human\ capital \end{pmatrix}$$

The MDI achievements plus provides an extension in the achievements dimension, i.e. we include more variables to measure the Achievements Index. These are labor productivity, employment ratio, adjusted net savings, dependency ratio, carbon intensity of GDP and the natural resource.

$$MDI_{A+} = I_E \times I_{A+} = I_E(Gini_{income}) \times I_{A+} \begin{pmatrix} GDPp.c. \\ savings/GDP \\ life\ expectancy \\ humancapital \\ labor\ productivity \\ employment\ ratio \\ adjusted\ net\ savings/GNI \\ depedency\ ratio \\ carbon\ intensity\ of\ GDP \\ nat.\ res.\ depletion/GNI \end{pmatrix}$$

3.3 Method of Calculation of the Multidimensional Inclusiveness Index

We aggregated the 14 variables into two subindices. Subsequently, both subindices are aggregated into the MDI. We distinguish between the three aforementioned MDI versions. We provide the two subindices in their respective extended forms, i.e. the Equity

Index plus (I_{E+}) and Achievements Index (I_{A+}) plus. Hence, we offer a total of five indices.

The MDI basic is calculated for up to 171 countries and each year in the timeframe 1960–2018.²⁵ The selection of countries is based on the definitions used for the World Bank data base. The availability of the MDI equity plus and the MDI achievements plus as well as the subindices differs due to the data availability. With the MDI, we want to improve the data availability in measuring inclusive development and making scores comparable across countries and time, thereby addressing major issues pointed out (United Nations Economic Commission for Europe, 2014).

3.3.1 Imputation

Due to the long timeframe and large number of countries, there are missing observations for several variables. We follow Heckman et al. (2013) and impute missing observations within a series by using linear interpolation. Missing observations at the beginning or the end of a series are substituted by the timewise closest observation that is available. This means that the earliest available value is carried backward to earlier time periods of the series and the latest available value is carried forward until the end of the time series. Missing data tends to be more prevalent in the earlier years as data coverage has improved over time.

As shown in Table 1, the share of missing observations that were extrapolated is considerable, especially in earlier years. While, on average, for the 1960s only about a quarter of all countries data is available, the data coverage for the 2010s is more than three quarters. With our imputation method, we can increase the data availability to 84.9% over the whole timeframe. We argue that the extrapolated data is better than having no data. Even if the specific value of the extrapolated data does not reflect the true data points, the scores of countries in single variables and consequential index ranks are less fluctuating over time. Therefore, this extrapolation carries valuable information and gives an approximation of the unobserved true values. Since we extrapolate naïvely, the index for a country is simply kept constant over time with regard to the extrapolated variable. As soon as the aggregated index value for a country changes over time, this reflects real changes in the actually observed data.

The starting point of the MDI is determined by the earliest time period in the underlying cross-country data. This is mainly determined by the WDI database which starts in 1960 and the income Gini database also starting in 1960. Because of the large proportion of extrapolated data, there is not much variation in the MDI in early years. Thus, a starting point at a later point would also be conceivable.²⁶

3.3.2 Normalization and Inverting

We normalize all variables to a [0, 1] scale where 0 represents the observation with the lowest value in the sample and 1 the observation with the highest value in the entire sample

²⁵ Because of the aggregation method (section Weighting and Aggregation), the MDI cover less countries for some years, e.g. in 1980 it covers 129 countries, in 1995 162 countries, in 2008 the maximum of 171 countries.

²⁶ We leave it to the individual researcher to define the sufficient level of data coverage above which the MDI is deemed meaningful.

covering all years and countries. We are aware of the problem that index scores are sensitive to the selection of boundaries (Klasen, 2010). Also, assigning the observation with the highest value a score of 1 suggests that there are no improvements possible. This is a normative implication that we want to avoid. We only intend to provide a suitable framework for inter-country measurement of inclusive development. All other observations are assigned values according to the percentiles of the distribution of each variable. We normalize over the whole sample (panel normalization) to capture time changes within countries. This allows us to compare the progress within countries across time (Heckman et al., 2013). Compared to normalization for each year separately, this procedure is not sensitive to outliers in specific years but only to those for the whole sample. A disadvantage is that this panel normalization procedure is sensitive to data changes, e.g. when the underlying data is updated or extended in the future, which can result in changed rankings and index values over all years (Heckman et al., 2013). This procedure enables to compare countries' performance with regards to inclusive development in a relative way, i.e. to compare it over time or to other countries. Whether countries can be considered "inclusive" or "not inclusive" would require to define a specific threshold value (similar to the definition of absolute poverty for people living below \$1.90 a day). Defining this threshold requires an extensive (normative) discussion about the minimum requirements under which countries can be considered to be "inclusive". We consider the extensiveness this debate requires to be beyond the scope of this paper. Nonetheless, it would be valuable addition in future debates and research.

For all variables in the Equity Index, as well as carbon intensity of GDP and the dependency ratio in the Achievements Index, high values impact inclusive development negatively. The values of these variables were inverted applying the same scaling. Therefore, the variable can be included in the same manner as all other variables, i.e. high values are beneficial for inclusive development.

Although the income and wealth Gini as well as the education and health inequality measurement technically have a $[0, 1]$ scale, we normalize them into a $[0, 1]$ scale ranging from the highest to the lowest value in the data sample. For the wealth Gini, some reported values are greater than one which is possible when households in the underlying distribution report negative net wealth. We normalize the inequality measure on health and education on a $[0, 1]$ scale as well.

3.3.3 Weighting and Aggregation

The weighting and aggregation methods matter largely for the index score, however, their choice is highly normative and arbitrary. Equal weighting of all variables seems straightforward but is an arbitrary determination based on value judgements. The same holds for adjusted weighting methods based on expert judgement or survey results. Once the variables were given weights, the aggregation method is decisive for the overall index score. While an arithmetic mean aggregation is straightforward and simple, it implies that a bad performance in one score can easily be compensated by a good score in another variable which was criticized for being inappropriate in the context of inclusiveness (Dollar and Kraay, 2002). We claim that all dimensions matter for inclusiveness such that they should not be excluded ad hoc. Yet, a perfect substitution is not justifiable.

To address the underlying data structure, we follow Dörffel et al. (2021) and Gygli (2019) and employ a statistical method that bases the weighting and aggregation on the common characteristics of the data. Principle component analysis uses the full data sample

Table 1 Data coverage

	1960–1969	1970–1979	1980–1989	1990–1999	2000–2009	2010–2018
Imputed	84.90%	84.90%	84.90%	84.90%	84.90%	84.90%
No imputation	25.20%	33.10%	40.10%	57.40%	63.30%	77.00%

The cells show the fraction of countries for which data is available

to determine the weights by partitioning the variance of the variables in the respective sub-index. This is a useful, data-driven method to aggregate multiple variables into one single variable (the index) in a way that best reflects the original data (Gwartney and Lawson, 2006) based on their commonalities. In line with this approach, (Hoekstra, 2019, p. 2063) argue that aggregation through factor analysis (PCA) is preferable to e.g. taking a simple average of variables because it is less arbitrary and also accounts for measurement errors. Weights are determined in a way that maximizes the variation of the resulting principal component (PC). First, individual variable weights are determined, then variables are aggregated into PCs in a second step.²⁷ As opposed to Dörffel et al. (2021); Gygli (2019), we do not use only one PC for each sub-index (or sub-group of variables) but apply the “Kaiser-Criterion”, a common stopping rule (see Ngepah, 2017). According to this criterion, we include all PCs that have an eigenvalue higher than 1. The PCs are again weighted when aggregating them into the two subindices. This aggregation again uses the weighted arithmetic mean. Weights are determined according to relative proportion of the variance of the individual PCs to the total variance (Ngepah, 2017). Although this is not free of value judgements because the choice of aggregation method necessarily involves judgements, we argue that our approach improves upon aggregation by a simple average.

Table 2 shows the resulting number of PCs for the subindices of the respective MDI version and their weights for the single variables. The MDI basic gets by with one PC for each subindex. When including additional variables in the MDI_{E+} and MDI_{A+} respectively, we obtain an increased number of PCs. The percentages in brackets reflect variable weights within each PC. We see diverse weights for single variables across the MDI versions accounting for statistical characteristics in the data.²⁸

²⁷ Weights for the variables that determine each PC are determined by the procedure described in Ngepah (2017). They are calculated from squared factor loadings which are then scaled to sum to 1.

²⁸ The basic achievements index that goes into the MDI basic and MDI_{E+} puts almost equal weights on GDP p.c., live expectancy and human capital (each around 30%) and a very low weight on savings (7%). This indicates that for overall development achievements, GDP, life expectancy and human capital are all similarly important while savings does not contribute much to explain overall variance. The achievements index for the MDI_{A+} contain three components, where the first component has the largest weight by far, making out 69% of the overall index. The first component gives high weights to variables grouping classic development outcomes such as GDP p.c., life expectancy, human capital, labor productivity and the dependency ratio (none of them stand out particularly as weights range 16–20% for these variables). The second component contributes 16% to the overall index and gives most weight to environmental sustainability aspects 57% (the employment ratio contributes another 30%). The last component has a weight of 15% and variables adj. net savings and savings/GDP have weights of 60% and 23% respectively. Thus, this component centers around intergenerational sustainability and sound finances. Lastly, the MDI_{E+} consists of two components with the first one have twice the weight than the first (68% and 32% respectively). The first component gives almost equal weights to income, health and education inequality while the second component almost exclusively contains wealth inequality. This indicates that income, health and education are conceptually closer together and similarly important to explain overall variance as compared to wealth which involves much greater intergenerationality (wealth stocks can be passed on over generations, solidifying inequalities).

An observation of a subindex is reported as missing if more than 40% of observations in the underlying variables are missing (see Heckman et al., 2013). The MDI score is only calculated if both subindexes are available for the respective country and year.

We aggregate the equity and achievements subindexes into the MDI applying equal weights for the multiplication, i.e. both the Equity Index and Achievements Index contribute 50% each to the MDI score. Here, we apply the value judgement that, based on our definition, both dimensions matter likewise for inclusive development. We decide for a geometric aggregation because the easy compensation between subindex scores seems inadequate. Using this aggregation method, a country requires a good performance in both dimensions to obtain a high MDI score. Afterwards, we multiply the MDI and the subindexes by 100, thereby, bringing it into a [0,100] scale, making it more digestible. Additionally, by constructing the index in this way, we retain most of the exactness with respect to these two domains since researchers are able to analyze countries' performance separately for those two domains and, therefore, disentangle the effects. We show applications of this in Sect. 4, especially in Figs. 4, 5 and 6.

The MDI still comes with some limitations. Due to the outlined construction with pooling of variables, the MDI cannot be perfectly sensitive to specific contexts. We make no claims about the specific drivers of the score for each observation and emphasize that we are not able to directly derive policy conclusions. The MDI is largely centered around a variety of aspects that are relevant for humans' lives, it cannot show structural differences between sexes, people of different age-groups and between rural and urban population. These differences may, however, be important for development. Nevertheless, we are confident that with the chosen procedure, the MDI is an important step forward in measuring inclusive development.

In the following section, we show that MDI is a valuable addition to existing indices in that it captures the concept of inclusive development well and expands data compared to existing indices.

4 Overview of the Multidimensional Inclusiveness Index Data

Table 4 (see “Appendix”) shows the MDI basic ranks of all countries for the years 1993 and 2018 plus the 25-year changes of the scores (absolute and percentage changes) for the 168 countries for which data points are available for those years. We deem this time interval long enough to capture structural changes in the development of a country.

With the most recent data from 2018, we see top positions largely dominated by Western developed countries. With Norway ranking first, the top ten positions are taken by Central and Northern European countries. The first non-European countries are Canada ranking 15th and Japan 19th. At the bottom of the ranking, we see many Sub-Saharan African and Central Asian countries as well as small island states.

As shown in the last two columns in Table 4, the vast majority of countries improved their scores (at least between the two listed years). Only ten countries—about 7% of the sample—experienced a drop in their scores. The drops are rather small in scale; Eswatini and Cote d'Ivoire having the biggest losses with 9.8% and 7% respectively. In this case, Eswatini becomes a worrying example in light of its low absolute score. The improvements in the scores are much bigger in magnitude. Rwanda and Peru, for example, were

Table 2 Index weights for different MDI versions

Index	Subindex	Variable	Variable weight (PC 1) (%)	Variable weight (PC 2) ^a (%)	Variable weight (PC 3) ^a (%)
MDI basic	Achievements index [50%]	GDP p.c.	32		
		Savings	7		
		Life expectancy	28		
		Human capital	33		
		Income equity	100		
MDI equity+	Achievements index [50%]	GDP p.c.	32		
		Savings	7		
		Life expectancy	28		
		Human capital	33		
		Income equity	28	6	
	Equity index [50%]	Wealth equity	0	90	
		Education equity	34	1	
		Health equity	39	2	
		Income equity	100		
		Income equity	100		
MDI achievements+	Achievements index [50%]	GDP p.c.	18	5	1
		Savings	4	4	23
		Life expectancy	16	0	2
		Human capital	20	0	10
		Labor productivity	16	0	0
		Employment ratio	3	30	0
		Adj. net savings	3	1	60
		Carbon intensity	0	57	3
		Nat. res. depletion	2	0	0
		Dependency ratio	18	2	1
		Income equity	100		
		Income equity	100		

^aEmpty cells indicate that only one principal component is used; Principal components are weighted according to their relative contribution to overall variance; in the I_E in the MDI_{E+} PC 1 has a weight of 68% and PC 2 a weight of 32%; in the I_A in the MDI_{A+} PC 1 has a weight of 69%, PC 2 16% and PC 3 15%

two countries able to more than double their scores. The most populous countries, China and India, both show positive developments with improvements of 12.6% and 9% respectively, and neither country is in a top position with China ranking 68nd and India 120th. The results suggest successes in facilitating inclusive development, with forerunners leading and still improving their scores and many countries lacking behind but catching up over time.

Figure 1 provides a graphical overview of MDI scores for 2018. Namibia sets the lower, Norway the upper boundary—with the scores 1.75 and 75.1 respectively. The map shows the four quartiles of MDI basic values in between. It shows a heterogenous picture. Most of North America, Europe, Oceania and Russia display relatively high MDI scores, most countries in South America and Southeast Asia have scores in the middle quartiles and most countries in Sub-Saharan Africa and notably India have low scores. The figure reveals trends to regional concentrations, i.e. if we observe a high MDI score in one country, the

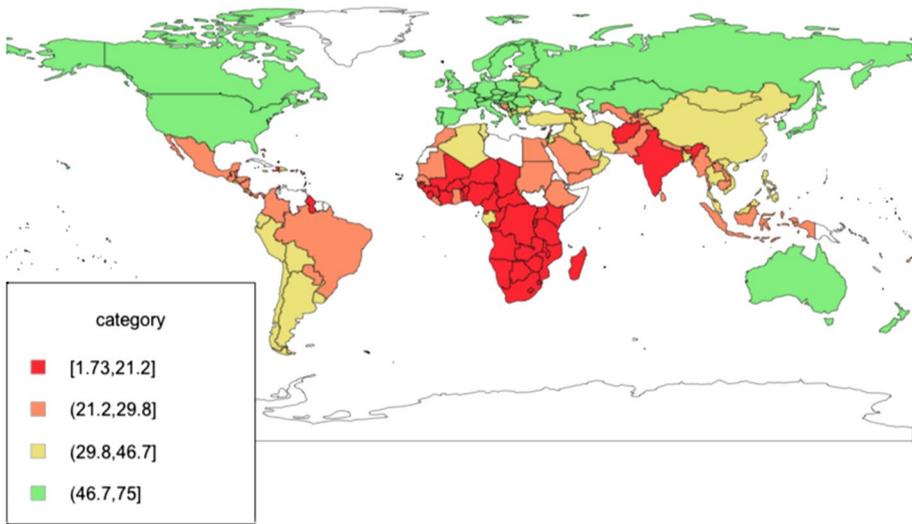


Fig. 1 MDI basic map for 2018. *Note:* Countries are grouped into quartiles. White countries reflect missing data

neighboring country is likely to score (relatively) high as well. In most cases, neighboring countries are in adjacent quartiles.

Figure 2 shows the development of MDI basic scores in nine selected countries. We choose Norway as the country with the highest MDI basic score in 2018. The figure demonstrates that Norway has obtained high MDI scores since the late 1980s with minor fluctuations and rapidly increasing scores in earlier periods. The United States and Russian Federation both scored very similar in 2018, but their graphs reveal very different developments over time. The US score peaked in 1979, showing that development took place mostly in the post-World War II period. Russia, on the other hand, had high MDI scores thanks to high income equality in the times of the Soviet Union. After the collapse of the Soviet Union, the societal and economic changes led to a 15-point decline in the MDI score. Since it hit rock bottom around 1995, the situation has substantially improved. Interestingly, China has made no big improvements in the last 30 years. After large improvements through the early 1980s, the MDI scores stagnated during the 1990s and even declined in the 2000s. Only, recent years show improvements. Peru is the country with the second largest gain during the last 25 years, i.e. 105%. From the beginning of the timeframe, Peru has made steady progress, and the gains are especially large since 2000. Ethiopia also almost doubled its score in the last 25 years from 11.9 to 23.5, reflecting a 98% increase. Rwanda is also a remarkable case because it has almost the same MDI score today that it had in the mid-1980s. The political turbulences in the country, culminating in the genocide in 1994, had a clearly visible impact on the MDI scores dropping down to a value of 6 but climbing back to about 15 reflecting the largest increase in our sample between 1993 and 2018 (of 129%). Eswatini ranks 152nd and has experienced the largest decrease since 1993. Namibia, last in our 2018 ranking, shows very little improvement in its MDI score.

In Fig. 3, we compare the development of the MDI basic score of four countries covered in Fig. 2 to their development with regards to HDI, IHDI, GDP p.c. and IDI scores. In the

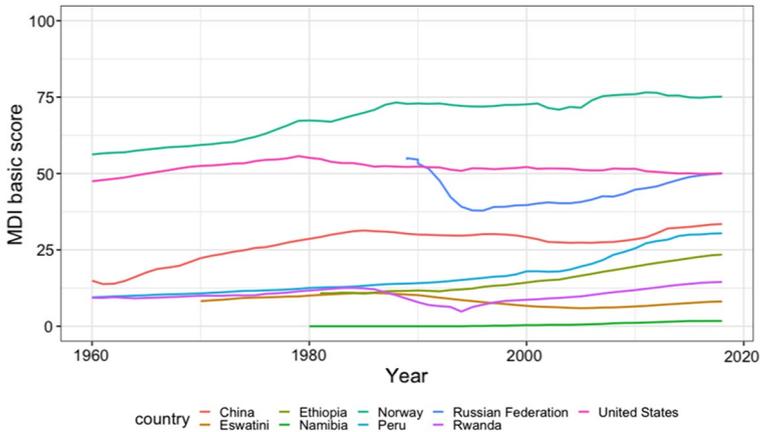


Fig. 2 MDI basic scores for selected countries

case of the USA, an increase in GDP p.c. does not necessarily translate into improvements in the MDI. Similarly, the panel with China illustrates that there is a close connection to the increase in GDP p.c. and the increase in the HDI but that the MDI does not follow this trend. For China, GDP p.c. and HDI have increased substantially over the last 30 years but this is not mirrored by advances in the MDI. In both cases, this may be ascribed to increasing inequalities within the society. The panel of Peru shows a larger increase in the MDI than in GDP p.c. or HDI in the last 20 years. Again, the HDI trend seems to be closely related to the trendline in GDP p.c.. Lastly, Eswatini illustrates that the MDI follows a different trend than GDP p.c. or HDI data. Eswatini's GDP p.c. has increased steadily during the last 30 years, while the MDI declined. The HDI data show a large drop around the year 2005 when Eswatini introduced a constitution with more democratic rights and regular elections. The comparison to the IHDI is harder due to its limited data availability (data is available only after 2010 and, in the case of China, it is even patchy). For all four countries, overall IHDI scores are higher than MDI scores. The IHDI trends seem to follow the HDI trends quite closely, except for Peru where the IHDI trend is steeper than the HDI trend and resembles more the trend of the MDI. In the case of Eswatini the IHDI trend shows no similarity to the MDI trend. In the case of Peru this might be due to changes in equality as compared to development achievements while the opposite is probably true for Eswatini. In the three panels, where IDI data is available, the IDI ranks countries somewhere in between GDP p.c. and MDI. Due to missing time-series data of the IDI, we cannot compare the trends over time.

Figure 3 illustrates two important aspects. First, as suggested by significantly different behavior, the MDI contains information different from the HDI and GDP p.c.. The MDI uses additional information in its equity subindex and weights it against the achievements index (which is closer to trends in GDP p.c. or the HDI). Second, having a larger sample than the HDI and especially the IDI, the MDI is advantageous in revealing long-term

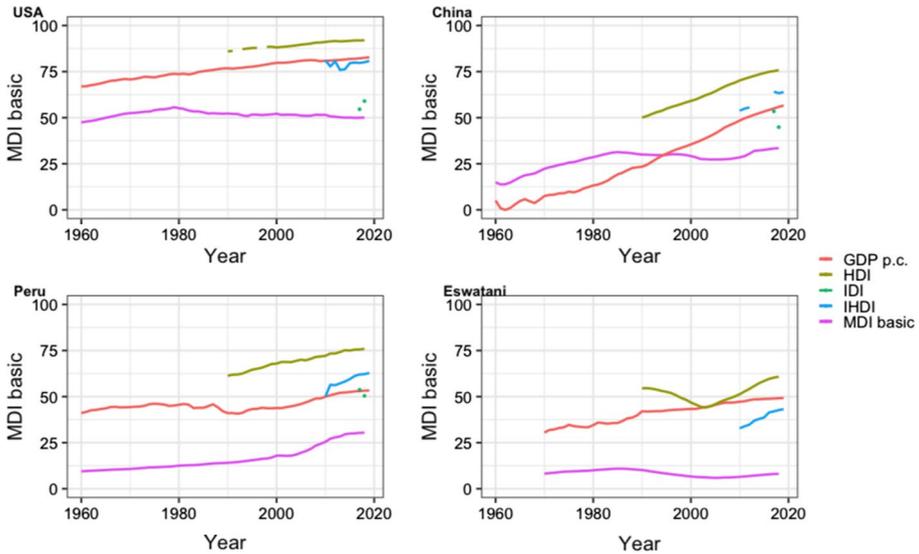


Fig. 3 Comparison of MDI to HDI, IHDI, IDI and GDP development for selected countries

development patterns. In fact, the MDI sample size, with 8145 observations, is 50% larger than the HDI sample with 5399 observations, 5.6 times larger than the IHDI with 1454 observations and about 40 times bigger than the IDI sample.²⁹

The performance differences of the MDI basic, HDI, IDI and GDP p.c. are shown in Table 3, where we calculate the respective correlation coefficients for the year 2018 (i.e. we ignore time-series correlation here). The Pearson correlation coefficient looks at the distances between country scores in the data while the Spearman correlation coefficient compares the ranks of countries. Table 3 reveals that correlations are significantly different from zero for the overall sample and most subsamples and for both methods used. The correlation of the MDI for all countries is less pronounced with HDI and GDP p.c., large with the IDI, largest with IHDI. Correlations are much smaller and sometimes not significantly different from zero for non-OECD countries, Least Development Countries (LDCs), and low-income countries (LICs).

Although most correlation coefficients are relatively large and significant, the previous analysis shows that MDI provides different information. Part of the correlation of the MDI basic with the comparison indices is the result of including similar variables such as GDP p.c.. The correlation with the IHDI is—with correlation coefficients of over 0.9—extremely large (except for LDCs and LICs). This is no big surprise since the IHDI is conceptually very close to the concept of inclusive development used to construct the MDI. We see this optimistically as additional confirmation that the MDI is an appropriate measure for inclusive development which also substantially expands sample size to research inclusive development compared to the IHDI. One major reason why the MDI behaves

²⁹ The MDI sample spans the years 1960–2018 and up to 171 countries while the HDI data spans between the years 1990–2018 for up to 204 countries. The IDI is only available for the years 2017 and 2018 for 103 countries each.

Table 3 Correlations between the MDI basic, HDI, IHDI, IDI and GDP p.c. for different country groupings for the year 2018

	OECD countries (n = 36)	Non-OECD countries (n = 141)	LDCs (n = 42)	Non-LDCs (n = 135)	LICs (n = 24)	MICs (n = 98)	HICs (n = 55)	All countries (n = 175)
Pearson corr. coeff.								
MDI basic and HDI	0.82*	0.73*	0.45*	0.82*	0.22	0.68*	0.75*	0.83*
MDI basic and IHDI	0.92*	0.85*	0.68*	0.90*	0.38	0.79*	0.71*	0.91*
MDI basic and IDI***	0.76*	0.68*	0.73*	0.82*	0.54	0.55*	0.71*	0.86*
MDI basic and log GDP p.c.	0.74*	0.59*	0.26	0.71*	0.25	0.42*	0.55*	0.78*
Spearman rank-corr. coeff.								
MDI basic and HDI	0.65*	0.76*	0.40**	0.82*	0.24	0.69*	0.69*	0.87*
MDI basic and IHDI	0.83*	0.86*	0.57*	0.92*	0.38	0.80*	0.78*	0.93*
MDI basic and IDI***	0.80*	0.72*	0.61**	0.82*	0.33	0.55*	0.78*	0.87*
MDI basic and log GDP p.c.	0.65*	0.60*	0.27	0.70*	0.08	0.44*	0.55*	0.78*

* p -val < 0.01; ** p -val < 0.05; ***respective samples for the IDI are smaller. LDCs are least developed countries, LICs are low income countries, MICs are middle income countries and HICs are high income countries, as defined by the World Bank

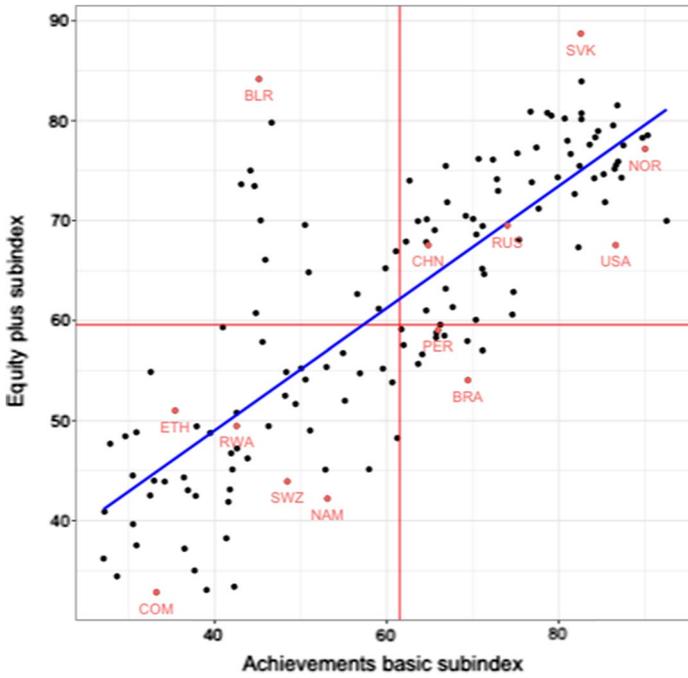


Fig. 4 Scores in achievements index basic and equity index plus for 2018

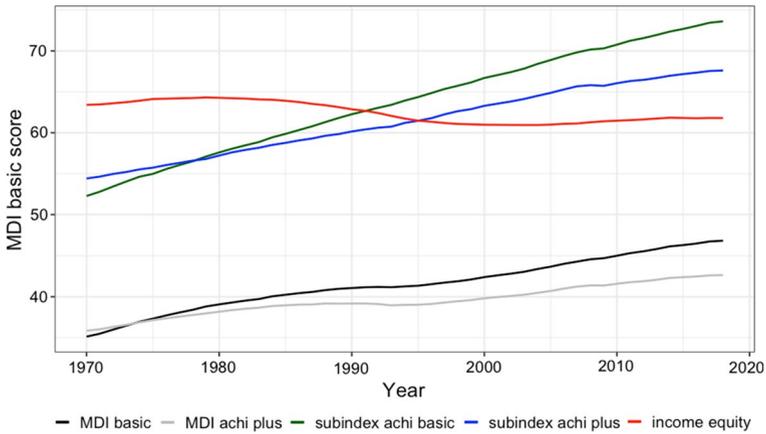


Fig. 5 Development of long-term global averages of the MDI basic, MDI achievements and their subindices (1970–2018)

differently than the GDP p.c. or HDI data is that we combine achievement data (as do HDI and GDP p.c.) with equity data. To illustrate this, we show Figs. 4, 5 and 6 where we look at the subindices separately.

The MDI set-up with equity and achievements subindices helps to disentangle countries' performances in these dimensions. Figure 4 shows all available scores of the I_{E+} and I_A subindices

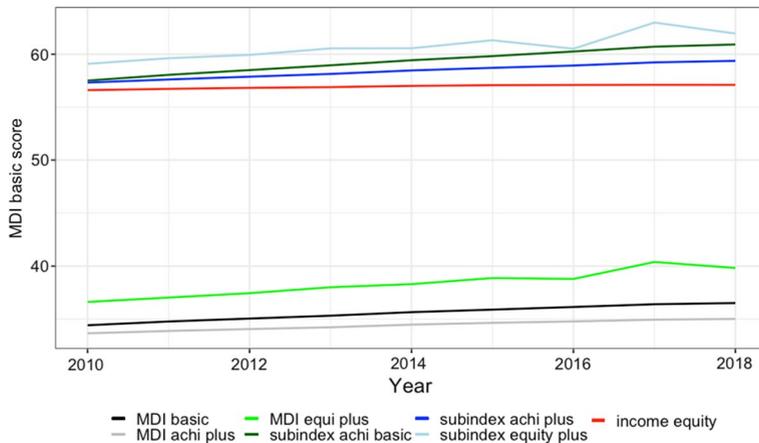


Fig. 6 Development of short-term global averages of all MDI versions and subindices (2010–2018)

for 2018. We choose to show the MDI_{E+} results because it is richer in information on equity. For comparison purposes, we highlight the nine countries included in Fig. 2. Overall, the performance of countries is quite heterogeneous. The red lines show the sample averages for both indices. The blue linear fitting line highlights the positive correlation between the scores in the subindices. Countries which perform well in the I_A subindex tend to also score high in the I_{E+} subindex. However, there are countries which perform very differently in the two subindices. Belarus (BLR), for instance, scores high in the I_{E+} but low in the I_A subindex. That means that development achievements in Belarusian society are below the global average but they are relatively equally distributed. A contrary picture applies to Brazil (BRA). This country obtained a higher score in the Achievement Index but obviously the merits are spread comparatively unequally within the population. As argued in Sect. 2.1, both countries cannot be perceived as truly inclusive because of deficiencies in one of subindices. In fact, while Belarus ranks 2nd in the equity subindex, its I_{E+} position is 114th. Brazil ranks on 54st position in the achievements subindex but only lands on the 109th I_{E+} position. Overall MDI ranks are somewhere in between: Belarus ranks 55th and Brazil 88th. The highest I_{E+} score is obtained by the Slovak Republic (SVK), the lowest by the Comoros (COM).

Concerning the question of countries' performance over time, Figs. 5 and 6 show the developments of the global averages of the three MDI versions and their subindices. Figure 5 addresses the evolution of the global averages for the different MDI basic, MDI_{A+} and their subindices for the longer time frame from 1970 to 2018. Figure 6 displays the short-term period—2010–2018—for which the data availability is improved with regards to equity indicators. Both figures show a clearly positive trend for all three MDI versions, with countries scoring the highest in the MDI_{E+} in recent years. Following the positive progression of the 1970s and 1980s, the MDI basic and MDI_{A+} experience a kink in the early 1990s, (see Fig. 5) which is mostly driven by the undesirable development of the global income equity. The income equity displays a worrying picture over the whole timeframe, i.e. the income distribution has become more unequal since 1970 with strongest drop taking place in the early 1990s which might be associated to the collapse of the Soviet Union and the economic restructuring in the former member states. We also see slight flattening in trends of the achievements subindices following the 2008 global financial crisis. In the last years, there has been slight improvements of global income equity. When including the other inequality measures on the distribution of wealth, health and education which are available from the year 2010

(see Fig. 6), we see that the latest upward trends are even more substantial. Figure 5 (after 1995) and Fig. 6 reveal that, on average, the performance in the achievements subindices is better than in the equity subindices.

5 Conclusion

Despite substantial success in global poverty reduction translating into income gains in many countries, there has been ongoing discontent with regards to development outcomes. Environmental problems and inequalities might be among the most pressing issues of our times. For a better evaluation of development processes, we propose a comprehensive multidimensional development index that is human-centered and that captures a variety of aspects relevant for individual human development. We are confident that the MDI—in its three versions—is an important addition to the existing indices, such as the HDI, Inequality-adjusted HDI and IDI. It allows a comparison of inclusive development outcomes for a large number of countries and a long timeframe. The MDI is based on 14 single indicators that are grouped into two subindices—one on development achievements and one on development equity respectively. The distinction between the subindices helps to disentangle the effects with regards to these two domains. Both subindices are weighted equally as both matter for inclusive development. In order to aggregate of the subindices, we apply PCA to determine the weights of single variables.

Due to similarities in the variables that are included, the MDI, to a certain degree, shows correlations with other development measurement, namely the HDI and IDI and especially the IHDI. However, we show that the MDI, processes a larger set of information and reveals differences in the performance when compared to the HDI and IDI while showing high similarity to the IHDI. These differences, and the increase in data availability by 50% compared to the HDI and 5.6 times compared to the IHDI, make the MDI a valuable addition.

In the MDI data, we see mainly European and other Western industrialized countries on the top positions, many Sub-Saharan African countries on the last ranks. Over the whole time period (1960–2018), the global averages for all MDI versions have been increasing. This progress can mainly be related to successes in the achievements dimensions. This means that many people in the world have a higher living standard than a generation ago. The global average with regards to the income equity is lower today than it was in 1970. While on average the world has become more prosperous, the welfare gains seem to be distributed more unequally. However, last years' trends create a more comforting impression. In MDI country trends we see that big societal and economic changes (e.g. the end of the Soviet Union or the Rwandan genocide) are very pronounced in the data.

The three versions of the MDI and the subindices can serve as a starting point for future debates and empirical analysis of human development on a comprehensive scale. Careful investigation can identify structural development patterns and those factors that facilitate MDI scores. Once there is a enhanced understanding of the determinants of inclusive development outcomes, policy choices can be more closely tied to preformulated objectives which would ultimately make the MDI a valuable conceptual framework (United Nations Economic Commission for Europe, 2014, p. 89).

Appendix

See Table 4.

Table 4 Ratings of multidimensional inclusive development

Rank	Country	MDI basic score 2018	MDI basic score 1993	Δ 1993–2018 (abs.)	Δ 1993–2018 (%)
1	Norway	75.2	72.5	2.7	3.70
2	Slovak Republic	71.3	66.2	5.1	7.70
3	Denmark	70.7	70	0.8	1.10
4	Slovenia	70.7	63.6	7.1	11.10
5	Iceland	70.3	58	12.4	21.30
6	Czech Republic	70.3	66.5	3.8	5.70
7	Sweden	70.3	69.4	0.9	1.20
8	Finland	70.3	68	2.3	3.30
9	Switzerland	69.3	63	6.3	10.00
10	Netherlands	68.1	63.5	4.6	7.20
11	Luxembourg	67.9	65.4	2.6	3.90
12	Belgium	67.9	63.3	4.5	7.10
13	Austria	66.2	61.6	4.6	7.50
14	Germany	65.8	66.9	-1	-1.50
15	Canada	64.5	61.2	3.3	5.30
16	Malta	63.8	53.5	10.3	19.30
17	Ireland	63	49.4	13.6	27.40
18	France	61.5	57	4.4	7.80
19	Japan	60.8	61.2	-0.4	-0.60
20	Croatia	60.7			
21	Hungary	60.6	52.4	8.2	15.70
22	Australia	59.9	61.3	-1.4	-2.30
23	United Kingdom	59.6	51.8	7.8	15.00
24	Poland	59.6	51.2	8.3	16.20
25	Korea, Rep.	58.9	52.8	6.1	11.60
26	Kazakhstan	58.5	45.2	13.3	29.50
27	Estonia	56.4	44.5	11.8	26.60
28	New Zealand	56.4	54.3	2.1	3.80
29	Cyprus	56.3	50.2	6.1	12.20
30	Israel	56.1	53.8	2.4	4.40
31	Italy	53.8	49.2	4.6	9.30
32	Ukraine	53.1	47.6	5.5	11.50
33	Greece	52.9	45.1	7.8	17.20
34	Singapore	52.7	38.2	14.5	37.90
35	Spain	52.3	49.5	2.8	5.70
36	United States	50	51.3	-1.2	-2.40
37	Russian Federation	50	42.3	7.7	18.30
38	Romania	49.2	52.5	-3.3	-6.30
39	Serbia	48.6			
40	Lithuania	47.6			
41	Portugal	47.2	40.5	6.7	16.50
42	Latvia	46.7			
43	Moldova	46.1			
44	Bulgaria	46	44.6	1.4	3.20

Table 4 (continued)

Rank	Country	MDI basic score 2018	MDI basic score 1993	Δ 1993–2018 (abs.)	Δ 1993–2018 (%)
45	Qatar	44.4			
46	Kuwait	44.3	42.2	2.1	5.10
47	Uruguay	43.2	34.1	9.1	26.70
48	Hong Kong SAR, China	42.8	39	3.8	9.90
49	Kyrgyz Republic	42.7	33.7	9	26.60
50	Mongolia	42.1	32.8	9.3	28.30
51	Argentina	41.8	30.4	11.4	37.50
52	United Arab Emirates	41.2	37.3	3.8	10.30
53	Iraq	40.9	33	7.9	24.00
54	Armenia	39.8	33.2	6.7	20.10
55	Belarus	39.7	33.4	6.3	18.90
56	Vietnam	38.6	27.2	11.4	41.80
57	Albania	38.4	30.6	7.8	25.50
58	Algeria	38.4	28	10.4	37.20
59	Jordan	38.4	29.2	9.2	31.50
60	Malaysia	37.7	26.7	11	41.00
61	Mauritius	37.6	31.9	5.7	17.80
62	Thailand	36.1	23.5	12.6	53.60
63	Turkey	35.8	24.2	11.7	48.20
64	Montenegro	35.7			
65	Tunisia	34.9	24	10.8	45.10
66	Gabon	34	27.1	6.9	25.60
67	Chile	33.5	24.4	9.1	37.40
68	China	33.5	29.7	3.8	12.60
69	Oman	33.1	30.4	2.7	8.80
70	Azerbaijan	32.9	24.9	7.9	31.80
71	Ecuador	32.4	20.1	12.3	61.40
72	Jamaica	32	30.4	1.6	5.40
73	El Salvador	31.8	18.1	13.7	75.90
74	Philippines	31.8	26.1	5.7	21.80
75	Bangladesh	31.1	22.4	8.6	38.50
76	Dominican Republic	30.7	20.8	9.9	47.70
77	Peru	30.4	14.8	15.6	105.30
78	Bolivia	30.1	16.3	13.7	84.20
79	North Macedonia	30	29.2	0.8	2.60
80	Mexico	29.5	22.9	6.6	28.90
81	Myanmar	29.2	18	11.2	62.00
82	Barbados	29	28.5	0.5	1.80
83	Panama	28.9	18.9	10	52.90
84	Cambodia	28.4	17.9	10.5	58.50
85	Costa Rica	28.2	30.1	-2	-6.50
86	Pakistan	28.2	22.7	5.4	23.90
87	Lebanon	28.1	23.7	4.4	18.50
88	Brazil	27.9	14.3	13.6	95.20

Table 4 (continued)

Rank	Country	MDI basic score 2018	MDI basic score 1993	Δ 1993–2018 (abs.)	Δ 1993–2018 (%)
89	Morocco	27.7	21.1	6.6	31.30
90	Uzbekistan	27.4	23.1	4.3	18.60
91	Paraguay	27.3	20	7.3	36.80
92	Egypt, Arab Rep.	27	23.2	3.8	16.40
93	Colombia	26.6	16.6	10	60.10
94	Mauritania	25.6	18.8	6.8	36.20
95	Nicaragua	25.5	14.1	11.4	80.80
96	Belize	25.3	18.8	6.5	34.50
97	Bosnia and Herzegovina	25.3			
98	Seychelles	25.1	23	2.1	9.10
99	Brunei Darussalam	25	23.3	1.6	6.90
100	Bahrain	24.8	23.8	1	4.40
101	Sudan	24.5	17.8	6.7	37.70
102	Nepal	24.4	15.6	8.8	56.40
103	Ghana	24.3	21	3.3	15.50
104	Guatemala	24.3	13.9	10.4	75.10
105	Georgia	23.8	22.2	1.6	7.40
106	Sri Lanka	23.6	24.6	-1	-4.20
107	Ethiopia	23.5	11.9	11.6	97.90
108	Bahamas, The	23.4	22.2	1.2	5.40
109	Indonesia	23.1	22.2	0.9	4.10
110	Saudi Arabia	22.9	19.6	3.3	17.00
111	Timor-Leste	22.3			
112	Liberia	22.1			
113	Bhutan	21.6			
114	Senegal	21.5	15.3	6.2	40.50
115	Honduras	21.5	16.2	5.3	32.60
116	Uganda	21.3	12.3	9.1	73.90
117	Afghanistan	21.2			
118	Zimbabwe	20.2	15	5.2	34.60
119	Kenya	20.1	13.7	6.3	46.00
120	India	19.7	18.1	1.6	9.00
121	Kiribati	19.5	18.5	1	5.60
122	Nigeria	19.5	13.9	5.6	40.50
123	Congo, Rep.	18.7	16.4	2.2	13.40
124	Cameroon	18.2	15.5	2.8	17.80
125	Niger	18.1	11.8	6.3	53.00
126	Mali	17.8	11.6	6.2	53.70
127	Madagascar	17.5	13.3	4.2	31.10
128	Togo	17.4	14.8	2.6	17.80
129	Benin	17.2	14	3.2	22.90
130	Guyana	17	15.2	1.8	11.90
131	Puerto Rico	16.9	17	-0.1	-0.60
132	Guinea	16.9	11.5	5.4	47.00

Table 4 (continued)

Rank	Country	MDI basic score 2018	MDI basic score 1993	Δ 1993–2018 (abs.)	Δ 1993–2018 (%)
133	Gambia, The	16.8	12.3	4.6	37.30
134	Malawi	16.8	8.4	8.4	99.50
135	Burkina Faso	16.4	8.9	7.5	83.80
136	Sierra Leone	16	8.6	7.4	85.90
137	Congo, Dem. Rep.	15.8	12.6	3.3	25.90
138	Burundi	15.8	11.8	4	34.40
139	Angola	14.8	10	4.8	48.00
140	Rwanda	14.5	6.3	8.2	129.00
141	Cabo Verde	14.2			
142	Equatorial Guinea	13.7			
143	Chad	13.2	10.6	2.6	24.60
144	Guinea-Bissau	12.4	11.7	0.8	6.50
145	Mozambique	12	8.1	3.9	47.60
146	Cote d'Ivoire	11.7	12.6	-0.9	-7.00
147	Zambia	11.7	9.4	2.3	24.40
148	Botswana	11.4	9.1	2.3	25.20
149	Lesotho	10.8	9.6	1.2	12.10
150	Haiti	10.5	8.9	1.6	18.40
151	South Africa	8.4	8	0.4	5.20
152	Eswatini	8.1	9	-0.9	-9.80
153	Central African Republic	8	7	1	14.90
154	Comoros	8	6.9	1.1	16.60
155	Namibia	1.7	0	1.7	
156	Fiji		24.1		
157	Lao PDR		20.3		
158	Papua New Guinea		11.2		
159	Solomon Islands				
160	Syrian Arab Republic		22.6		
161	Tajikistan		29.1		
162	Turkmenistan		27.1		
163	Tonga		23.4		
164	Trinidad and Tobago		28.5		
165	Tanzania		13.4		
166	Venezuela, RB		29.4		
167	Vanuatu		19.6		
168	Yemen, Rep.		16.1		

Empty cells indicate missing values

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