

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

# The International Journal of Management Education

journal homepage: [www.elsevier.com/locate/ijme](http://www.elsevier.com/locate/ijme)

## Moving the world into a safe space—the GAPFRAME methodology

Katrin Muff<sup>a,\*</sup>, Agnieszka Kapalka<sup>a</sup>, Thomas Dyllick<sup>b</sup>

<sup>a</sup> Business School Lausanne, Rte de la Maladière 21, 1022 Chavannes, Switzerland

<sup>b</sup> University of St. Gallen, Tigerbergstr. 2, CH-9000 St.Gallen, Switzerland



### ARTICLE INFO

#### Keywords:

GAPFRAME

Index

Sustainable development goals (SDG)

Business sustainability

Methodology

Indicators

National priority issues

Long-term business opportunities

### ABSTRACT

In September 2015 the United Nations General Assembly unanimously adopted the 2030 Agenda for Sustainable Development with its 17 Sustainable Development Goals (SDGs), one of the most ambitious and important global agreements in recent history. To advance implementation of the SDGs, a new framework – the GAPFRAME – has been developed and published recently in this journal (Muff, Kapalka, Dyllick, 2017). The GAPFRAME highlights the gap between the current state of the world and a desired future state, defined as a “safe space”, and identifies priority issues that need to be addressed on a national, regional, and global level. The [www.gapframe.org](http://www.gapframe.org) website provides free access to the data collected for 196 countries and 22 regions across the world. This website was launched with the intention to provide decision-makers and stakeholders with aggregated information on the priority issues to be urgently addressed.

The GAPFRAME focuses attention on addressing identified priority issues, holding each country or region accountable for the successful implementation of the global sustainability targets within their area of responsibility. It can be used as a planning tool, in particular for business, to identify long-term business opportunities. It can be also used as an educational tool to sensitize students to relevant sustainability problems and to evaluate and compare different sets of priorities.

In this article, we explain in detail the GAPFRAME methodology, covering the different steps in the design of the framework, in scaling, normalization, weighting, and aggregating the information collected for the GAPFRAME Index V1 version. It will be best understood if the GAPFRAME concept is already known, but it can be read as well as a stand-alone article, primarily with a methodological focus.

### 1. Introduction

In September 2015 the United Nations General Assembly unanimously adopted the 2030 Agenda for Sustainable Development, one of the most ambitious and important global agreements in recent history. The agenda with its 17 Sustainable Development Goals (SDGs) at its heart aims to set the world on a path towards a better future for all. It recognizes that addressing these challenges is everybody's responsibility and explicitly call on business, civil society, and the tertiary and academic sectors among others to collaborate with governments and international organizations towards the achievement of the SDGs (United Nations, 2016).

To advance implementation of the SDGs, we took up the challenge of creating a new framework, called GAPFRAME, translating the 17 SDGs into nationally relevant issues and showing where a country (or a region) is today as compared to where it should be. In other words, the framework highlights the gap between the current state of the world and a desired future state, identifying priority issues that need to be urgently addressed on a national, regional, and global level to make progress towards the global “Agenda 2030”

\* Corresponding author.

E-mail address: [katrin.muff@gmail.com](mailto:katrin.muff@gmail.com) (K. Muff).

and ultimately reach a collective “safe space”. The GAPFRAME is a first attempt to develop a composite index which compares the current state of the world to its ideal future, based on an integral approach that embeds four sustainability dimensions: environment, society, economy and governance in one single framework.

In this article, we present information related to the GAPFRAME methodology. We cover the different steps in the design of the framework, in scaling, normalization, weighting, and aggregating information to create the GAPFRAME Index V1 version. It elaborates on the recently published article presenting the GAPFRAME concept in this journal (Muff et al., 2017). The [www.gapframe.org](http://www.gapframe.org) website provides free access to the GAPFRAME data collected for 196 countries and 22 regions across the world. The present article will be best understood if the GAPFRAME concept is already known, but it can be read as well as a stand-alone methodological article.

To the best of our knowledge, an attempt to compare the current state of the world to its ideal future state and creating an index that measures the gap between these two states has not been made yet. Instead of comparing countries among themselves (i.e. provide a traditional performance ranking for countries), we seek to point out the weakest issues of each individual country, encouraging various stakeholders to address these sore spots and improve the local situation while simultaneously contributing to the global welfare. In particular we aim to encourage business to transform the identified issues into business opportunities by following the *Business Sustainability Typology 3.0* approach (Dyllick & Muff, 2016). This approach implies an *outside-in* perspective where a company addresses big sustainability challenges and applies its resources, competencies and innovation power to help resolve them.

We acknowledge that the GAPFRAME approach is very demanding, implying the definition and approximation of an “ideal state” of the world which is very challenging on many grounds. They include questions of indicators selection, data availability, manipulation and aggregation, but also normative questions related to defining ideal states for the different indicators. In particular regarding the normative challenges, we want to provide as much transparency as possible to enable the reader to understand what we did. However, we realize, that there always will remain a degree of subjectivity.

Between October 2015 and December 2016, we co-created the first version (V1) of the GAPFRAME Index in a multi-step consultation process. The V1 version is a first attempt to assess the gap between where we stand today and what needs to be done (country by country) so that all of us can live well on the one planet we have. The GAPFRAME approach is still in a developmental phase (work in progress) and its true viability will prove itself with an expansion of the user base, who will be invited to join expert panels to review this first version of the framework.

## 2. Overview of the GAPFRAME approach

The Agenda 2030 demands the implementation of the Sustainable Development Goals by all of us – from governments and business to NGOs and individuals – and relies on a robust follow-up and review mechanism to monitor progress and to ensure accountability of all nations (United Nations, 2016).

To advance implementation of the SDGs and to monitor sustainable development, we developed the GAPFRAME in consultation with a panel of experts (see *Acknowledgments*). Its focus is on addressing priority issues at a national level, holding each country equally accountable for the successful implementation of the globally agreed sustainability targets.

The GAPFRAME development process included 6 steps, as summarized in Fig. 1.

In the **first step** we reorganized the 17 Sustainable Development Goals into 24 GAPFRAME issues and four sustainability dimensions: planet, economy, society, and governance following Rockström’s suggestion (Rockström and Sukhdev, 2017).

In the **second step** we selected 68 publicly available indicators to substantiate the underlying issues and to collect respective data for 196 countries and 22 regions in the world. The selected indicators serve as best currently available proxies to measure the state of the issues.

In the **third step** we tackled the issues to define an “ideal” state of the world and ideal target values for each indicator. We understand this step is the most critical and debatable element of the present framework.

In the **fourth step** we looked at data harmonization and processing. The indicators coming from various sources were normalized and scaled using a 0 – 10-point scale, with 0 being the worst case (a threat) and 10 being the best case (an ideal state). In this operation, the actual values were compared to their ideal values, relating the current state of the world to its ideal future state.

In the **fifth step** the normalized and scaled indicators were aggregated to calculate the GAPFRAME Index based on the arithmetic mean, thereby giving equal weights to all indicators within an issue, and to all issues within a dimension. In order to construct the GAPFRAME Index score – for a country, region, or the world – we used its weakest dimension, not the average of all 4 dimensions. This was done to follow an approach of strong sustainability, which ensures that one dimension is not improved at the cost of another dimension. As a result, the GAPFRAME score shows how far a given country or region is still away from an ideal state, indicating the priority issues that need to be solved to reach the desired future state.

In the final **sixth step** we specified a five-level scale and we defined a “safe space” as a desired future state, being inspired by the idea of a “safe operating space” developed by Raworth (2012). We place the “safe space” (GAPFRAME score between 7.5 and 8.8) at roughly 80% of the ideal state (the maximum) and we consider it as “good enough” of what future state should be attained. Hence, on the GAPFRAME scale, the goal for any country, region and the world are to move as quickly as possible from the current state to the safe space and above (GAPFRAME Score > 7.5).

These six steps (Fig. 1) present a snapshot of the GAPFRAME V1 development process. They are discussed in detail in the subsequent sections. It is worthwhile to mention that the GAPFRAME development process is still ongoing and the limitations of the GAPFRAME V1 version (see section 9) are being progressively addressed to increase the robustness of the GAPFRAME Index (see also *Future Developments* – section 10).

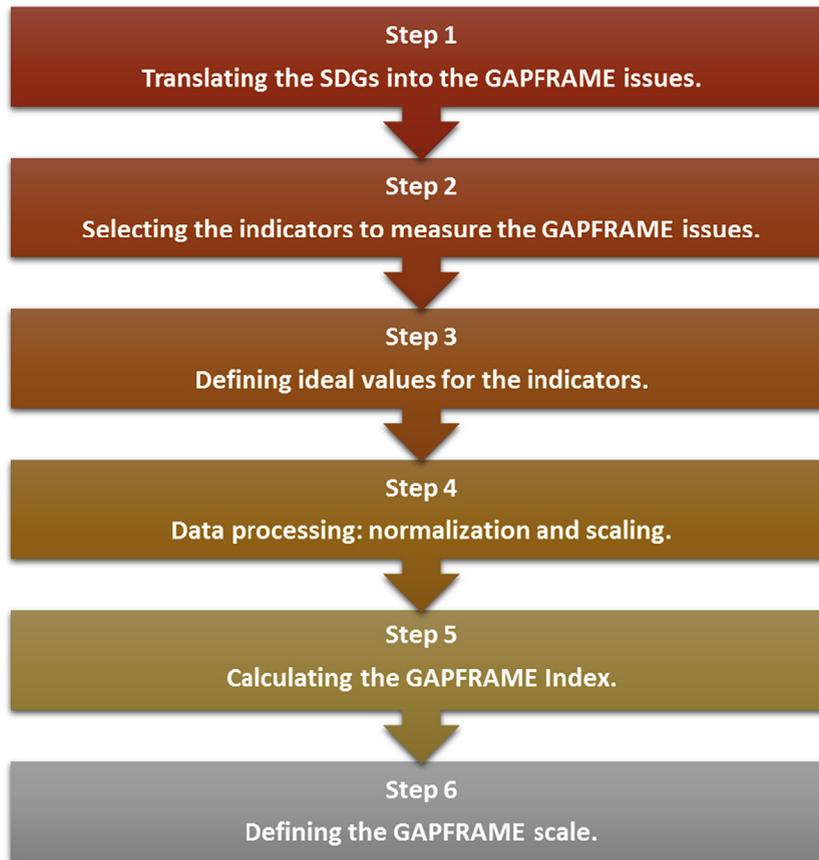


Fig. 1. Steps in developing the GAPFRAME.

### 3. Translating the SDGs into the GAPFRAME issues (step 1)

The first step of the GAPFRAME development process was translating the Sustainable Development Goals into the GAPFRAME framework. The 17 SDGs were reorganized into 24 issues of relevance to all nations and businesses. They were structured according to four sustainability dimensions: planet, society, economy, and governance (see Fig. 2).

The reorganization of the SDGs into the GAPFRAME dimensions was inspired by the Rockström “wedding cake” concept (Rockström and Sukhdev, 2017) which implies that economy and society are seen as embedded parts of the biosphere. The Rockström model represents a way of viewing the ecological, social, and economic aspects of the Sustainable Development Goals, where the economy serves society so that it evolves within the safe operating space of the planet. Following the Rockström concept, we applied a hierarchical classification of the 4 dimensions (see Fig. 2), placing the planet at the bottom of the “wedding cake” to allow the environment to guide sustainable development. The planet dimension is followed by society, economy and governance, which operate and evolve within the limits of the planet. Within such an approach, the issues in the GAPFRAME are numbered from the bottom of the “cake”, starting with the *Biodiversity* issue in the planet dimension and finishing with the *Transparency* issue in the governance dimension (see Fig. 2).

We reinforced and completed the GAPFRAME framework by adding issues that are underrepresented in the Agenda 2030 compared to similarly ambitious and holistic frameworks, *Agenda 21* (1992) and the Swiss *Cercle Indicateurs* (2015). As a result, we added the *Business Integrity*, *Public Finance*, and *Transparency* issues in the governance dimension, whereas the economy, society and environment dimensions were completed with the *Resource Use*, *Social Integration*, and *Clean Air* issues, respectively. Finally, SDG 12 in the economy dimension, *Sustainable Consumption and Production*, was split into two separate issues, given the relevance and impact of each, particularly for business.

Ultimately, we organized the GAPFRAME issues within the four sustainability dimensions as follows:

The **Planet dimension** covers issues related to protection of biodiversity (*Biodiversity*), preservation of land and forests (*Land & Forests*), reduction of carbon footprint (*Carbon Quotient*), conservation of marine environment and its resources (*Oceans*), enhancement of ambient air quality (*Clean Air*), preservation of water resources (*Water*), use of renewable energy (*Clean Energy*) and responsible management of wastes (*Waste treatment*). The planet dimension does not include *climate change* as a separate element because it is an overarching, inter and *trans*-dimensional issue.

The **Society dimension** includes social issues related to the standard of life (*Living Conditions*), general well-being (*Quality of Life*), health related aspects (*Health*), access to education and its relevance (*Education*), trends in gender and income equality (*Equal*



Fig. 2. Translating the 17 Sustainable Development Goals (SDGs) into the GAPFRAME issues.

Opportunity) as well as deeper societal trends like tolerance towards homosexuals and minorities (*Social Integration*). As with *climate change* in the planet dimension, the society dimension does not distinguish *human rights* as a separate issue, due to its inter and *trans-dimensional* nature.

The **Economy dimension** goes beyond a country's Gross Domestic Product (which is a measure of economic activity and not economic well-being) to provide a business-focused perspective that helps to identify long-term business opportunities. Consequently, the economy dimension measures global issues related to employment and job security (*Employment*), responsible use of natural resources (*Resource Use*), sustainable production and consumption (*Sustainable Production, Sustainable Consumption*), and the degree of innovation in developing new solutions (*Innovation*).

The **Governance dimension** is only partially covered in the SDGs although it will be of crucial importance to get this dimension right to deal effectively with the complex sustainability issues. In the GAPFRAME this dimension includes issues related to the financial situation of the public sector (*Public Finance*), the adequacy of the general infrastructure and public sector (*Structural Resilience*), political and legal rights as well as civil liberties (*Peace & Cooperation*), responsible and ethical business practices (*Business Integrity*) as well as transparency in managing public resources (*Transparency*).

#### 4. Selecting the indicators to measure the GAPFRAME issues (step 2)

The GAPFRAME issues were substantiated with a set of meticulously selected indicators. Fig. 3 presents an overview of the GAPFRAME structure, listing 68 indicators to measure the 24 GAPFRAME issues. The selection criteria for the indicators and their sources are discussed below.

##### 4.1. Indicator selection criteria

For each issue, we defined several indicators that had to represent the issue in a valid way. Here, data availability and comparability were quite a challenge.

The final choice of indicators was governed by the following criteria and considerations:

- **An indicator data source had to be reputable and known for rigorous data collection.** The aim was to collect data from trustworthy sources which are updated on a regular basis.
- **Indicator values needed to be publicly available** (open source data) to allow for independent consultation and verification at any time.

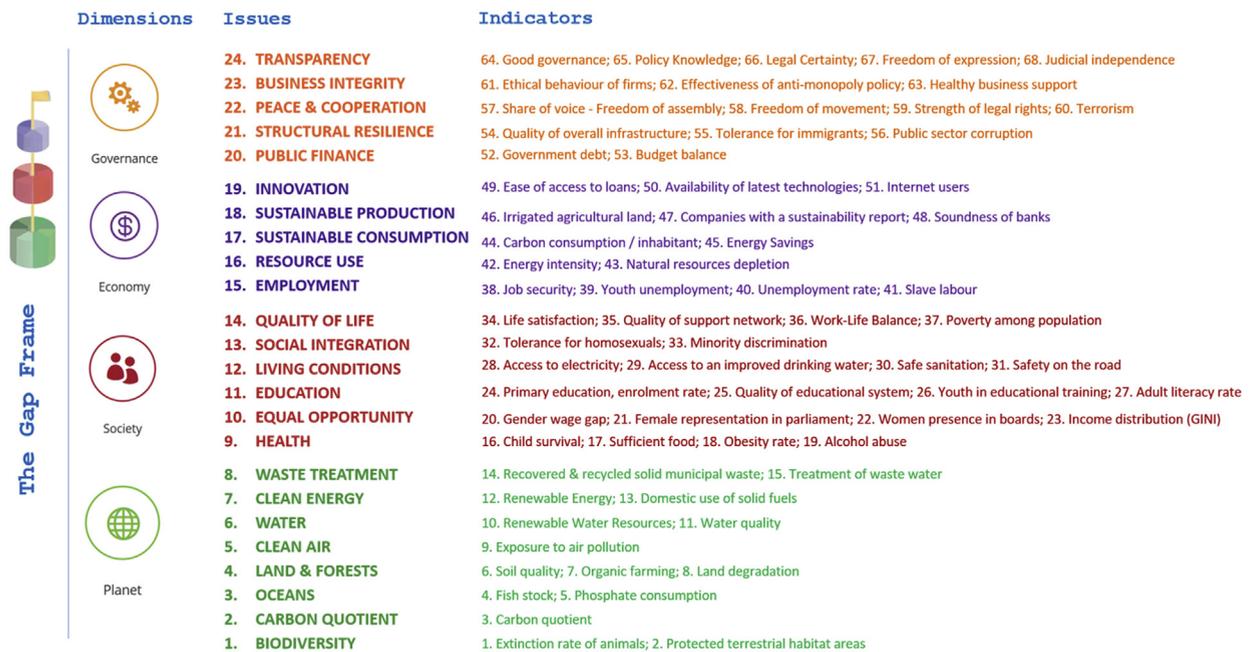


Fig. 3. The GAPFRAME dimensions, issues, and indicators.

- **The collected data had to be recent.** We collected the latest available data although this meant using data as far back as 2008, in some cases. The aim was to create the most recent index possible while not excluding indicators that collected information on a less frequent basis.
- **An indicator had to be a relevant proxy for an issue.** When selecting the indicators, we involved experts from various fields in a multi-consultation process.
- **The geographical coverage of available data had to be very wide.** Ideally, each indicator data had to be available for most if not all countries considered. In certain cases, we also accepted an indicator with a smaller regional coverage (e.g., data for OECD countries) but are planning to replace them in the next revision of the framework.
- **An indicator had to allow setting an ideal value.** Defining an ideal value for each indicator is a crucial element of the GAPFRAME concept. Many initially considered indicators were dropped during the consultation process, due to difficulties in setting the ideal values (*example*: there is no ideal value for the number of species by country).
- If necessary, a **new indicator** had to be **defined by ourselves** to substantiate a specific issue. They had to be developed in consultation with experts in the field and rely on publicly available data, however.

#### 4.2. Selected indicators

Following the rules specified above, we ultimately selected 68 indicators to substantiate the GAPFRAME V1 version, averaging 2.8 indicators per issue. Since the indicators are used both to measure a state of an issue and to illustrate different aspects of the issue, we did not identify the statistically most relevant indicator per issue but used as many indicators as available and needed to illustrate the issue as comprehensively as possible.

The selected indicators are considered as best currently available proxies for the GAPFRAME issues. It is important to emphasize that the indicators are proxies for the symptoms of the problems linked to the GAPFRAME issues. Solving an issue will require to go deeper to address the underlying causes and drivers of the issue.

Ultimately, we constructed the issues of the GAPFRAME as follows (see [Tables 1–4](#) for detailed definitions of the different indicators):

The **Biodiversity issue** (1) is measured as an average of two indicators: *extinction rate of animal species* and *protected terrestrial habitat areas* (EPI, 2014). To the best of our knowledge, there is no publicly available indicator that measures the extinction rate of species per country. Therefore, we defined this indicator ourselves, based on the IUCN Red List data (IUCN, 2016a and, 2016b); see details in section 4.4.1.

The **Carbon Quotient issue** (2) reflects the carbon footprint represented as a fraction of remaining global biocapacity. We defined this indicator ourselves, based on the National Footprint Accounts data for ecological footprint and biocapacity (Global Footprint Network, 2016); see details in section 4.4.2.

The **Oceans issue** (3) is calculated as an average of two publicly available indicators: *fish stocks* (EPI, 2014) and *phosphate consumption* (UNEP, 2010). In the future, we would like to include two more aspects in the *Oceans issue*, *ocean acidification* and *plastic consumption*, when the related indicators are published on a global level.

The **Land & Forests issue** (4) is represented by three publicly available indicators: *soil quality* (EPI, 2014), *organic farming* (SSI, 2014), and *land degradation* (UNEP, 2010).

The **Clean Air issue** (5) is based solely on the *exposure to air pollution* (EPI, 2014). We admit that having only one indicator for the *Clean Air issue* is not sufficient to reflect the air pollution problem. We will address this limitation in the next revision of the framework.

The **Water issue** (6) is measured averaging two publicly available indicators: *renewable water resources* (SSI, 2014) and *water quality* (OECD, 2015). Unfortunately, the second indicator is currently available only for OECD countries.

The **Clean Energy issue** (7) is calculated as an average of the *renewable energy consumption* (SSI, 2014) and the *domestic use of solid fuels* (UNEP, 2010).

The **Waste Treatment issue** (8) is calculated as an average of two indicators: *recovered & recycled solid municipal waste* (World Bank, 2012) and *treatment of waste water* (EPI, 2014). The first indicator is currently provided only for 47 countries.

**Table 1**

The GAPFRAME indicators and data sources: **Planet Dimension**.

	ISSUE	INDICATOR		
		NAME	DESCRIPTION	DATA SOURCE
PLANET	1. Biodiversity	1. Extinction rate of animal species	Extinction rate of animal species calculated as a number of extinctions per million species-years (E/MSY)	Calculation based on IUCN Red List
		2. Protected terrestrial habitat areas	Protection of globally critical terrestrial biomes, as % of their globally proportional abundance.	Environmental Performance Index (EPI)
	2. Carbon quotient	3. Carbon quotient	Carbon quotient (in global hectares per person) is a carbon footprint represented as a fraction of remaining (available) global biocapacity	Calculation based on Global Footprint Network - NFA 2016 ed.
	3. Oceans	4. Fish stock	Fish Stocks (FSOC) - Fraction (in %) of overexploited fish stocks & collapsed by economic zone	Environmental Performance Index (EPI)
		5. Phosphate consumption / cultivated land	Phosphate total nutrients consumption (prod + imp - exp) in tons divided by cultivated land (km <sup>2</sup> )	UNEP
	4. Land & forests	6. Soil quality	Use of Persistent Organic Pollutants (POPs) - Pesticide Regulation	Environmental Performance Index (EPI)
		7. Organic farming	Organic farming as % of total agricultural area	Sustainable Society Foundation
		8. Land degradation (desertification)	Areas with a potential hazard of desertification (drylands) as % of total area	UNEP
	5. Clean air	9. Exposure to air pollution	Population (in %) exposed to tiny particulate material (PM 2.5 µg/m <sup>3</sup> ). Indicator code PM25	Environmental Performance Index (EPI)
	6. Water	10. Renewable water resources	Renewable water resources as % of annual water withdrawals	Sustainable Society Foundation
		11. Water quality	People (in %) reporting being satisfied with the quality of local water	OECD Better Life Index
	7. Clean energy	12. Renewable Energy	Consumption of renewable energy as % of total energy	Sustainable Society Foundation
		13. Domestic use of solid fuels	Population (in %) using solid fuels	UNEP
	8. Waste treatment	14. Recovered & recycled solid municipal waste	The sum of compost and recycled municipal solid waste as % of total waste	Worldbank report - What a waste (2012)
		15. Treatment of waste water	Treated waste water (in %). Indicator code WASTEEXN	Environmental Performance Index (EPI)

The **Health issue** (9) is calculated as an average of four indicators: *child survival* (EPI, 2014), *sufficient food* (SSI, 2014), *obesity rate* (SPI, 2015), and *alcohol abuse* (WHO, 2010).

The **Equal Opportunity issue** (10) is calculated as an average of four indicators: *gender wage gap* (OECD, 2010–2013), *female representation in parliament* (OECD, 2010–2013), *women presence in boards* (OECD, 2010–2013), and *income distribution* (World Bank, 2010–2015). The first three indicators are only available mostly for OECD countries.

The **Education issue** (11) is calculated by averaging four indicators: *primary education enrolment rate* (WEF GCI, 2005–2014), *quality of the educational system* (WEF GCI, 2005–2014), *youth in educational training* (OECD, 2013), and *adult literacy rate* (World Bank, 2010–2015). *Youth in educational training* has a small geographical coverage (i.e., data available mainly for OECD countries)

and needs to be replaced in the next revision of the framework. In addition, we would also like to measure two adjacent aspects: *life-long learning* and *relevance of education*, to broaden the perspective of the *Education* issue.

The **Living Conditions issue** (12) is represented by four indicators: *access to electricity* (EPI, 2014), *access to improved drinking water* (EPI, 2014), *safe sanitation* (SSI, 2014), and *road safety* (SPI, 2015).

The **Social Integration issue** (13) is calculated as an average of two indicators: *tolerance for homosexuals* (SPI, 2015) and *minority discrimination* (SPI, 2015).

The **Quality of Life issue** (14) is based on an average of four indicators: *life satisfaction* (OECD, 2015), *quality of support network*

Table 2

The GAPFRAME indicators and data sources: **Society Dimension**.

ISSUE	INDICATOR		
	NAME	DESCRIPTION	DATA SOURCE
9. Health	16. Child survival	Probability of child surviving 5th birthday. Indicator code CHMORT	Environmental Performance Index (EPI)
	17. Sufficient food	Undernourished people as % of total population	Sustainable Society Foundation
	18. Obesity rate	Population (in %) with a BMI of 30	Social Progress Index
	19. Alcohol abuse	Adults (15+ years) with >60 grams of pure alcohol at least once in 30 days	World Health Organization (WHO)
10. Equal opportunity	20. Gender wage gap	Difference between male and female median wages divided by the male median wages	OECD
	21. Female representation in parliament	Proportion of seats held by women in national parliaments (in %)	OECD
	22. Women presence on boards	Share of women on boards of directors in Forbes Global 500 companies	OECD
	23. Income distribution (GINI)	Estimated income distribution by the World Bank	The World Bank
11. Education	24. Primary education, enrolment rate	School enrolment rate of children (in %)	World Economic Forum Global Competitiveness Index (WEF GCI)
	25. Quality of the educational system	Assessment of how well the educational system meets the needs of a competitive economy	World Economic Forum Global Competitiveness Index (WEF GCI)
	26. Youth in educational training	School enrolment rate (in %) of youth (15-19 years old)	OECD
	27. Adult literacy rate	Adult literacy rate as a % of population (15+ years)	The World Bank
12. Living conditions	28. Access to electricity	Population (in %) with access to electricity	Environmental Performance Index (EPI)
	29. Access to an improved drinking water	Population (in %) using an improved drinking water source	Environmental Performance Index (EPI)
	30. Safe sanitation	Population (in %) with sustainable access to improved sanitation	Sustainable Society Foundation
	31. Road safety	Estimated road traffic fatal injury deaths per 100'000 inhabitants	Social Progress Index
13. Social integration	32. Tolerance for homosexuals	Degree of tolerance for homosexuals	Social Progress Index
	33. Minority discrimination	Discrimination and violence against minorities	Social Progress Index
14. Quality of life	34. Life satisfaction	Average self-evaluation on a scale from 0-10	OECD
	35. Quality of support network	Population (in %) with friends/relatives to rely on if needed	OECD Better Life Index
	36. Work-life balance	Employees (in %) whose usual hours of work per week are 50 hours or more	OECD Better Life Index
	37. Poverty among population	Poverty headcount ratio at national poverty lines (% of population)	The World Bank

(OECD, 2015), *work-life balance* (OECD, 2015), and *poverty among population* (World Bank, 2010–2015). The first three indicators are only mostly available for OECD countries. Ideally, in the *Quality of Life* issue, we would also like to measure the *child well-being* aspect, if related data is published on a global level.

The **Employment issue** (15) is calculated as an average of four indicators: *job security* (OECD, 2015), *youth unemployment* (World Bank, 2010–2015), *unemployment rate* (SSI, 2014), and *slave labor* (The Global Slavery Index, 2016). The *job security* indicator is only available for OECD countries.

The **Resource Use issue** (16) is calculated as an average of two indicators: *energy intensity* (World Bank, 2010–2015) and *natural resources depletion* (World Bank, 2010–2015).

The **Sustainable Consumption issue** (17) is based on two indicators: *carbon consumption* (Peters et al., 2011) and *energy savings* (SSI, 2014). In the future, we plan to include also *individual meat consumption*.

The **Sustainable Production issue** (18) is calculated as an average of three indicators: *irrigated agricultural land* (World Bank, 2010–2015), *companies with a sustainability report* (KPMG, 2015), and *soundness of banks* (WEF GCI, 2005–2014). A drawback to the use of the two first indicators is their limited data coverage (available data for 61 and 45 countries, respectively). Ideally, we would also like to include *fossil fuel subsidies* and *true cost considerations* when looking at the *Sustainable Production* issue.

The **Innovation issue** (19) is calculated as an average of three indicators: *ease of access to loans* (WEF GCI, 2005–2014), *availability of latest technologies* (WEF GCI, 2005–2014), and the number of *internet users* (SPI, 2015).

Table 3

The GAPFRAME indicators and data sources: **Economy Dimension**.

ISSUE	INDICATOR		
	NAME	DESCRIPTION	DATA SOURCE
15. Employment	38. Job security	Employees (in %) with risk of losing job	OECD Better Life Index
	39. Youth unemployment	Youth unemployment, as % of total labour force ages 15-24	The World Bank
	40. Unemployment rate	Number of people seeking work and being long-term unemployed, as % of employed	Sustainable Society Foundation
	41. Slave labour	Proportion of the population in modern slavery	Global Slavery Index
16. Resource use	42. Energy intensity	Cost of primary energy consumption, as % GDP	The World Bank
	43. Natural resources depletion	Adjusted savings: natural resources depletion multiplied by GINI coefficient	The World Bank
17. Sustainable consumption	44. Carbon consumption / inhabitant	Carbon national production and transfers (imports and exports), in million tons of carbon / year, divided by inhabitants	Global Carbon Project
	45. Energy savings	Energy savings 2008-2012 in %	Sustainable Society Foundation
18. Sustainable production	46. Irrigated agricultural land	Irrigated agricultural land as % of total agricultural land	The World Bank
	47. Companies with a sustainability report	Number of companies that complete a GRI report, as % of all stock-quoted companies	KPMG
	48. Soundness of banks	Assessment of soundness of banks	World Economic Forum Global Competitiveness Index (WEF GCI)
19. Innovation	49. Ease of access to loans	Assessment of how easy it is to obtain a bank loan with a good business plan and no collaterals	World Economic Forum Global Competitiveness Index (WEF GCI)
	50. Availability of latest technologies	Assessment to what extent latest technologies are available	World Economic Forum Global Competitiveness Index (WEF GCI)
	51. Internet users	Number of internet users as % of population	Social Progress Index

The **Public Finance issue** (20) is calculated as an average of two indicators: *government debt* (SSI, 2014) and *budget balance* (WEF GCI, 2005–2014).

The **Structural Resilience issue** (21) is calculated as an average of three indicators: *quality of overall infrastructure* (WEF GCI, 2005–2014), *tolerance for immigrants* (SPI, 2015), and *public-sector corruption* (SPI, 2015). If possible, in the next framework revision round we would like to include two more indicators, covering *speculation* and *cyber-attacks*.

The **Peace & Cooperation issue** (22) is calculated as an average of four indicators: *share of voice – freedom of assembly* (SPI, 2015), *freedom of movement* (SPI, 2015), *strength of legal rights* (World Bank, 2010–2015), and *terrorism* (GTI, 2015). We would also like to use indicators that measure *interstate conflicts* and *migration*.

The **Business Integrity issue** (23) is calculated as an average of three indicators: *ethical behavior of firms* (WEF GCI, 2005–2014), *effectiveness of anti-monopoly policy* (WEF GCI, 2005–2014), and *healthy business support* (WEF GCI, 2005–2014). Within this issue, we would like to include *government incentives for sustainable and just business practices* for which there are no global indicators available yet.

The **Transparency issue** (24) is calculated as an average of five indicators: *good governance* (SSI, 2014), *policy knowledge* (SGI, 2016), *legal certainty* (SGI, 2016), *freedom of expression* (SPI, 2015), and *judicial independence* (WEF GCI, 2005–2014). Two considered

**Table 4**  
The GAPFRAME indicators and data sources: **Governance Dimension.**

ISSUE	INDICATOR		
	NAME	DESCRIPTION	DATA SOURCE
20. Public finance	52. Government debt	General government debt, as % of GDP	Sustainable Society Foundation
	53. Budget balance	Government budget balance, as % of GDP	World Economic Forum Global Competitiveness Index (WEF GCI)
21. Structural resilience	54. Quality of overall infrastructure	Assessment of infrastructure (transport, telephony, energy)	World Economic Forum Global Competitiveness Index (WEF GCI)
	55. Tolerance for immigrants	Degree of tolerance for immigrants	Social Progress Index
	56. Public sector corruption	Perceived level of public sector corruption	Social Progress Index
22. Peace & cooperation	57. Share of voice - Freedom of assembly	The extent to which freedoms of assembly and association are subject to actual governmental limitations or restrictions	Social Progress Index
	58. Freedom of movement	Both freedom to move domestically and abroad with right to return home	Social Progress Index
	59. Strength of legal rights	Collateral and bankruptcy laws protecting and facilitate lending	The World Bank
	60. Terrorism	Global terrorism, country ranking	Global Terrorism Index
23. Business integrity	61. Ethical behaviour of firms	Assessment of ethical behaviour of companies with public officials, politicians and other firms	World Economic Forum Global Competitiveness Index (WEF GCI)
	62. Effectiveness of anti-monopoly policy	Assessment of extent to which anti-monopoly policy promotes competition	World Economic Forum Global Competitiveness Index (WEF GCI)
	63. Healthy business support	Number of procedures to start a business	World Economic Forum Global Competitiveness Index (WEF GCI)
24. Transparency	64. Good governance	World Bank Index - total score	Sustainable Society Foundation
	65. Policy knowledge	The extent to which citizens are informed of government policymaking	Sustainable Governance Indicators (SGI)
	66. Legal certainty	The extent to which government and administration act on the basis of and in accordance with legal provisions to provide legal certainty	Sustainable Governance Indicators (SGI)
	67. Freedom of expression	Press Freedom Index	Social Progress Index
	68. Judicial independence	Assessment of degree of judicial independence from members of government, citizens, or firms	World Economic Forum Global Competitiveness Index (WEF GCI)

indicators, *policy knowledge* and *legal certainty* have only a very small geographical coverage (41 countries) and must be replaced in the next revision of the framework.

#### 4.3. Data sources and data treatment

The indicator data was collected from various publicly available sources, including organizations like United Nations Environment Programme (UNEP), World Health Organization (WHO), Sustainable Society Foundation, The World Bank, and many others. The sources for all 68 indicators are listed in [Tables 1–4](#)

The values for 63 indicators were downloaded and used directly for the GAPFRAME issues. An additional treatment of data was performed only on three indicators:

- Indicator no 5, *Phosphate consumption*, was divided by cultivated land to determine the level of fertilizers used in agriculture by country;
- Indicator no 43, *Natural resources depletion*, was multiplied by the GINI coefficient, to make the natural resources depletion independent of income or wealth distribution of a country's residents;
- Indicator no 44, *Carbon consumption*, was divided by the number of inhabitants per country to better compare the carbon consumption between nations.

Two indicators, for which we could not find publicly available data, were developed by ourselves to substantiate the GAPFRAME issues, as discussed in the following section.

#### 4.4. Development of new indicators

We developed two new indicators based on publicly available data. These are: *Extinction rate of animal species* (Indicator no 1), developed to approximate the loss of biodiversity per country and *Carbon quotient* (Indicator no 3), developed to compare the national carbon footprint against the remaining global biocapacity.

##### 4.4.1. Extinction rate of animal species

Although the global extinction rate of species is known, to the best of our knowledge there is no publicly available indicator that represents the extinction rate of species per country. In the GAPFRAME, we estimated the *Extinction rate of animal species* based on the IUCN Red List of Threatened Species data, in collaboration with experts in the field (see [Acknowledgments](#) section).

We have calculated the extinction rate of animals in E/MSY units (extinction per million species-years), using the following formula ([Pimm et al., 2014](#)):

$$\text{Extinction rate of animal species} = \frac{\text{Number of animal extinction per country}}{\text{Average species-years}} * 1000000$$

To estimate the “*number of animal extinction per country*” we used the IUCN Red List data ([IUCN, 2016a](#)) and counted the total number of extinct (EX) and extinct in the wild (EW) animals per country.

We further calculated the “*average species – years*” by multiplying the total “*number of assessed species*” by country with the “*average years described to present*” that represents an average time elapsed since the species were discovered ([Pimm et al., 2006](#)):

$$\text{Average species-years} = \text{Number of assessed species} * \text{Average years described to present}$$

To estimate the “*number of assessed species*” by country, we used the IUCN Red list data ([IUCN, 2016b](#)) and summed up the total assessed endemic and non-endemic animal species that included: mammals, birds, crocodiles & alligators, chameleons, amphibians, groupers, sturgeons, wrasses & parrotfishes, sharks & rays, crabs, crayfishes, lobsters, cone snails, and reef-forming corals.

In the GAPFRAME V1, we calculated the “*average years described to present*” for two taxonomic groups: birds and fishes and used the average value (138 years) to calculate the “*average species-years*”. In future, we plan to extend the calculations to more taxonomic groups to increase the precision in estimation of this parameter.

##### 4.4.2. Carbon quotient

In the GAPFRAME process, we also developed the *Carbon quotient* indicator, based on the National Footprint Accounts (2016) data for ecological footprint and biocapacity.

The *Carbon quotient*, measured in global hectares per person, is defined as a country's carbon footprint divided by the average remaining global biocapacity:

$$\text{Carbon quotient} = \frac{\text{National carbon footprint}}{\text{Remaining global biocapacity}}$$

The “*remaining global biocapacity*” is calculated by subtracting the ecological footprint (consisting of the footprints from agriculture, grazing, forestry, fishing, and built land) from the total available biocapacity globally. Using the global rather than a country's remaining biocapacity serves to equalize different landmasses per nation, to prevent punishing unfairly a small densely populated country.

Ideally, the carbon footprint should stay within the limits of the remaining global biocapacity, implying the ideal value for the *Carbon quotient* must be below 1. More information on determination of the ideal values in the GAPFRAME is given in the section below.

#### 5. Defining ideal values for the indicators (Step 3)

To approximate an ideal state of the world, we accepted the challenge to define ideal values (desired target values) for each indicator in the dataset. The definition of ideal target values is a very challenging process and requires full transparency about the ongoing efforts to verify and correct (if necessary) the defined values.

For the GAPFRAME V1 version, we defined the ideal and worst values by following two rules:

- (1) Where possible, we respected the original scale and the target (ideal) and worst values associated with individual indicators and their data sources. For example, the Environmental Performance Indices (EPI) are measured on a 0–100 scale, with 100 being the target value to be achieved. Similarly, the Sustainable Governance Indicators (SGI) are measured on a 1–10 scale, with 10 being the target value and 1 being the worst value. In total, 37 GAPFRAME indicators (out of 68) have predefined target values in their original source.
- (2) For indicators without specified target values (e.g., some of The World Bank or World Economic Forum GCI indicators), we defined ideal and worst values based on currently observed min and max values as well as by projecting ourselves into a desirable ideal state, following common sense. For example, we estimated the target ideal value for “Female representation in parliament” to be 50% (perfect gender equality) or for the *Gender wage gap* indicator to be 0% (no wage gap). For *Female representation in parliament*, we set the worst value at 10%, based on the smallest actual values in the world. For the *Gender wage gap*, we set the worst value at 40%, based on the largest actual values in the world. Following a similar approach, we defined the ideal and worst values for 31 GAPFRAME indicators (out of 68). Tables 5–8 provide detailed information on how the ideal and worst values were set for each individual indicator in our framework. It is important to add that prior to the definition of the ideal/worst values, we removed the outlying values from the indicator datasets (example: for the *Extinction rate of animal species* indicator, we set the worst value at 100 although the actual value for USA is 700, which is overall an outlying value).

#### 5. Data processing: normalization and scaling (step 4)

Once the ideal and worst values were determined for all the indicators, we could start the data normalization and scaling process. In the normalization operation, the actual values were compared to their reference values (i.e., their ideal and worst values). The scaling process aimed at transforming the data coming from various sources into a consistent dataset represented on the 0–10-point GAPFRAME scale.

The normalization and conversion of data into a 0–10 scale was performed by using the following approach:

- (A) If the worst value of an indicator equals zero, we simply divide the indicator's current value by its reference ideal target value and we multiply the result by 10 (which is a scaling factor):

$$\text{GAPFRAME indicator} = \frac{\text{Indicator current value}}{\text{Indicator ideal value}} * 10$$

- (B) If the ideal value of an indicator equals zero, we divide the indicator's current value by its worst reference value and we multiply it by 10 (a scaling factor). Then, we subtract the obtained result from 10 (the reversal method):

$$\text{GAPFRAME indicator} = 10 - \frac{\text{Indicator current value}}{\text{Indicator worst value}} * 10$$

- (C) If the ideal and worst values of an indicator are different from zero, we normalize the indicator's current values prior to operations (A) or (B) as follows:

$$\text{GAPFRAME indicator (A)} = \frac{\text{Indicator current value} - \text{Indicator worst value}}{\text{Indicator ideal value} - \text{Indicator worst value}} * 10$$

or

$$\text{GAPFRAME indicator (B)} = 10 - \frac{\text{Indicator current value} - \text{Indicator ideal value}}{\text{Indicator worst value} - \text{Indicator ideal value}} * 10$$

Table 9 lists the formulas applied to convert all 68 indicators into the 0–10 GAPFRAME scale, illustrating the steps (A)–(C). In some cases, the normalization and scaling processes resulted in values that exceeded the GAPFRAME upper or lower scale limits. These outlying values were substituted with 10 and 0, respectively.

**Table 5**  
Definition of ideal values and worst values for indicators in the **planet dimension**.

ISSUE	INDICATOR					
	NAME	IDEAL VALUE	RATIONALE	WORST VALUE	RATIONALE	
PLANET	1. Biodiversity	1. Extinction rate of animal species	2	Close to pre-industrial extinction rate. Based on smallest observable values	100	Close to largest observable values
		2. Protected terrestrial habitat areas	100	Indicator original scale is respected	0	Indicator original scale is respected
	2. Carbon quotient	3. Carbon quotient	0.9	Carbon footprint lower than available biocapacity	5	Close to largest observable values
	3. Oceans	4. Fish stock	100	Indicator original scale is respected	0	Indicator original scale is respected
		5. Phosphate consumption / cultivated land	0	No use of fertilizers. Based on smallest observable values	10	Close to largest observable values
	4. Land & forests	6. Soil quality	100	Indicator original scale is respected	0	Indicator original scale is respected
		7. Organic farming	20	Indicator target value is respected	0	Based on smallest observable values
		8. Land degradation (desertification)	0	No hazard of desertification. Based on lowest observable values	100	Based on largest observable values
	5. Clean air	9. Exposure to air pollution	100	Indicator original scale is respected	0	Indicator original scale is respected
	6. Water	10. Renewable water resources	10	Indicator original scale is respected	1	Indicator original scale is respected
		11. Water quality	100	Everyone is satisfied with water quality. Close to largest observable value	60	Based on smallest observable values
	7. Clean energy	12. Renewable energy	100	Indicator target value is respected	0	Based on smallest observable values
		13. Domestic use of solid fuels	0	Solid fuels are not used. Close to smallest observable values	100	Close to largest observable values
	8. Waste treatment	14. Recovered & recycled solid municipal waste	100	All waste can be recycled	0	Based on smallest observable values
		15. Treatment of waste water	100	Indicator original scale is respected	0	Indicator original scale is respected

## 6. Calculating the GAPFRAME index (step 5)

The GAPFRAME Index calculation is based on an aggregation of the normalized and scaled indicators. In the V1 version of the framework, the GAPFRAME Index was calculated and visualized for 155 countries (out of 196 initially considered), 22 regions, and the world, for which sufficient data was collected across all dimensions to generate an index (see more details in section 9.2).

### 6.1. Data aggregation

To calculate the GAPFRAME Index for a country, region or the world, we aggregated data from the indicators that substantiate the GAPFRAME issues and dimensions. The aggregation of data was based on the arithmetic mean of the normalized and scaled indicators, giving equal weight to all indicators within an issue, and to all issues in a dimension.

Since very few indicators provide regional or world values, we calculated them in our framework to construct the GAPFRAME Index for the world and for regions. We thus calculated the GAPFRAME regional indicator values as a weighted arithmetic mean of respective country values, with country inhabitants used as weight:

*Regional indicator weighted mean value*

$$= \frac{\text{SUM}(\text{country (1) ind. value} * \text{country (1) inhabitants, country (2) ind. value} * \text{country (2) inhabitants, ..., country (n) ind. value} * \text{country (n) inhabitants,})}{\text{SUM}(\text{inhabitants (1), inhabitants (2), ..., inhabitants (n)})}$$

**Table 6**  
Definition of ideal values and worst values for indicators in the **society dimension**.

	ISSUE	INDICATOR				
		NAME	IDEAL VALUE	RATIONALE	WORST VALUE	RATIONALE
SOCIETY	9. Health	16. Child survival	100	Indicator original scale is respected	0	Indicator original scale is respected
		17. Sufficient food	0	Indicator target value is respected	40	Close to largest observable values
		18. Obesity rate	0	No obesity problem	40	Based on largest observable values
		19. Alcohol abuse	0	No alcohol abuse	40	Based on largest observable values
	10. Equal opportunity	20. Gender wage gap	0	No gender wage gap	40	Based on largest observable values
		21. Female representation in parliament	50	Perfect gender balance	10	Based on smallest observable values
		22. Women presence on boards	50	Perfect gender balance	0	Based on smallest observable values
		23. Income distribution (GINI)	0	Indicator original scale is respected	100	Indicator original scale is respected
	11. Education	24. Primary education, enrolment rate	100	Enrolment is 100%. Based on largest observable values	60	Based on smallest observable values
		25. Quality of the educational system	7	Indicator original scale is respected	1	Indicator original scale is respected
		26. Youth in educational training	100	Enrolment is 100%. Close to largest observable values	50	Based on smallest observable values
		27. Adult literacy rate	100	Everyone can write and read. Based on largest observable values	30	Based on smallest observable values
	12. Living conditions	28. Access to electricity	100	Indicator original scale is respected	0	Indicator original scale is respected
		29. Access to an improved drinking water	100	Indicator original scale is respected	0	Indicator original scale is respected
		30. Safe sanitation	100	Indicator original scale is respected	0	Indicator original scale is respected
		31. Road safety	0	No fatal injuries. Close to smallest observable values	40	Based on largest observable values
13. Social integration	32. Tolerance for homosexuals	1	Indicator original scale is respected	0	Indicator original scale is respected	
	33. Minority discrimination	0	Indicator original scale is respected	10	Indicator original scale is respected	
14. Quality of life	34. Life satisfaction	10	Indicator original scale is respected	0	Indicator original scale is respected	
	35. Quality of support network	100	People support and help each other. Close to largest observable values	70	Based on smallest observable values	
	36. Work-life balance	0	Work-life balance is preserved. Based on smallest observable values	30	Based on largest observable values	
	37. Poverty among population	0	No poverty. In accordance with SDGs	75	Based on largest observable values	

To calculate a regional or world value for a given indicator, we set a rule that data for at least the 60% of respective countries had to be available.

## 6.2. The GAPFRAME index score

Once the indicator data was aggregated into respective issues and dimensions, we could start calculating the GAPFRAME Index. The GAPFRAME Index score was defined as the lowest value of all four dimensions: planet, society, economy and governance:

$$\text{GAPFRAME Score} = \text{MIN}(\text{planet}, \text{society}, \text{economy}, \text{governance})$$

This deliberate decision for the lowest of the four-dimensional scores reflects strong sustainability approach, implying that one

**Table 7**  
Definition of ideal values and worst values for indicators in the **economy dimension**.

ISSUE	INDICATOR				
	NAME	IDEAL VALUE	RATIONALE	WORST VALUE	RATIONALE
<b>15. Employment</b>	38. Job security	0	No risk of loosing job. Close to smallest observable values	15	Based on largest observable values
	39. Youth unemployment	0	No unemployment. Close to smallest observable values	60	Based on largest observable values
	40. Unemployment rate	0	Indicator target value is respected	30	Based on largest observable values
	41. Slave labour	0	No slavery. Close to smallest observable values	1.5	Based on largest observable values
<b>16. Resource use</b>	42. Energy intensity	2	Based on smallest observable values	20	Based on largest observable values
	43. Natural resources depletion	0	No depletion of natural resources. Based on smallest observable values	15	Based on largest observable values
<b>17. Sustainable consumption</b>	44. Carbon consumption / inhabitant	0	Carbon consumption approaching zero. Value set by an expert	70	Based on largest observable values
	45. Energy savings	0.4	Based on largest observable values	-0.4	Based on smallest observable values
<b>18. Sustainable production</b>	46. Irrigated agricultural land	0	No irrigation. Based on smallest observable values.	35	Based on largest observable values
	47. Companies with a sustainability report	100	All companies complete GRI report. Based on largest observable values.	25	Based on smallest observable values
	48. Soundness of banks	7	Indicator original scale is respected	1	Indicator original scale is respected
<b>19. Innovation</b>	49. Ease of access to loans	7	Indicator original scale is respected	1	Indicator original scale is respected
	50. Availability of latest technologies	7	Indicator original scale is respected	1	Indicator original scale is respected
	51. Internet users	100	Everyone can use internet. Close to on largest observable values.	1	Based on smallest observable values

dimension should not be improved at the cost of another dimension. Using the average of the 4 dimensions instead would suggest a “weak sustainability” approach whereby one dimension could be sacrificed in favor of another dimension (e.g. the environment at the expense of economic concerns). Using the lowest score ensures focusing on the sore spots. And this is precisely the purpose of the GAPFRAME: to highlight the biggest gap for a country between its current state and the desired ideal future state. We thus provide an *Average of 4 Dimensions* value only as an additional reference point, but do not use it for any ratings and rankings:

$$\text{Average of 4 Dimensions} = \text{AVERAGE}(\text{planet}, \text{society}, \text{economy}, \text{governance})$$

Fig. 4 presents the world maps based on the (A) GAPFRAME Score and the (B) *Average of 4 Dimension* assessment, to visualize the difference between these two approaches. The GAPFRAME lowest score approach results in a less pleasant global picture, indicating a higher urgency to address the identified priority issues.

### 6.3. The GAPFRAME index score visualization

To visualize the GAPFRAME Index score at an individual country level, we have created a country stamp, as illustrated in Fig. 5. A country stamp consists of two circles: an outer and an inner circle which correspond to the “*Average of 4 dimensions*” and the “GAPFRAME Score” assessment, respectively. The inner circle contains a letter that refers to the priority dimension (i.e., the “weakest” dimension) that needs to be most urgently addressed at a country level. The colors of the inner and outer circles (yellow and red in the example of Switzerland, Fig. 5) refer to the GAPFRAME 0–10-point scale, as explained in detail in the next section.

## 7. Defining the GAPFRAME scale (step 6)

In the GAPFRAME, the performance of countries, regions and the world are measured on the 0–10-point color scale, as illustrated in Fig. 6.

Table 8

Definition of ideal values and worst values for indicators in the **governance dimension**.

ISSUE	INDICATOR				
	NAME	IDEAL VALUE	RATIONALE	WORST VALUE	RATIONALE
20. Public finance	52. Government debt	2.5	Indicator target value is respected	150	Based on largest observable values
	53. Budget balance	1	Budget with no deficit. Ideally, with a small surplus	-15	Based on smallest observable values (deficit)
21. Structural resilience	54. Quality of overall infrastructure	7	Indicator original scale is respected	1	Indicator original scale is respected
	55. Tolerance for immigrants	1	Indicator original scale is respected	0	Indicator original scale is respected
	56. Public sector corruption	100	Indicator original scale is respected	0	Indicator original scale is respected
22. Peace & cooperation	57. Share of voice - Freedom of assembly	2	Indicator original scale is respected	0	Indicator original scale is respected
	58. Freedom of movement	4	Indicator original scale is respected	0	Indicator original scale is respected
	59. Strength of legal rights	12	Indicator original scale is respected	0	Indicator original scale is respected
	60. Terrorism	0	Indicator original scale is respected	10	Indicator original scale is respected
23. Business integrity	61. Ethical behaviour of firms	7	Indicator original scale is respected	1	Indicator original scale is respected
	62. Effectiveness of anti-monopoly policy	7	Indicator original scale is respected	1	Indicator original scale is respected
	63. Healthy business support	2	Ideally, only 2 procedures needed to start a new business. Based on smallest observable values	15	Based on largest observable values
24. Transparency	64. Good governance	15	Indicator original scale is respected	-15	Indicator original scale is respected
	65. Policy knowledge	10	Indicator original scale is respected	1	Indicator original scale is respected
	66. Legal certainty	10	Indicator original scale is respected	1	Indicator original scale is respected
	67. Freedom of expression	0	Indicator original scale is respected	100	Indicator original scale is respected
	68. Judicial independence	7	Indicator original scale is respected	1	Indicator original scale is respected

The GAPFRAME scale is inspired by the idea of a “safe operating space” as developed by [Raworth \(2012\)](#). Her model suggests that there is certain safe space within which humanity must operate, considering both outer planetary boundaries ([Rockström et al., 2009](#)) as well as certain minimum levels of social achievements to ensure that all 9 billion citizens can live well on one planet ([WBCSD, 2010](#)).

Consequently, rather than a 0–10-point scale, with 10 representing the ideal value to be imperatively achieved, we defined a “safe space” lying between a minimum required value (“watchlist”) and an ideal state. Applying the commonly used 80/20 rule, we located the “safe space” at roughly 80% of the ideal state and have defined a range of 75–88% as the lower and upper measures for the safe space. Hence, the “safe space” does not represent the maximum or ideal value, but it can be considered as “good enough” for the future state to be attained.

With the “safe space” being central for the GAPFRAME scale, we defined the GAPFRAME classification levels as follows:

**Threat (0–5; grey):** Any issue with a value resulting from the average of the underlying indicators below 5 is considered a burning issue that represents a threat for that country and for humanity: significant improvement and urgent attention is needed to drive change towards the safe space.

**Critical (5.1–6.6; red):** Any issue with values between 5.1 and 6.6 is considered as critical and risky for humanity, therefore, an immediate action needs to be undertaken to improve the current situation.

**Watch list (6.7–7.4; yellow):** Any issue with an average value between 6.7 and 7.4 is considered as being on the watch list. This zone (level) is close to the “safe space”, indicating a need for closer examination to determine if things are indeed moving in the right direction.

**Safe space (7.5–8.8; green):** We define a range from 7.5 to 8.8 as a “safe space”. The safe space does not represent the maximum or ideal value of a given issue or dimension, but it can be considered as “good enough”.

**Table 9**  
Formulas to convert indicator values into the 0–10 GAPFRAME scale.

INDICATOR			FORMULA TO CONVERT INDICATOR DATA INTO THE 0-10 GAPFRAME SCALE
NAME	IDEAL VALUE	WORST VALUE	
<b>Scale with 10</b>			
Access to an improved drinking water	100	0	$= \frac{\text{Indicator value}}{\text{Indicator ideal value}} * 10$
Access to electricity	100	0	
Child survival	100	0	
Exposure to air pollution	100	0	
Fish stock	100	0	
Freedom of movement	4	0	
Organic farming	20	0	
Protected terrestrial habitat areas	100	0	
Public sector corruption	100	0	
Recovered & recycled solid municipal waste	100	0	
Renewable energy	100	0	
Safe sanitation	100	0	
Share of voice - Freedom of assembly	2	0	
Soil quality	100	0	
Strength of legal rights	12	0	
Tolerance for homosexuals	1	0	
Tolerance for immigrants	1	0	
Treatment of waste water	100	0	
Women presence on boards	50	0	
<b>Reverse and scale with 10</b>			
Alcohol abuse	0	40	$= 10 - \frac{\text{Indicator value}}{\text{Indicator worst value}} * 10$
Carbon consumption / inhabitant	0	70	
Domestic use of solid fuels	0	100	
Freedom of expression	0	100	
Gender wage gap	0	40	
Income distribution (GINI)	0	100	
Irrigated agricultural land	0	35	
Job security	0	15	
Land degradation (desertification)	0	100	
Minority discrimination	0	10	
Natural resources depletion	0	15	
Obesity rate	0	40	
Phosphate consumption / cultivated land	0	10	
Poverty among population	0	75	
Road safety	0	40	
Slave labour	0	1.5	
Sufficient food	0	40	
Terrorism	0	10	
Unemployment rate	0	30	
Work-life balance	0	30	
Youth unemployment	0	60	
<b>Normalize and scale with 10</b>			
Adult literacy rate	100	30	$= \frac{\text{Indicator value} - \text{Indicator worst value}}{\text{Indicator ideal value} - \text{Indicator worst value}} * 10$
Availability of latest technologies	7	1	
Companies with a sustainability report	100	25	
Ease of access to loans	7	1	
Effectiveness of anti-monopoly policy	7	1	
Ethical behaviour of firms	7	1	
Female representation in parliament	50	10	
Good governance	15	-15	
Internet users	100	1	
Judicial independence	7	1	
Legal certainty	10	1	
Policy knowledge	10	1	
Primary education enrolment rate	100	60	
Quality of the educational system	7	1	
Quality of overall infrastructure	7	1	
Quality of support network	100	70	
Renewable water resources	10	1	
Soundness of banks	7	1	
Water quality	100	60	
Youth in educational training	100	50	
<b>Normalize, reverse and scale with 10</b>			
Budget balance	1	-15	$= 10 - \frac{\text{Indicator value} - \text{Indicator ideal value}}{\text{Indicator worst value} - \text{Indicator ideal value}} * 10$
Carbon quotient	0.9	5	
Energy intensity	2	20	
Energy savings	0.4	-0.4	
Extinction rate of animal species	2	100	
Government debt	2.5	150	
Healthy business support	2	15	
<b>No data conversion</b>			
Life satisfaction	10	0	

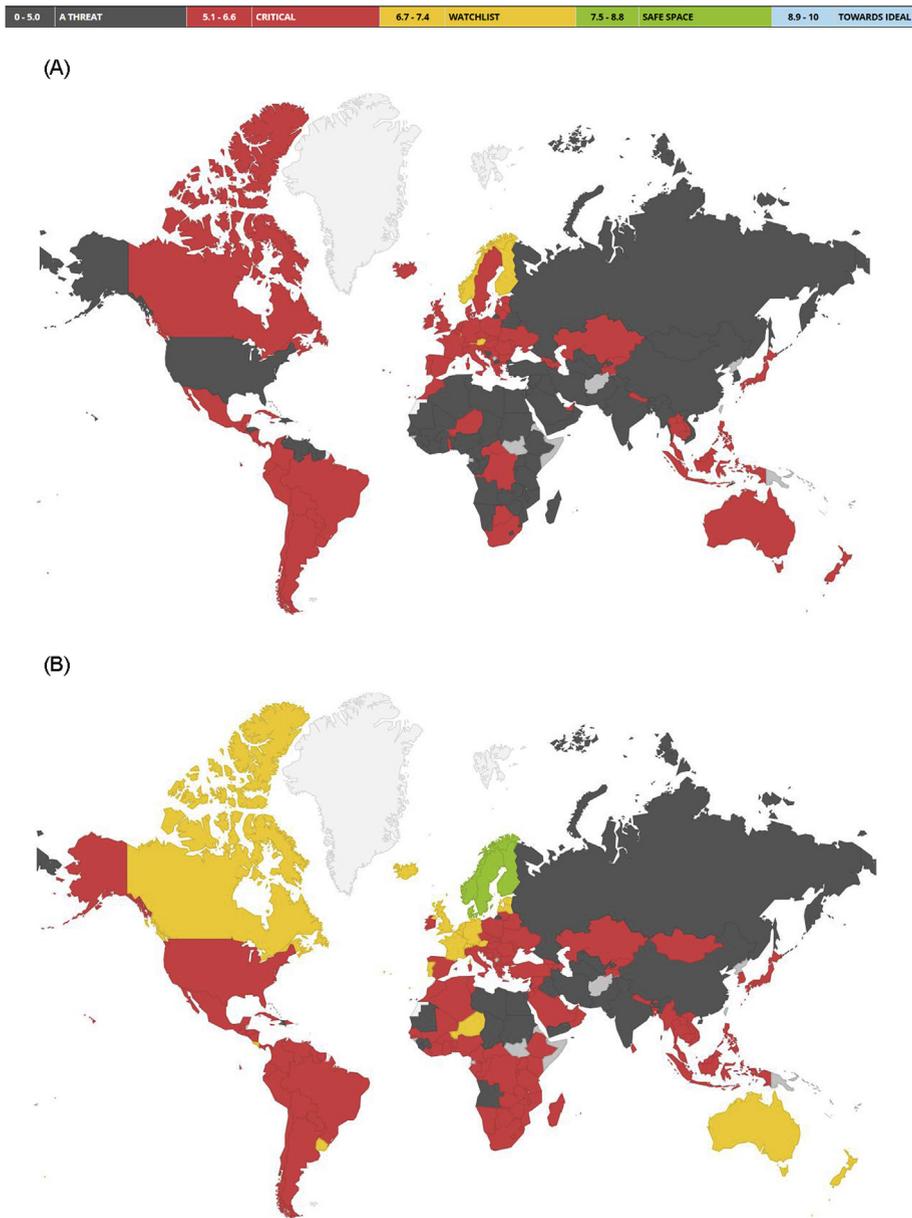


Fig. 4. The GAPFRAME country performance using the (A) “GAPFRAME Score” assessment and the (B) “Average of 4 Dimensions” assessment.

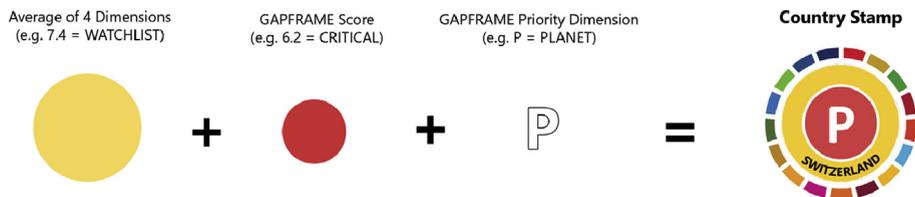


Fig. 5. The GAPFRAME country stamp for Switzerland – an example of the GAPFRAME score visualization.

**Towards ideal (8.9–10; blue):** Any value above 8.8 is considered approaching an ideal state, which we do not particularly highlight for not suggesting to stakeholders to spend their 80% of efforts required to advance the last 20% to perfection. We rather want to draw the attention to those issues that need urgent action (i.e. those below 6.7).

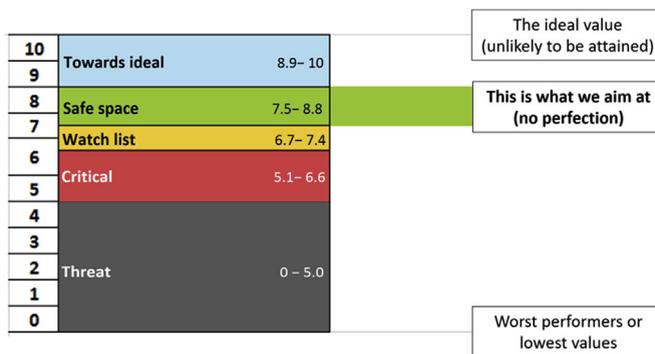


Fig. 6. The GAPFRAME scale and its five levels: “Threat”, “Critical”, “Watch list”, “Safe space”, and “Towards ideal”.

### 8. Limitations of the GAPFRAME V1 version

The GAPFRAME V1 version is a first attempt to develop a composite index which compares the current state of the world to its ideal future, based on an integral approach that embeds four sustainability dimensions: environment, society, economy and governance. We acknowledge that this version has limitations that must be addressed to develop an increasingly robust index.

At this point of time, we see the main shortcomings of the GAPFRAME V1 version in the following four areas: selection of indicators, treatment of missing data, determination of target values, and index robustness, as discussed in detail below.

#### 8.1. Selection of indicators

Despite our effort to identify the best possible indicators, the final set of 68 indicators is far from satisfactory. The main limitation to the GAPFRAME V1 version is that it includes indicators with insufficient data. 18 out of 68 selected indicators provide national values for less than 60% of the considered countries (thus less than 118 countries). Moreover, 11 indicators out of these 18 provide data for less than 45 countries, often restricting data to OECD countries. Being aware of this limitation, we temporarily include the indicators with insufficient data as long as they are pertinent to the issues. In the next revision round of the framework, we plan to complete the set of 68 indicators and replace those with insufficient data.

We also plan to revise and complete the allocation of indicators to our 24 issues. Currently, some issues are only partially covered by the available indicators. The best example is the *Clean Air* issue which is based on only 1 indicator, *Exposure to air pollution (PM25)*, that covers a very narrow aspect of the issue. This issue needs to be completed to cover the air pollution problem more broadly.

To account for the potential overlaps between indicators, we would have liked to use the principal component analysis (PCA). However, since the satisfactory indicators data set has not yet been defined, we decided to postpone this analysis to a new framework revision round in which experts will review and amend the current indicators choices.

#### 8.2. Treatment of missing values

There are a lot of data gaps in the current version of the GAPFRAME. Imputing the missing data with replacement values (coming from mean substitution, correlation results, time series or other methods), and treating these as if they were observed, would be the optimal way to treat the missing values in the dataset. However, since we have not yet collected the historical data for the indicators, we are not able to estimate the missing values using statistical methods based on past values. To diminish uncertainty when imputing missing data based on partially collected information, we ultimately decided to ignore the missing data and analyse only the available data in the GAPFRAME V1 version.

Consequently, the GAPFRAME Score and the Average of 4 Dimensions were calculated only if sufficient data for at least three dimensions existed. As a result, the GAPFRAME score was calculated only for 155 out of the 196 countries initially considered.

The dimensions were calculated if at least 60% of the data existed for related issues. Therefore, the planet dimension was evaluated for 178 countries, the society dimension for 143 countries, the economy dimension for 159 countries, and the governance dimension for 155 countries.

The issues were calculated if at least 50% of the data existed for related indicators. Most issues were calculated for at least 130 countries. The exceptions are the *Equal opportunity*, *Quality of Life*, and *Sustainable production* issues that were calculated for only 43, 36, and 81 countries, respectively. This limitation comes from the fact that for some indicators data was available mainly for the OECD countries.

To calculate the indicators, issues and dimensions for the regions and the world, we required data for at least 60% of the respective countries. Thus, to evaluate the world value for any indicator, issue, or dimension we needed to collect data for at least 118 countries; for the OECD, for at least 21 countries.

### 8.3. Determination of target values

Determination of ideal target values as well as worst values for all chosen indicators is a challenging process and demands an ongoing multi-expert effort to check and improve these values and how they are defined. A reason for using the opinions of several experts when determining ideal values for indicators was that a group approach may provide a broader perspective when defining an ideal case for a given indicator. Consequently, in the GAPFRAME, we rely on a multi-consultation process with experts to determine ideal values for indicators that reflect the desired future state of the world. The determination of ideal values for indicators is a non-trivial task as it is based on collecting subjective opinions which inherently introduce bias and uncertainty.

To simplify the process, where possible, we respected the target values inherent to the indicators sources and their respective scales. A drawback of this approach lays in the difficulty in obtaining uniform data and metrics across all indicators. Some indicators may provide target values based on the highest observed value or other metrics, and not necessarily on the ideal value to be achieved. Let's take for example the *Exposure to air pollution (PM25)*, an indicator taken from the Environmental Performance Index (EPI), to illustrate this point. This indicator refers to suspended particles in the air (2.5 µm diameter) that contribute to acute lower respiratory infections and other diseases such as cancer. Average annual concentrations of greater than 10 µg/m<sup>3</sup> are known to be injurious to human health. For this indicator, the low-performance benchmark is 49.92 µg/m<sup>3</sup>, which is based on the worst actual values, whereas the high-performance benchmark is set at 10 µg/m<sup>3</sup>. As a result, all countries with 10 µg/m<sup>3</sup> (or lower) concentration levels get the EPI score of 100 being the highest possible score (target score) on the 0–100 EPI scale. And here the question arises: should we consider the 100 score as an ideal value to be achieved if this score corresponds to particles concentration of 10 µg/m<sup>3</sup> which is already an injurious limit for the health? Shouldn't we aim higher?

Similar reasoning could be used with all the indicators, analysing the indicators raw data and the way they were aggregated, normalized and scaled. In fact, we could have used the indicator raw data instead of the transformed (normalized) data, introducing uniform metrics across all of them to determine the ideal and worst values and subsequently, proposing adequate normalization and scaling process. This however is a time and labour consuming process, which was not within the scope of the GAPFRAME V1 version. We might consider this approach in the next framework revision round.

### 8.4. Robustness of the index

The robustness of the GAPFRAME Index is yet to be evaluated and that is one of the major limitations of the GAPFRAME V1 version. The sensitivity and uncertainty analysis are planned to be performed within the next framework revision round to test the efficacy and robustness of the proposed tool.

## 9. Future Developments

The validity and the usefulness of the GAPFRAME will come from an expansion of its users and applications. We see the GAPFRAME as an ongoing process in which we look forward to receiving and including feedback and comments in next iterations of the GAPFRAME. After publication of the data in 2017 and an extended round of use and applications, an expert panel will be formed to review indicator by indicator, issue by issue, dimension by dimension, total results and scores to integrate further improvements and amendments. A bi-annual revision and upgrade of the framework is an integral part of how its relevance can and must be assured in the coming years.

In a next step, we plan to add historical data to our dataset to enable trend data analysis and related system-thinking tools including loop diagrams highlighting levels of change. This will enable us to assess not only where a country is in a given period (now) but to understand if a country is moving in the right direction (towards the safe space or away from it) in any given issue and sustainability dimension. An integral approach taken in the GAPFRAME allows to study interlinkages and the dynamics across all four sustainability dimensions (planet, society, economy, and governance) what may increase comprehensibility of this complex system.

Finally, we will seek to understand the impact of historical, political and cultural factors on a country's score, to gain a better understanding of the existing differences among countries and regions in the world.

## 10. Conclusions

According to the [GlobeScan and SustainAbility Survey \(2017\)](#), “only a very small proportion of surveyed professionals (9%) feel positive about the progress made to date in the transition to sustainable development, suggesting a tremendous amount of work remains to be done in this area”. Moreover, “sustainability experts view NGOs as having contributed the most toward progress on the Sustainable Development Goals to date, followed by social entrepreneurs, the UN, citizen-led mass social change movements and academics. In contrast, national governments and the private sector are perceived as having contributed very little”.

In the light of these findings, we see the GAPFRAME as a tool to support and strengthen the implementation of the Agenda 2030 for Sustainable Development (SDGs), and to monitor developments thereafter. [Table 10](#) shows how the Gapframe relates to the SDGs. The framework invites all stakeholders (e.g., business, governments, citizens, non-profit organization, etc.) to focus attention on addressing identified priority issues at a national level, holding each country accountable for the successful implementation of the global sustainability targets within their area of responsibility. The framework is particularly suited for business since it can be used as a strategic tool to identify long-term business opportunities, as extensively discussed in the previous publication ([Muff et al., 2017](#)). But it can also be used as a planning tool by public organizations and NGOs. Within the proposed framework, we aim to provide

**Table 10**  
Translation of the Gapframe to the 17 Sustainable Development Goals (SDGs).

	GAPFRAME	SDGs
PLANET	1. Biodiversity	14, 15
	2. Carbon quotient	13
	3. Oceans	14
	4. Land & forests	2, 15
	5. Clean air	13
	6. Water	6
	7. Clean energy	7
	8. Waste treatment	11
SOCIETY	9. Health	2, 3
	10. Equal opportunity	4, 8, 10
	11. Education	4, 5
	12. Living conditions	6, 7, 11
	13. Social integration	16
	14. Quality of life	1, 2
ECONOMY	15. Employment	8
	16. Resources use	11
	17. Sustainable Consumption	12
	18. Sustainable production	12
	19. Innovation	9
GOVERNANCE	20. Public finance	Additional
	21. Structural resilience	16
	22. Peace & cooperation	10, 16, 17
	23. Business integrity	Additional
	24. Transparency	Additional

decision-makers with aggregated information on local and regional situations to assist them in their planning and decision-making process and to enhance the multi-stakeholder collaboration across the globe.

Management educators can use the GAPFRAME as a tool to sensitize students to the global problems in their own country, but also in other parts of the world and discuss different approaches to address these problems. This will automatically bring-up important discussions on political, ethical and cultural issues in dealing with the conflicts between different environmental, social and economic priorities. If used in a multinational and multicultural context, this will automatically bring forward different perspectives and biases, possibly a Western bias. The factual basis of the GAPFRAME and the additional transparency created in the present paper should help to discuss such issues openly. Management educators may also use the GAPFRAME as a tool to evaluate and compare different sustainability issues and strategies in a variety of courses – e.g. Strategy, Business Policy, Sustainability, CSR, Public Policy - and for student projects. And they may use the GAPFRAME results to compare them to the results of other tools or methods used to prioritize issues and strategies, e.g. based on economic values or on political priorities.

We invite you to use and apply the data published so far for 196 countries and 22 regions on [www.gapframe.org](http://www.gapframe.org) and to share your feedback and comments with us ([community.gapframe.org](http://community.gapframe.org)), including an interest to become a part of the expert panels we will be setting up to upgrade the V1 version of the framework ([www.gapframe.org/contact](http://www.gapframe.org/contact)).

## Acknowledgments

The authors are most grateful for the expert panel that reviewed the Beta Version of the GAPFRAME for their substantial and critical support during 2016: Andreas Hauser (Swiss Federal Office of the Environment & Nature FOEN), Mathis Wackernagel (Global Footprint Network), André Schneider, Bruno Oberle, Lorenzo Massa and Albert Merino-Saum (EPFL Switzerland), Mathias Binswanger (FHNW Switzerland), Mark Halle und Laszlo Pinter (IISD), Sally Jeanrenaud (University of Exeter, UK), Basil Bornemann (University of Basel), Christian Kobler, Doris Hauser and Antoinette Hunziker-Ebnetter (Forma Futura), Eckhard Plinke (Vescore), Alexander Barkawi (Oikos Foundation).

The authors thank also Professor Stuart Pimm, President at Saving Species and Professor at Duke University in North Carolina, as well as Caroline Pollock, Programme Officer – Red List Unit at IUCN for numerous discussions and help in determination of the extinction rate of animals per country.

## Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.ijme.2018.05.001>.

## Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## References

- Agenda 21 (1992). *UNCED (united nations conference on environment and development)*. <https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf> accessed Jan 2016.
- Cercle Indicateurs (2015). *ARE (Bundesamt für Raumentwicklung): Nachhaltigkeitsindikatoren für Kantone und Gemeinden*. <https://www.are.admin.ch/> accessed in Jan 2016.
- Dyllick, T., & Muff, K. (2016). Clarifying the meaning of sustainable Business: Introducing a Typology from business-as-usual to true sustainability. *Organization & Environment*, 29(2016), 156–174.
- (EPI) Environmental Performance Index, 2014: <http://archive.epi.yale.edu/downloads>, accessed May 28th 2018.
- Global Footprint Network (2016). *National footprint accounts, 2016 edition*. accessed in Dec 2016.
- GlobeScan and SustainAbility (2017). *Evaluating progress towards the sustainable development goals, the GlobeScan and SustainAbility Survey 2017*. <http://sustainability.com/our-work/reports/evaluating-progress-towards-sustainable-development-goals/> accessed in May 2017.
- (GTI) Global Terrorism Index (2015). *Wikipedia*. [https://en.wikipedia.org/wiki/Global\\_Terrorism\\_Index](https://en.wikipedia.org/wiki/Global_Terrorism_Index) accessed in Jan 2016.
- IUCN: Red List of Threatened Species (2016a). *Number of animal species in each IUCN red list category by country (table 6a)*. <http://www.iucnredlist.org/about/summary-statistics> accessed in Nov 2016.
- IUCN: Red List of Threatened Species (2016b). *Total endemic and threatened endemic vertebrate (Table 8a) and invertebrate (Table 8b) species*. <http://www.iucnredlist.org/about/summary-statistics> accessed in Nov 2016.
- KPMG (2015). *The KPMG Survey of corporate responsibility reporting 2015*. <https://assets.kpmg.com/content/dam/kpmg/pdf/2016/02/kpmg-international-survey-of-corporate-responsibility-reporting-2015.pdf> accessed in Jan 2016.
- Muff, K., Kapalka, A., & Dyllick, T. (2017). The Gap Frame – translating the SDGs into relevant national grand challenges for strategic business opportunities. *International Journal of Management in Education*, 15(2017), 263–383.
- OECD: Education and Training (2013). <http://stats.oecd.org/Index.aspx>, accessed in Jan 2016.
- OECD: Social Protection and Well-being (2010-2013), <http://stats.oecd.org/Index.aspx>, accessed Jan 2016.
- OECD: The Better Life Index (2015), <http://www.oecdbetterlifeindex.org/>, accessed in Jan 2016.
- Peters, G. P., Minx, J. C., Weber, C. L., & Edenhofer, O. (2011). Growth in emission transfers via international trade from 1990 to 2008. *Proceedings of the National Academy of Sciences*, 108(2011), 8903–8908.
- Pimm, S. L., Jenkins, C. N., Abell, R., Brooks, T. M., Gittleman, J. L., Joppa, L. N., et al. (2014). The biodiversity of species and their rates of extinction, distribution and protection. *Science*, 344(2014), 987. <http://dx.doi.org/10.1126/science.1246752>.
- Pimm, S., Raven, P., Peterson, A., Şekercioğlu, C. A., Ehrlich, P. R., et al. (2006). Human impacts on the rates of recent, present, and future birds' extinctions. *Proceedings of the National Academy of Sciences*, 103(2006), 10941–10946.
- Raworth, K. (2012). *A safe and just space for humanity. Can we live within a doughnut?* Oxfam Discussion Papers, Feb 2012 [www.oxfam.org/grow](http://www.oxfam.org/grow).
- Rockström, J., Steffen, W., Noone, K., Persson, A., Chapin, F. S., III, Lambin, E. F., et al. (2009). A safe operating space for humanity. *Nature*, 461(2009), 472–475. <http://dx.doi.org/10.1038/461472a>.
- Rockström, J., & Sukhdev, P. (2017). *How food connects all the SDGs*. Stockholm Resilience Center <http://www.stockholmresilience.org/research/research-news/2016-06-14-how-food-connects-all-the-sdgs.html> accessed in Jul 2017.
- (SGI) Sustainable Governance Indicators (2016): Bertelsmann Stiftung, Germany, <http://www.sgi-network.org/2016/>, accessed in Nov 2016.
- (SPI) Social Progress Index (2015): Avina Foundation/Skoll Foundation/Deloitte, <http://www.socialprogressimperative.org/data/spi>, accessed in Jan 2016.
- (SSI) Sustainable Society Index, 2014: <http://www.ssfindex.com/>, accessed May 28, 2018.
- The Global Slavery Index (2016): <https://www.globallslaveryindex.org/>, accessed in Oct 2016.
- (UNEP) United Nations Environment Programme (2010). *Environment for development*. <http://ede.grid.unep.ch/> accessed in Jan 2016.
- United Nations (2016). *The sustainable development goals report 2017* <https://unstats.un.org/sdgs/report/2016/> accessed in May 2017.
- (WBCSD) World Business Council for Sustainable Development (2010). *Vision 2050. The new agenda for business*. <http://www.wbcscd.org/Overview/About-us/Vision2050/Resources/Vision-2050-The-new-agenda-for-business> accessed in Jun 2017.
- (WEF GCI) The World Economic's Forum Global Competitiveness Index (2005-2014). *The global competitiveness index historical dataset 2005-2014*. <http://reports.weforum.org/global-competitiveness-index/> accessed in Jan 2016.
- (WHO) World Health Organization (2010). *Age-standardized heavy episodic drinking by country*. <http://apps.who.int/gho/data/node.main.A1420?lang=en> accessed in Jan 2016.
- World Bank (2010-2015). *The World Bank group, indicators*. <http://data.worldbank.org/indicator/> accessed Jan 2016.
- World Bank (2012). *What a waste. A global review of solid waste management*. [https://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1334852610766/What\\_a\\_Waste2012\\_Final.pdf](https://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1334852610766/What_a_Waste2012_Final.pdf) accessed in Jan 2016.