



# Report Methodology

# Introduction: Report Scope and Methodology

“Advanced Biomedicine in the Gulf Region Landscape Overview” is a new analytical case study that applies the sophisticated multidimensional and big data analytics first developed for our previous report, [“Global Longevity Governance: Big Data Comparative Analysis of Longevity Progressiveness in 50 Countries”](#), to providing intelligible and fact-based benchmarking of Gulf Region countries in relation to their respective levels of Healthy Longevity, as measured by Health-Adjusted Life Expectancy (HALE), their current gaps between HALE and unadjusted life expectancy, their current levels of success in growing and maintaining National Healthy Longevity, and in dealing with the issue of aging. The results of this analysis are then used to provide tangible policy recommendations on how Gulf countries can either maintain or improve their current international standing and optimize their levels of National Healthy Longevity.

This special analytical case study also compares and contrasts a variety of key factors impacting National Healthy Longevity, and utilizes the results of its analysis to identify social policy, healthcare, medical, financial and socioeconomic factors having the greatest effect on the gap between life expectancy at birth and Health-Adjusted Life Expectancy (HALE) for Bahrain, Kuwait, Saudi Arabia, United Arab Emirates, Qatar and Oman. Some governments are putting policies on Longevity at the center of their growth strategies and budget planning, while others lag behind. This report is able to offer tangible and practical recommendations tuned to the specifics of individual countries, providing the necessary set of tools to reduce their HALE gap and improve their comparative global standing, transforming the deficit and challenge of the silver tsunami into the asset and opportunity of Healthy Longevity for the mutual benefit of their citizens and their economy.

The present report identifies the specific factors with the greatest likelihood of enabling governments to develop integrated Longevity strategies and ecosystems to scale, and to reduce as much as possible their national gap between life expectancy and Healthy Longevity with focus not just on quantity of life, but also on quality. 200 analyzed parameters were used per country (1200 parameters in total), divided into 6 layers and grouped in accordance with the nature of the variables being analyzed. Effectiveness ratios are derived from absolute values and ratios, and are used as a measure of how effective Longevity governance has been in utilizing the financial resources of a given country to generate acceptable increases in health-adjusted life expectancy and quality of life.

# Metrics Structure. 1st Level

1. Absolute values						
<b>General Health Status</b>						<b>Government Healthcare Policies</b>
Both Sexes HALE	Male HALE	Female HALE	Both Sexes Life Expectancy	Male Life Expectancy	Female Life Expectancy	Existence of an Operational Policy that Integrates Several NCDs and Their Risk Factors
<b>Government Healthcare Policies</b>						
Existence of a Set of Time-Bound National Targets Based on WHO Guidance for NCDs	Existence of any Policies to Reduce Population Salt Consumption	Implementation of Physical Activity Public Awareness Program	Existence of Operational Policy/Strategy/Action Plan for Cancer	Existence of Operational Policy/Strategy/Action Plan for Cardiovascular Diseases	Existence of Operational Policy/Strategy/Action Plan for Diabetes	Existence of Operational Policy/Strategy/Action Plan for Chronic Respiratory Diseases
<b>Government Healthcare Policies</b>						
Existence of Operational Policy/Strategy/Action Plan to Decrease Tobacco Use	Existence of Operational Policy/Strategy/Action Plan to Reduce Physical Inactivity	Existence of Operational Policy/Strategy/Action Plan to Reduce the Harmful Use of Alcohol	Existence of Operational Policy/Strategy/Action Plan to Reduce Unhealthy Diet Related to NCDs	Existence of Operational Policy/Strategy/Action Plan for Oral Health	Stand-Alone Law for Mental Health	Stand-Alone Policy or Plan for Mental Health
<b>Retirement and Ageing</b>					<b>Demography</b>	
Number of WHO Age Friendly Cities and Communities	Early Retirement Age Women	Early Retirement Age Men	Normal Retirement Age Women	Normal Retirement Age Men	Total Population	Population 65 +
<b>Demography</b>	<b>Temperature Conditions</b>		<b>Solar Radiation</b>	<b>Humidity</b>		
Net Migration	Diurnal Temperature Variation, °C	Daily Mean Air Temperature, °C	Sunshine Hours, Mean Monthly Number of Hours	Relative Humidity, %	Dew Point, °C	

The first level of metrics is used predominantly as a basis for the following more complicated levels of analysis.

# Metrics Structure. 2nd Level

2. Indices								
Healthcare		Melbourne Mercer Global Pension Index				Economy		
Healthcare Efficiency Index	HAQ (The Healthcare Access and Quality Index)	Overall Value Index	Sustainability	Adequacy	Integrity	Inclusive Development Index	Global Competitiveness Index	Consumer Price Index
International Health Regulations (2005) Monitoring Framework								
Legislation	Coordination	Surveillance	Response	Preparedness	Risk Communication	Human Resources	Laboratory	Points of Entry
International Health Regulations (2005) Monitoring Framework				Society				
Zoonosis	Food Safety	Chemical	Radionuclear	Education Index	Democracy Index	Human Development Index	Global Gender Gap Index	Corruption Perceptions Index 2016

The second level of metrics comprises a number of indices developed by international organizations and respected publications, such as WHO, The World Bank, Bloomberg, etc.

# Metrics Structure. 3rd Level (1)

3. Ratios								
Mental Health			Immunization					
Mental Hospitals (per 100 000 Population)	Mental Health Units in General Hospitals (per 100 000 Population)	Mental Health Outpatient Facilities (per 100 000 Population)	BCG Immunization Coverage among 1-Year-Olds (%)	Diphtheria Tetanus Toxoid and Pertussis (DTP3) Immunization Coverage among 1-Year-Olds (%)	Hepatitis B (HepB3) Immunization Coverage among 1-Year-Olds (%)	Hib (Hib3) Immunization Coverage among 1-Year-Olds (%)	Measles-Containing-Vaccine First-Dose (MCV1) Immunization Coverage among 1-Year-Olds (%)	Measles-Containing-Vaccine Second-Dose (MCV2) Immunization Coverage by the Recommended Age (%)
Immunization				Economy				
Neonates Protected at Birth against Neonatal Tetanus (%)	Pneumococcal Conjugate Vaccines (PCV3) Immunization Coverage among 1-Year-Olds (%)	Polio (Pol3) Immunization Coverage among 1-Year-Olds (%)	Rotavirus Vaccines Completed Dose (RotaC) Immunization Coverage among 1-Year-Olds (%)	GDP per Capita (Current US\$)	Adjusted Savings: Net National Savings (% of GNI)	Unemployment Rate, %	Net ODA Received (% of GNI)	% of People 65+ in Employment
Economy	Healthcare							
Income Gini Coefficient	Current Health Expenditure per Capita (Current US\$)	Public Health Care Expenditure (as % of GDP)	Domestic Private Health Expenditure (% of Current Health Expenditure)	Out-of-Pocket Expenditure (% of Current Health Expenditure)	Risk of Catastrophic Expenditure for Surgical Care (% of People at Risk)	Medical Equipment (per 1.000.000 People)	Biomedical Engineers Density (per 10 000 Population)	

The third level of metrics includes open data ratios mostly provided by WHO, OECD, The World Bank and Governmental institutions of each country, that are subsequently used for countries comparison and advanced calculations of growth rates of ratios and effectiveness ratios.

## Metrics Structure. 3rd Level (2)

3. Ratios							
General Health Status							
Population of Adults with AIDs (%)	Annual Cigarette Consumption per Capita	Alcohol Consumption per Capita (Litres of Pure Alcohol)	DALY Rates per 100 000 Population	Incidence of Tuberculosis (per 100 000 Population per year)	Prevalence of Overweight among Adults, BMI $\geq$ 25 (Age-Standardized Estimate) (%)	Prevalence of Undernourishment (% of Population)	Prevalence of Insufficient Physical Activity Among Adults aged 18+ Years (Age-Standardized Estimate) (%)
Environment and Infrastructure				Demography			
People Using Safely Managed Sanitation Services (% of Population)	Population Using Improved Water Sources (%)	Ambient Air Pollution, Concentration of Fine Particulate Matter (PM2.5)	Ambient Air Pollution, Concentration of Fine Particulate Matter PM2.5 (Ug/M3)	Ambient and Household Air Pollution Attributable Death Rate (per 100 000 Population)	Population Growth Rate, %	Total Fertility Rate (per Woman)	Crude Birth Rate (per 1 000 People)
Demography							
Crude Death Rate (per 1 000 People)	Population Density, Number of People/km2	Age Dependency Ratio	Total Age Dependency Ratio (per 1000 of Working-Age Population)	Population Over 65 (%)	Age Dependency Ratio, Old	Urban Population (% of Total)	Senior Poverty Ratio
Demography							
Murder rates 2016 per 100 000 population	The third level of metrics includes open data ratios mostly provided by WHO, OECD, The World Bank and Governmental institutions of each country, that are subsequently used for countries comparison and advanced calculations of growth rates of ratios and effectiveness ratios.						

# Metrics Structure. 4th Level

4. Growth Rates				
Life Expectancy and HALE				
Both Sexes Life Expectancy, CAGR (6 years)	Male Life Expectancy, CAGR (6 years)	Female Life Expectancy, CAGR (6 years)	Both Sexes HALE CAGR (6 Years)	Male HALE CAGR (6 Years)
Life Expectancy and HALE				Other
Female HALE CAGR (6 Years)	Both Sexes HALE and Life Expectancy Difference, CAGR (6 Years)	Male HALE and Life Expectancy Difference, CAGR (6 Years)	Female HALE and Life Expectancy Difference, CAGR (6 Years)	Human Development Index Score, CAGR (6 Years)

The fourth level of metrics is based on the first two levels and mostly represent the average percentage changes of metrics of a certain country.

Growth rates refer to the percentage change of a specific variable within a 6 year period. A compound annual growth rate (CAGR) is used to measure country's performance in a certain area. Its calculation assumes that growth is steady over a specified period of time. CAGR is a widely used metric due to its simplicity and flexibility to forecast further growth.

Both sexes life expectancy growth rate, for example, is derived as the average annual rate of change at which a country's life expectancy increases or decreases. This rate of growth is used to measure country's overall changes in mortality level of a population.

# Metrics Structure. 5th and 6th Level

5. Growth Rates of Ratios					
Economy			Healthcare Expenditure		
GDP (per Capita), CAGR (6 Years)	Adjusted Savings: Net National Savings (% of GNI), CAGR (6 Years)	Income Gini Coefficient, CAGR (6 Years)	Current Health Expenditure per Capita (Current US\$), CAGR (6 Years)	Public Health Care Expenditure (as % of GDP), CAGR (6 Years)	Domestic Private Health Expenditure (% of Current Health Expenditure), CAGR (6 Years)
Healthcare Expenditure	General Health State				Environment
Out-of-Pocket Expenditure (% of Current Health Expenditure), CAGR (6 Years)	Population of Adults with AIDs (%), CAGR (6 Years)	Alcohol Consumption (per Capita), CAGR (6 Years)	Prevalence of Overweight among Adults, BMI $\geq$ 25 (Age-Standardized Estimate) (%), CAGR (6 Years)	Prevalence of Undernourishment (% of Population), CAGR (6 Years)	Ambient Air Pollution, Concentration of Fine Particulate Matter (PM2.5), CAGR (6 Years)
6. Effectiveness Ratios					
HALE CAGR (6 Years)/Current Health Expenditures per Capita (Current US\$), CAGR (6 Years)	HALE and Life Expectancy Difference CAGR (6 Years)/Current Health Expenditures per Capita (Current US\$), CAGR (6 Years)		HALE CAGR (6 Years)/GDP per Capita CAGR (6 Years)	HALE CAGR (6 Years)/Prevalence of Overweight among Adults, BMI $\geq$ 25 CAGR (6 Years)	

The fifth and sixth levels are also based on the previous levels and are the main indicators of a country's position in the analysis of Healthy Longevity.

# Methodology for Absolute Values: General Health Status

HALE (Health-Adjusted life expectancy) refers specifically to the healthy number of years someone is expected to live at birth, which equals their life expectancy minus the number of years expected to be lived in a state of illness or disability as opposed to life expectancy at birth that is defined as how long, on average, a newborn can expect to live, if current death rates do not change. It takes into account both fatal and nonfatal outcomes and has a summary measure of population health. An important measure for HALE is disease prevalence, which is a combination of the number of people living with the disease and the overall impact of the severity of this disease on the affected people. Therefore, HALE is a more useful and revealing metric compared with average life expectancy.

The following metrics were used in this report:

<b>Metric definition</b>	<b>Calculation</b>
Both Sexes HALE - an indicator of both sexes healthy life expectancy.	An absolute value that is derived from sourcing the data.
Male HALE - an indicator of men healthy life expectancy.	An absolute value that is derived from sourcing the data.
Female HALE - an indicator of female healthy life expectancy.	An absolute value that is derived from sourcing the data.

To be regarded as a country with high HALE, it should have the maximum possible values in all three aforementioned metrics, i.e. HALE must be equal or tend to the largest possible number. HALE is measured in years, and the greater is the metric value, the longer is expected health-adjusted life duration in the country.

The source for all the data for the analysis is WHO Life tables.

# Methodology for Absolute Values: General Health Status

Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. Life expectancy could be considered as one of the most important measures of health. It is readily comparable across countries and indicates how well a government is doing in terms of healthcare improvements. It reflects the mortality level and pattern that prevails across different age groups of population - children, adolescents, adults, and elderly people.

For the report, the following metrics were used:

<b>Metric definition</b>	<b>Calculation</b>
Both sexes Life Expectancy - is a statistical measure of the average time a person is expected to live, based on the year of its birth, its current age and other demographic factors.	An absolute value that is derived from sourcing the data.
Male Life Expectancy - is a statistical measure of the average time men are expected to live.	An absolute value that is derived from sourcing the data.
Female Life Expectancy - is a statistical measure of the average time women are expected to live.	An absolute value that is derived from sourcing the data.

To be regarded as a country with high Life Expectancy, it should have the maximum possible values in all three aforementioned metrics, i.e. life expectancy must be equal or tend towards the largest possible number. Life Expectancy is measured in years, so the greater is the metric value, the longer is expected life duration in the country.

The source for all the data for the analysis is WHO Life tables.

# Methodology for Absolute Values: Government Healthcare Policies

Existence of an Operational Policy that Integrates Several NCDs (Noncommunicable diseases) and Their Risk Factors defines that country has a policy, strategy or action plan which is being used and implemented, has resources and funding available to implement it, and one or more government sectors outside of health are engaged.

Existence of a physical activity program, plan for cancer and policies to reduce population salt consumption, as well as a set of time-bound national targets for NCDs (based on the 9 voluntary global targets from the WHO Global Monitoring Framework for NCDs), along with other policies, are aimed to create the conditions that ensure good health for the entire population. For the report, the following metrics were used:

Metric definition	Calculation
Existence of an Operational Policy that Integrates Several NCDs and Their Risk Factors	Existence or non-existence of an Operational, Policy that Integrates Several NCDs and Their Risk Factors.
Existence of a Set of Time-Bound National Targets Based on WHO Guidance for NCDs	Existence or non-existence of a Set of Time-Bound National Targets Based on WHO Guidance for NCDs.
Existence of any Policies to Reduce Population Salt Consumption	Existence or non-existence of any Policies to Reduce Population Salt Consumption.
Implementation of Physical Activity Public Awareness Program	Existence or non-existence of Physical Activity Public Awareness Program.
Existence of Operational Policy/Strategy/Action Plan for Cancer	Existence or non-existence of Operational Policy/Strategy/Action Plan for Cancer.

If the country has an operational policy, strategy, action plan or program from listed metrics, the metric takes on a value of 1, and if the aforementioned operational policy, strategy, action plan or program is not used and implemented, the metric takes on a value of 0. The source for all the data for the analysis is WHO Life tables.

# Methodology for Absolute Values: Government Healthcare Policies

The main objective of national health policy is to provide them access to quality healthcare with optimal conditions for the entire population of the country. Proposed metrics indicate whether the country has an operational policy, strategy, or action plan for cardiovascular and chronic respiratory diseases, diabetes, tobacco use, and physical inactivity reduction.

For the report, the following metrics were used:

Metric definition	Calculation
Existence of Operational Policy/Strategy/Action Plan for Cardiovascular Diseases	Existence or non-existence of Operational Policy/Strategy/Action Plan for Cardiovascular Diseases.
Existence of Operational Policy/Strategy/Action Plan for Diabetes	Existence or non-existence of Operational Policy/Strategy/Action Plan for Diabetes.
Existence of Operational Policy/Strategy/Action Plan for Chronic Respiratory Diseases	Existence or non-existence of Operational Policy/Strategy/Action Plan for Chronic Respiratory Diseases.
Existence of Operational Policy/Strategy/Action Plan to Decrease Tobacco Use	Existence or non-existence of Operational Policy/Strategy/Action Plan to Decrease Tobacco Use.
Existence of Operational Policy/Strategy/Action Plan to Reduce Physical Inactivity	Existence or non-existence of Operational Policy/Strategy/Action Plan to Reduce Physical Inactivity.

If the country has an operational policy, strategy, action plan or program from listed metrics, the metric takes on a value of 1, and if the aforementioned operational policy, strategy, action plan or program is not used and implemented, the metric takes on a value of 0. The source for all the data for the analysis is WHO Life tables.

# Methodology for Absolute Values: Government Healthcare Policies

The main objective of national health policy is to provide them access to quality healthcare with optimal conditions for the entire population of the country. Proposed metrics indicate whether the country has an operational policy, strategy, or action plan to reduce the harmful use of alcohol and unhealthy diet-related to NCDs, and plan for oral health. It is also important to determine the presence of stand-alone law and policy for mental health, as mental disorders take place among the leading causes of ill-health and disability worldwide.

For the report, the following metrics were used:

Metric definition	Calculation
Existence of Operational Policy/Strategy/Action Plan to Reduce the Harmful Use of Alcohol	Existence or non-existence of Operational Policy/Strategy/Action Plan to Reduce the Harmful Use of Alcohol.
Existence of Operational Policy/Strategy/Action Plan to Reduce Unhealthy Diet Related to NCDs	Existence or non-existence of Operational Policy/Strategy/Action Plan to Reduce Unhealthy Diet Related to NCDs.
Existence of Operational Policy/Strategy/Action Plan for Oral Health	Existence or non-existence of Operational Policy/Strategy/Action Plan for Oral Health.
Stand-Alone Law for Mental Health	Existence or non-existence of Stand-Alone Law for Mental Health.
Stand-Alone Policy or Plan for Mental Health	Existence or non-existence of Stand-Alone Policy or Plan for Mental Health.

If the country has an operational policy, strategy, action plan or program from listed metrics, the metric takes on a value of 1, and if the aforementioned operational policy, strategy, action plan or program is not used and implemented, the metric takes on a value of 0. The source for all the data for the analysis is WHO Life tables.

# Methodology for Absolute Values: Retirement and Ageing

Retirement is defined when a person chooses to leave the workforce. Many people choose to retire when they are eligible for private or public pension benefits, although some are forced to retire when bodily conditions no longer allow the person to work any longer (by illness or accident) or as a result of legislation concerning their position.

Age-friendly cities/communities indicate whether cities and communities adapt their structures and services to the needs of older people. For the report, the following metrics were used:

Metric definition	Calculation
Number of WHO Age-Friendly Cities/Communities	Based on own research
Early retirement age Women - an indicator of female early pension withdrawal before age 60 that is possible in occupational and private pension plans.	An absolute value that is derived from sourcing the data.
Early retirement age Men - an indicator of male early pension withdrawal before age 60 that is possible in occupational and private pension plans.	An absolute value that is derived from sourcing the data.
Normal retirement age Women - an indicator of females the lowest normal statutory pension age.	An absolute value that is derived from sourcing the data.
Normal retirement age Men - an indicator of males the lowest normal statutory pension age.	An absolute value that is derived from sourcing the data.

To be regarded as a country with high Retirement, it should have the maximum possible values in a total number of retired. Countries with a high number of WHO age-friendly cities/communities have a metric value that tends towards the largest possible number.

The source for all the data for the analysis is WHO Life tables, World Bank, National Bureaus of Statistics.

# Methodology for Absolute Values: Demography

Demography is an important part of public policy analysis and development. Furthermore, it can provide explanations of observed economic and social trends in the country. An increase in the number of people of retirement age (65+) in the total number of the country's population will lead to an increase in the burden on those of working age to cover expenses for social expenditure that provide comfortable conditions for the elderly.

Net migration is the difference between immigration into and emigration from the area during the year. If the number of emigrants exceeds the number of immigrants, it can cause problems relating to unemployment and, in some areas, a reduction or glut in a particular labor force.

For the report, the following metrics were used:

<b>Metric definition</b>	<b>Calculation</b>
Total population	An absolute value that is derived from sourcing the data.
Population 65+	An absolute value that is derived from sourcing the data.
Net migration	An absolute value that is derived from sourcing the data.

The total population is an absolute value that describes the total amount of people living in a specific country, the larger is value, the more people are living in the country. Population 65+ metric defines the elderly population in a country. Net migration value is positive when the number of immigrants exceeds the number of emigrants.

The source for all the data for the analysis is WHO Life tables, The World Bank, National Bureaus of Statistics.

# Methodology for Meteorological Analysis: Temperature Conditions

Temperature conditions are major indicators of weather patterns and are one of the most well-known rates to the general public. Furthermore, diurnal temperature variation or diurnal temperature range (DTR) is a well-known risk factor of weather-related human health. Numerous studies have described a positive association between DTR and mortality (Caoet al. 2009; Limet al. 2015; Tamet al. 2009; Vutcoviciet al. 2014; Yanget al. 2013a), and have reported that people who are elderly, less educated, female or have cardiovascular or respiratory disease are more susceptible to DTR than others (Kan et al. 2007b; Lim et al. 2012a; Yang et al. 2013b).

For the report, the following metrics were used:

Metric definition	Formula
Diurnal Temperature Variation, °C is the difference between the daily maximum and minimum temperature.	$\frac{(1/n \sum_{i=1}^n (T_{\max i} - T_{\min i}) * P_i + 1/n \sum_{j=1}^n (T_{\max j} - T_{\min j}) * P_j + 1/n \sum_{k=1}^n (T_{\max k} - T_{\min k}) * P_k + 1/n \sum_{l=1}^n (T_{\max l} - T_{\min l}) * P_l)}{(P_i + P_j + P_k + P_l)}$ <p>where i-l stand for the respective weather station, <math>P_i</math>-<math>P_l</math> stand for 2016 population value of the city weather station is situated in, <math>T_{\max i}</math> is monthly mean maximum temperature observed at the respective weather station, <math>T_{\min i}</math> is monthly mean minimum temperature observed at the respective weather station.</p>
Daily Mean Air Temperature, °C is daily average air temperature value.	$\frac{(1/n \sum_{i=1}^n T_i * P_i + 1/n \sum_{j=1}^n T_j * P_j + 1/n \sum_{k=1}^n T_k * P_k + 1/n \sum_{l=1}^n (T_l * P_l)}{(P_i + P_j + P_k + P_l)}$ <p>where i-l stand for the respective weather station, <math>P_i</math>-<math>P_l</math> stand for 2016 population value of the city weather station is situated in, <math>T_i</math> is monthly mean temperature observed at the respective weather station.</p>

There are no definite “best” values, but scientific evidence suggests that for the country to have a comfortable temperature condition, Diurnal Temperature Variation should have the least possible value, Daily Mean Air Temperature should have the value close to 15°C. The source for all the data for the analysis is Ogimet, RP5.

# Methodology for Meteorological Analysis: Solar Radiation

Sunlight, an essential prerequisite for life, may be extremely dangerous to human health. Excessive exposure to the sun is known to be associated with increased risks of various skin cancers, cataracts, and other eye diseases, as well as accelerated skin ageing. It may also adversely affect people's ability to resist infectious diseases and compromise the effectiveness of vaccination programmes. Within the Bureau of Meteorology network, bright sunshine has generally been recorded with a Campbell-Stokes recorder. This device only measures the duration of “bright” sunshine, which is less than the amount of “visible” sunshine. For example, sunshine immediately after sunrise and just before sunset is visible, but would not be bright enough to register on the Campbell-Stokes recorder.

For the report, the following metrics were used:

Metric definition	Formula
<p>Sunshine Hours, Mean Monthly Number of Hours is an average number of hours of bright sunshine each month in a calendar year. Hours of bright sunshine is measured from midnight to midnight.</p>	$\frac{(1/n \sum_{i=1}^n H_i * P_i + 1/n \sum_{j=1}^n H_j * P_j + 1/n \sum_{k=1}^n H_k * P_k + 1/n \sum_{l=1}^n H_l * P_l)}{(P_i + P_j + P_k + P_l)}$ <p>where i-l stand for the respective weather station, <math>P_i</math>-<math>P_l</math> stand for 2016 population value of the city weather station is situated in, <math>H_i</math> is monthly mean number of sunshine hours observed at the respective weather station.</p>

There are no definite “best” values, but scientific evidence suggests that for the country to have comfortable levels of solar radiation, Sunshine Hours, Mean Monthly Number of Hours should not have extreme values, i.e. the function should avoid its maximum and minimum values.

The source for all the data for the analysis is Ogimet, RP5.

# Methodology for Meteorological Analysis: Humidity

Humidity affects human health in various ways. Humid conditions disrupt the human body temperature regulation system: the sweat evaporates more slowly, making it hard for our bodies to cool off, so they get more stressed and over-exercised. When combined with high temperatures, high humidity levels can cause several symptoms including dehydration, muscle cramps, fatigue, heat exhaustion, fainting, and heatstroke.

For the report, the following metrics were used:

Metric definition	Formula
<p>Relative Humidity, % is a measure of the actual amount of water vapor in the air compared to the total amount of vapor that can exist in the air at its current temperature.</p>	$\left( \frac{1}{n} \sum_{i=1}^n RH_i * P_i + \frac{1}{n} \sum_{j=1}^n RH_j * P_j + \frac{1}{n} \sum_{k=1}^n RH_k * P_k + \frac{1}{n} \sum_{l=1}^n RH_l * P_l \right) / (P_i + P_j + P_k + P_l)$ , where i-l stand for the respective weather station, $P_i$ - $P_l$ stand for 2016 population value of the city weather station is situated in, $RH_i$ is monthly mean relative humidity value observed at the respective weather station.
<p>Dew Point, °C provides a measure of the actual amount of water vapor in the air, is the temperature to which the air must be cooled for air to be saturated.</p>	$\left( \frac{1}{n} \sum_{i=1}^n T_{d_i} * P_i + \frac{1}{n} \sum_{j=1}^n T_{d_j} * P_j + \frac{1}{n} \sum_{k=1}^n T_{d_k} * P_k + \frac{1}{n} \sum_{l=1}^n T_{d_l} * P_l \right) / (P_i + P_j + P_k + P_l)$ , where i-l stand for the respective weather station, $P_i$ - $P_l$ stand for 2016 population value of the city weather station is situated in, $T_{d_i}$ is monthly mean dew point value observed at the respective weather station.

There are no definite best values, but scientific evidence suggests that for the country to have comfortable levels of humidity, Relative Humidity and Dew Point should not have extreme values, i.e. the function should avoid its maximum and minimum values.

The source for all the data for the analysis is Ogimet, RP5.

# Methodology for Indexes: Healthcare

Healthcare efficiency measures whether healthcare resources are being used to get the best value for money, where the value of healthcare is as a means to improve health. Efficiency is concerned with the relation between resource inputs (costs, in the form of labor, capital, or equipment) and either intermediate outputs (numbers treated, waiting time, etc) or final health outcomes (lives saved, life years gained, quality-adjusted life-years (QALYs)).

The HAQ Index encompasses 32 causes of death considered to be avoidable provided that quality healthcare is available. The general trend shows that country index values improved in nearly all countries compared to 1990.

For the report, the following metrics were used:

<b>Metric definition</b>	<b>Calculation</b>
Healthcare Efficiency Index	A weighted average of Life Expectancy, Relative Healthcare Cost, Absolute Healthcare Cost.
HAQ (The Healthcare Access and Quality Index)	Based on 32 causes from which death should not occur in the presence of effective care to approximate personal health-care access.

To be regarded as a country with high Healthcare, two aforementioned metrics should have the largest possible value, i.e. Health-Efficiency Index and Global Healthcare Access and Quality Index should be equal to the largest possible number on the scale of 0 to 100, with 0 as the first percentile (worst) and 100 as the best. It would indicate that the country's healthcare system is not just of high quality but affordable and cost-effective as well.

The source for all the data for the analysis is Bloomberg, The Lancet.

# Methodology for Indexes: Melbourne Mercer Global Pension Index

The Melbourne Mercer Global Pension Index (MMGPI) compares retirement income systems around the world based on their adequacy, sustainability, and integrity. The provision of financial security in retirement is critical for both individuals and societies as countries grapple with the social and economic effects of aging populations. The Index provides a valuable contribution to the global debate about how best to support older members of our societies. It is encouraging to see governments responding to their Index ranking as they develop their national schemes.

For the report, the following metrics were used:

<b>Metric definition</b>	<b>Formula</b>
Overall Value Index	A weighted average of Sustainability, Adequacy, Integrity sub-indexes.
Sustainability - considers a number of indicators which influence the long-term sustainability of current retirement income systems.	Based on the economic importance of the private pension system, its level of funding, the length of expected retirement both now and in the future, etc.
Adequacy - considers the benefits provided to the poor and the average-income earner as well as several design features and characteristics which enhance the efficacy of the overall retirement income system.	Based on the net household saving rate, the level of household debt and the homeownership rate are also included as non-pension savings represent an important source of financial security during retirement.
Integrity - defines the requirements that apply to the funded pension plans which normally exist in the private sector.	Based on three broad areas of the pension system, namely regulation and governance, protection and communication for members, and costs.

Melbourne Mercer Global Pension Index in all four aforementioned metrics has a range of values of 0-100. The source for all the data for the analysis is the Australian Centre for Financial Studies.

# Methodology for Indexes: Retirement

Retirement is when a person chooses to leave the workforce. The concept of full retirement as an ability to permanently leave the workforce later in life is relatively new, and for the most part, only culturally widespread in first-world countries. Dramatic advances in healthcare have extended the lives of people in predominantly first-world and developed countries. That means that an increasing number of people are going to become retirees, which will pose a significant burden on the government and the workforce.

For the report, the following metrics were used:

Metric definition	Formula
Global Retirement Index (%)	Based on Health, Material well-being, Quality of life/environment, and Finances in retirement.
Global AgeWatch Index	Based on Income security, Health status, Capability, and Enabling environment .

Global Retirement Index and the Global AgeWatch Index are indicating a good state of retirement in the country when two aforementioned metrics are equal or tend towards the largest possible number on the scale of 0 to 100.

Global Retirement Index value of 0 means that the state of retirement in the country is the lowest possible, and 100 means that the state of retirement in the country is the largest possible. The bigger is the Global AgeWatch Index value, the better the fare older people have in the country.

The source for all the data for the analysis is Naxitis, Global AgeWatch Index.

# Methodology for Indexes: Society

The Human Development Index (HDI) is a summary measure of average achievement in key aspects of human development: a long and healthy life, being knowledgeable and have a decent standard of living. Well-being, population development level, and capabilities should be the ultimate criteria for assessing the development of a country. For the report, the following metrics were used:

Metric definition	Formula
Education Index	Based on Mean Years of Schooling and Expected Years of Schooling.
Democracy Index	Based on the Electoral Process and Pluralism, Civil Liberties, the Functioning of Government, Political Participation, and Political Culture.
Human Development Index (HDI)	Based on Life expectancy at birth, Expected Years of Schooling and Mean Years of Schooling, and GNI (Gross national income) per capita (PPP \$).
Global Gender Gap Index	Based on Economic Participation and Opportunity, Educational Attainment, Health and Survival, and Political Empowerment.
Corruption Perceptions Index 2016	Based on data from 13 different sources, which is rescaled and averaged

Society indexes are indicating a healthy state of society in the country when two aforementioned metrics are equal or tend towards the largest possible number. Education Index, Human Development Index, and the Global Gender Gap Index have a range of values of 0 to 1. Democracy Index has a range of values of 0 to 10.

# Methodology for Indexes: International Health Regulations (2005) Monitoring Framework

International Health Regulations (2005) Monitoring Framework use listed metrics to detect, assess, and respond to public health events in the country and international levels. For each capacity, one to three indicators is used to measure the country's progress towards fully developed and functional IHR capacities.

For the report, the following metrics were used:

Metric definition	Formula
Legislation	Based on the proportion/percentage of a set of specific elements or functions which reflect the level of performance or achievement of Core Capacity 1: National legislation, policy, and financing.
Coordination	Based on the proportion/percentage of a set of specific elements or functions which reflect the level of performance or achievement of Core Capacity 2: Coordination and NFP Communication.
Surveillance	Based on the proportion/percentage of a set of specific elements or functions which reflect the level of performance or achievement of Core Capacity 3: Surveillance.
Response	Based on the proportion/percentage of a set of specific elements or functions which reflect the level of performance or achievement of Core Capacity 4: Response.

# Methodology for Indexes: International Health Regulations (2005) Monitoring Framework

International Health Regulations (2005) Monitoring Framework use listed metrics to detect, assess, and respond to public health events in the country and international levels. For each capacity, one to three indicators is used to measure the country's progress towards fully developed and functional IHR capacities.

For the report, the following metrics were used:

Metric definition	Formula
Preparedness	Based on the proportion/percentage of a set of specific elements or functions which reflect the level of performance or achievement of Core Capacity 5: Preparedness.
Risk Communication	Based on the proportion/percentage of a set of specific elements or functions which reflect the level of performance or achievement of Core Capacity 6: Risk communication.
Human Resources	Based on the proportion/percentage of a set of specific elements or functions which reflect the level of performance or achievement of Core Capacity 7: Human resources.
Laboratory	Based on the proportion/percentage of a set of specific elements or functions which reflect the level of performance or achievement of Core Capacity 8: Laboratory.
Points of Entry	Based on the proportion/percentage of a set of specific elements or functions which reflect the level of performance or achievement of Points of Entry.

# Methodology for Indexes: International Health Regulations (2005) Monitoring Framework

International Health Regulations (2005) Monitoring Framework use listed metrics to detect, assess, and respond to public health events in the country and international levels. For each capacity, one to three indicators is used to measure the country's progress towards fully developed and functional IHR capacities.

For the report, the following metrics were used:

Metric definition	Formula
Zoonosis	Based on the proportion/percentage of a set of specific elements or functions which reflect the level of performance or achievement of IHR Potential hazards 1: Zoonotic events.
Food Safety	Based on the proportion/percentage of a set of specific elements or functions which reflect the level of performance or achievement of IHR Potential hazards 2: Food safety.
Chemical	Based on the proportion/percentage of a set of specific elements or functions which reflect the level of performance or achievement of IHR Potential hazards 3: Chemical events.
Radionuclear	Based on the proportion/percentage of a set of specific elements or functions which reflect the level of performance or achievement of IHR Potential hazards 4: Radionuclear emergencies.

To be regarded as a country with high International Health Regulations (2005) Monitoring Framework Indexes, value of the aforementioned metrics should be equal or tend to the largest possible number on the scale of 0 to 100.

The source for all the data for the analysis is WHO Life tables, World Bank.

# Methodology for Indexes: Economy

The **Inclusive Development Index** (IDI) was submitted in 2017 as part of the World Economic Forum's System Initiative. It is a new, annual economic index that recognizes broad-based and sustained progress in living standards as the key measure for national economic performance, rather than GDP growth alone. A comparison between a country's IDI and GDP rank reveals to what extent economic growth has been inclusive, meaning it is distributed fairly across society and creates opportunities for all. The **Consumer Price Index** (CPI) is a measure that examines the weighted average of prices of a basket of consumer goods and services, such as transportation, food, and medical care. CPI is one of the most common indexes which is used to identify inflation and deflation processes in the country.

For the report, the following metrics were used:

Metric definition	Formula
Inclusive Development Index	Based on Growth and Development, Inclusion, Intergenerational Equity, and Sustainability.
Global Competitiveness Index	Based on 12 pillars of competitiveness, which are grouped into the Basic requirements subindex, Efficiency enhancers subindex, Innovation, and Sophistication factors subindex.
Consumer Price Index	$(\text{Cost of Market Basket in Given Year} / \text{Cost of Market Basket in Base Year}) * 100$

Inclusive Development Index and Global Development Index scores are limited to a scale of 1 to 7, and 1 means the country has the lowest index score, and 7 is the largest score the country can get.

The source for all the data for the analysis is the National Bureaus of Statistics, WEF.

# Methodology for Ratios: Mental Health

Mental health includes emotional, psychological, and social well-being. According to the World Health Organization (WHO), mental health includes "subjective well-being, perceived self-efficacy, autonomy, competence, intergenerational dependence, and self-actualization of one's intellectual and emotional potential, among others."

The WHO further states that the well-being of an individual is encompassed in the realization of their abilities, coping with normal stresses of life, productive work, and contribution to their community. Cultural differences, subjective assessments, and competing professional theories all affect how one defines mental health.

The following Mental Health metrics were used in this report:

Metric definition	Formula
Mental Hospitals (per 100 000 Population)	$\frac{\text{Number of Mental Hospitals} \times \text{Total population}}{100\,000 \text{ population}}$
Mental Health Units in General Hospitals (per 100 000 Population)	$\frac{\text{Number of Mental Health Units in General Hospitals} \times \text{Total population}}{100\,000 \text{ population}}$
Mental Health Outpatient Facilities (per 100 000 Population)	$\frac{\text{Number of Mental Health Outpatient Facilities} \times \text{Total population}}{100\,000 \text{ population}}$

To be regarded as a country with high Mental Health ratios, it should have the maximum values in all aforementioned metrics, e.g. amount of mental hospitals, mental health units in general hospitals and mental health outpatient facilities per 100 000 population should tend towards the largest possible number.

The source for all the data for the analysis is WHO Life tables.

# Methodology for Indexes: Immunization

For the report, the following metrics were used:

Metric definition	Formula
Measles-Containing-Vaccine Second-Dose (MCV2) Immunization Coverage by the Recommended Age (%)	Number of people who have received the second dose of Measles-Containing-Vaccine/ Population (total number)
Neonates Protected at Birth against Neonatal Tetanus (%) - the proportion of neonates in a given year that can be considered as having been protected against tetanus as a result of maternal immunization.	Number of neonates that can be considered as having been protected against tetanus as a result of maternal immunization/ Total number of neonates
Pneumococcal Conjugate Vaccines (PCV3) Immunization Coverage among 1-Year-Olds (%) - the percentage of one-year-olds who have received three doses of pneumococcal conjugate vaccine (PCV3) in a given year.	Number of one-year-olds who have received three doses of pneumococcal conjugate vaccine/ Population aged under 12 months
Polio (Pol3) Immunization Coverage among 1-Year-Olds (%) - the percentage of one-year-olds who have received three doses of polio vaccine in a given year.	Number of one-year-olds who have received three doses of polio vaccine/ Population aged under 12 months
Rotavirus Vaccines Completed Dose (RotaC) Immunization Coverage among 1-Year-Olds (%) - the percentage of surviving infants who received the final recommended dose of rotavirus vaccine, which can be either the 2nd or the 3rd dose depending on the vaccine in a given year.	Number of surviving infants who received the final recommended dose of rotavirus vaccine/ Total number of surviving infants

To be regarded as a country with high Immunization, it should have the maximum possible values in all ten aforementioned metrics, i.e. percentile must be equal or tend to the greatest value of 100%. The source for all the data for the analysis is WHO.

# Methodology for Indexes: Healthcare

Immunization is a proven tool for controlling and eliminating life-threatening infectious diseases and is estimated to avert 2-3 million deaths each year. It is one of the most cost-effective health investments, with proven strategies that make it accessible to even the most hard-to-reach and vulnerable populations. For the report, the following metrics were used:

Metric definition	Formula
BCG Immunization Coverage among 1-Year-Olds (%) - the percentage of one-year-olds who have received 1 dose of bacilli Calmette-Guérin (BCG) vaccine in a given year.	Number of one-year-olds who have received one dose of bacilli Calmette-Guérin/ Population aged under 12 months
Diphtheria Tetanus Toxoid and Pertussis (DTP3) Immunization Coverage among 1-Year-Olds (%) - the percentage of one-year-olds who have received 3 doses of the combined DTP vaccine in a given year.	Number of one-year-olds who have received three doses of the combined diphtheria, tetanus toxoid and pertussis vaccine/ Population aged under 12 months
Hepatitis B (HepB3) Immunization Coverage among 1-Year-Olds (%) - the percentage of one-year-olds who have received 3 doses of hepatitis B vaccine in a given year.	Number of one-year-olds who have received three doses of hepatitis B vaccine/ Population aged under 12 months
Hib (Hib3) Immunization Coverage among 1-Year-Olds (%) - the percentage of one-year-olds who have received 3 doses of Haemophilus influenzae type B vaccine in a given year.	Number of one-year-olds who have received three doses of Haemophilus influenzae type B vaccine/ Population aged under 12 months
Measles-Containing-Vaccine First-Dose (MCV1) Immunization Coverage among 1-Year-Olds (%) - the percentage of children under one year of age who have received at least one dose of measles-containing vaccine in a given year.	Number of one-year-olds who have received at least one dose of measles-containing vaccine/ Population aged under 12 months

# Methodology for Indexes: Economy

The impacts of the economy are measured using the following key indicators: gross domestic product (GDP), worker headcount in the employment pool, and wages and salaries earned workers as a result of the spending of those aged 50 years or older. Therefore, for the report, there were used the following metrics:

Metric definition	Formula
GDP per Capita (Current US\$)	GDP, Current Prices 2016 value/Population (total number)
Adjusted Savings: Net National Savings (% of GNI)	Net savings volume/Gross national income
Unemployment Rate, %	Number of unemployed people/Population (total number)
Net ODA Received (% of GNI)	Net official development assistance volume/Gross national income
% of People 65+ in Employment	Number of employed people of the age group/ Population aged over 65 years
Income Gini Coefficient	$G = 1 - 2 \sum_{i=1}^n x_i cumy_i + \sum_{i=1}^n x_i y_i$ <p>X<sub>i</sub> - share of the group in the population; Y<sub>i</sub> - group share in revenue.</p>

To be regarded as a country with high Economy ratios, GDP per capita and Adjusted savings should tend towards the largest possible value. Net ODA and Unemployment rate should tend towards the lowest possible value. Gini Coefficient should be as close to 0 as possible. The source for all the data for the analysis is WHO, National National Bureaus of Statistics and World Bank.

# Methodology for Ratios: Healthcare

Health spending measures the final consumption of health care goods and services (i.e. current health expenditure) including personal health care (curative care, rehabilitative care, long-term care, ancillary services, and medical goods) and collective services (prevention and public health services as well as health administration), but excluding spending on investments. The following ratio metrics were used in this report:

Metric definition	Formula
Current Health Expenditure per Capita (Current US\$)	Total health expenditure in US\$/Total number of population
Public Health Care Expenditure (as % of GDP)	Total Public Health Care Expenditure/GDP
Domestic Private Health Expenditure (% of Current Health Expenditure)	Total Domestic Private Health Expenditure/Total health expenditure in US\$
Out-of-Pocket Expenditure (% of Current Health Expenditure)	Out-of-Pocket payments volume/Total health expenditure in US\$
Risk of Catastrophic Expenditure for Surgical Care (% of People at Risk)	The proportion of population at risk of catastrophic expenditure (direct out of pocket payments for surgical and anaesthesia care exceeding 10% of total income) when surgical care is required.
Medical Equipment (per 1.000.000 People)	Number of medical devices/1 000 000 population
Biomedical Engineers Density (per 10 000 Population)	Number of biomedical engineers (holding the corresponding university degree) and biomedical technicians/10 000 population

To be regarded as a country with high Healthcare ratios, all aforementioned metrics (besides out-of-pocket expenditures and risks of catastrophic expenditure for surgical care) should have the largest possible values.

# Methodology for Ratios: General Healthcare Status

The prevalence of HIV refers to the percentage of people aged 15-49 who are infected with HIV. HIV prevalence rates reflect the rate of HIV infection in each country's population.

Low national prevalence rates can be misleading, however. They often disguise epidemics that are initially concentrated in certain localities or population groups and threaten to spill over into the wider population. In many developing countries most new infections occur in young adults, with young women especially vulnerable. Tobacco use causes significant economic damage, which, in particular, is expressed in the form of significant health care costs associated with the treatment of diseases caused by tobacco use, as well as in the loss of human capital due to tobacco morbidity and mortality. The following ratio metrics were used in this report:

Metric definition	Formula
Population of Adults with AIDs (% of total) - percentage of population ages 15-49 with HIV .	$N / (\text{defined population}) * 100\%$ , where N - the number of adults with AIDs.
Alcohol Consumption per Capita (litres of pure alcohol) - litres of pure Alcohol are consumed by one person per year.	Total (sum of recorded and unrecorded alcohol, over a calendar year) amount of alcohol / Population 15 and over years old, adjusted for tourist consumption.
Annual Cigarette Consumption (per Capita) - the number of cigarettes that a person consumes per year.	Total (sum of legally-sold machine-made and roll-your-own, over a calendar year) amount of cigarettes/ Population 15 and over years old.

To be regarded as a country with high General Healthcare status basing on population of adults with AIDs, alcohol and cigarette consumption, three aforementioned metrics should have the lowest possible value.

# Methodology for Ratios: General Healthcare Status

One DALY represents the loss of the equivalent of one year of full health. DALYs for a disease or health condition are the sum of the years of life lost due to premature mortality (YLLs) and the years lived with a disability (YLDs) due to prevalent cases of the disease or health condition in a population. Using DALYs, the burden of diseases that cause premature death but little disability (such as drowning or measles) can be compared to that of diseases that do not cause death but do cause disability (such as cataract causing blindness).

Incidence of tuberculosis is the estimated number of new and relapse tuberculosis cases arising in a given year, expressed as the rate per 100,000 population. All forms of TB are included, including cases in people living with HIV. For the report, the following metrics were used:

<b>Metric definition</b>	<b>Formula</b>
Disability-adjusted life years (DALY) Rates per 100 000 Population - years of healthy life lost to premature death and disability per 100 000 Population (2016 - WHO).	$(YLL + YLD)/100\ 000\ Population$ where YLLs - years of life lost due to premature mortality, years of healthy life lost due to disability (YLDs) .
Incidence of tuberculosis (per 100,000 people) - new cases per 100 000 population per year.	$N/100\ 000\ Population,$ where N - the number of new cases.

To be regarded as a country with high General Healthcare status basing on DALY and Incidence of tuberculosis data, both aforementioned metrics should have the lowest possible value. The source for all the data for the analysis is WHO and World Data Bank.

## Methodology for Ratios: General Healthcare Status

Underweight, overweight, and obesity in childhood and adolescence are associated with adverse health consequences throughout the life-course. The given data helps to estimate worldwide trends in mean body-mass index (BMI) and a comprehensive set of BMI categories that cover underweight to obesity in children and adolescents and to compare trends with those of adults.

Population below minimum level of dietary energy consumption (also referred to as the prevalence of undernourishment) shows the percentage of the population whose food intake is insufficient to meet dietary energy requirements continuously. Prevalence of insufficient physical activity among adults aged 18+ years is a percent of defined population attaining less than 150 minutes of moderate-intensity physical activity per week, or less than 75 minutes of vigorous-intensity physical activity per week, or equivalent. Therefore, for the report, there were used the following metrics:

Metric definition	Formula
Prevalence of overweight among adults, BMI $\geq$ 25, percentage of defined population with a body mass index (BMI) of 25 kg/m <sup>2</sup> or higher.	$N/(\text{defined population}) \times 100\%$ , where N - the number of adults with a body mass index (BMI) of 25 kg/m <sup>2</sup> or higher.
Prevalence of undernourishment (% of population), population (in percentage) below minimum level of dietary energy consumption.	$N/(\text{defined population}) \times 100\%$ , where N - the number of persons below minimum level of dietary energy consumption.
Prevalence of insufficient physical activity among adults aged 18+ years (age-standardized estimate).	$N/(\text{defined population}) \times 100\%$ , Where N- the number of adults attaining less than 150 minutes of moderate-intensity physical activity per week.

To be regarded as a country with high General Healthcare status basing on the prevalence of overweight among adults, undernourishment, and insufficient physical activity among adults, three aforementioned metrics should have the lowest possible value. The source for all the data for the analysis is WHO and World Data Bank.

# Methodology for Ratios: Environment and Infrastructure

Global access to safe water and proper hygiene education can reduce illness and death from disease, leading to improved health, poverty reduction, and socio-economic development. However, many countries are challenged to provide these necessities to their populations, leaving people at risk for water, sanitation, and hygiene (WASH)-related diseases.

Improved sanitation facilities include flush/pour flush to piped sewer systems, septic tanks or pit latrines: ventilated improved pit latrines, composting toilets or pit latrines with slabs. Sanitation generally refers to the provision of facilities and services for the safe disposal of human urine and feces. Inadequate sanitation is a major cause of disease worldwide, and improving sanitation is known to have a significant beneficial impact on people's health. Basic and safely managed sanitation services can reduce diarrheal disease, and can significantly lessen the adverse health impacts of other disorders responsible for death and disease among millions of children.

For the report, the following metrics were used:

<b>Metric definition</b>	<b>Formula</b>
Population using improved water sources (%) - percentage of the country population that uses improved water sources.	$N/(\text{country Population}) \times 100\%$ Where N - the number of persons that uses improved water sources.
People using safely managed sanitation services (% of population)	$N/(\text{country Population}) \times 100\%$ Where N - the number of persons that uses managed sanitation services.

To be regarded as a country with wide access to Improved water sources and Safely managed sanitation services, both aforementioned metrics should have the largest possible value.

The source for all the data for the analysis is World Data Bank.

# Methodology for Ratios: Environment and Infrastructure

Ambient air pollution results from emissions from industrial activity, households, cars, and trucks which are complex mixtures of air pollutants, many of which are harmful to health. Of all of these pollutants, fine particulate matter has the greatest effect on human health. The majority of the burden is borne by the populations in low and middle-income countries.

Air pollution consists of many pollutants, among other particulate matter. These particles can penetrate deeply into the respiratory tract and therefore constitute a risk for health by increasing mortality from respiratory infections and diseases, lung cancer, and selected cardiovascular diseases. The mean annual concentration of fine suspended particles of less than 2.5 microns in diameters is a common measure of air pollution. The mean is a population-weighted average for the urban population in a country.

For the report, the following metrics were used:

<b>Metric definition</b>	<b>Formula</b>
Ambient and Household Air Pollution Attributable Death Rate (per 100 000 Population) - the country deaths are summed according to the region of interest and divided by the corresponding regional population.	$N/100\ 000$ Population, N - the number of deaths caused by ambient and household air pollution.
Ambient Air Pollution, Concentration of Fine Particulate Matter PM2.5 ( $\mu\text{g}/\text{M}3$ )	Concentration of Fine Particulate matter PM2.5 measured in 3000 cities ( $\mu\text{g}/\text{m}3$ )

To be regarded as a country with low air pollution, both aforementioned metrics should have the lowest possible value. The source for all the data for the analysis is WHO.

# Methodology for Ratios: Demography

One of the tasks of demography is the development of a demographic policy based on the study of the laws of population reproduction. The demographic policy is a system of measures aimed at bringing the course of demographic processes as close as possible to the optimal one. Since demographic processes influence socio-economic development, in particular, economics, the task is to determine the most favorable (optimal) course of these demographic processes. The policy should influence all demographic processes, not only population changes. It is also important to assess the possible effect of certain measures, as well as their consequences.

For the report, the following metrics were used:

Metric definition	Formula
Murder rates 2016 per 100 000 population	$(\text{Amount of homicides} * \text{Total population}) / 100\ 000$
Population Growth Rate, %	$\text{Ln}(\text{the end period population} / \text{the beginning period population}) / \text{the number of years in between}$
Total Fertility Rate (per Woman)	A measure of the fertility of an imaginary woman who passes through her reproductive life subject to all the age-specific fertility rates for ages 15–49 that were recorded for a given population in a given year.
Crude Birth Rate (per 1 000 People)	$(\text{Number of live births} / \text{Total midyear population}) * 1000$
Crude Death Rate (per 1 000 People)	$(\text{Number of deaths} / \text{Total midyear population}) * 1000$
Population Density, Number of People/km <sup>2</sup>	Population / Area

# Methodology for Ratios: Demography

For the report, the following metrics were used:

Metric definition	Formula
Age Dependency Ratio	$((\text{Percentage of children aged under 15 years} + \text{Percentage of older population aged 65+}) / \text{Percentage of working-age population aged 15-64 years}) * 100$
Total Age Dependency Ratio (per 1000 of Working-Age Population)	$((\text{Percentage of children aged under 15 years} + \text{Percentage of older population aged 65+}) / \text{Percentage of working-age population aged 15-64 years}) * 1000$
Population Over 65 (%)	$\text{Population over 65 years} / \text{Population (total number)}$
Age Dependency Ratio, Old	$(\text{Percentage of older population aged 65+} / \text{Percentage of working-age population aged 15-64 years}) * 1000$
Urban Population (% of Total)	$\text{The numbers of persons residing in an area defined as "urban"} / \text{Population (total number)}$
Senior Poverty Ratio	$\text{Number of senior people whose income falls below the poverty line} / \text{Total number of senior people.}$

To be regarded as a country with high demography ratios, the Senior poverty ratio should be as near to 0 as possible. Age dependency ratios and Crude death rates should tend towards the lowest possible value and crude birth rate - towards the largest.

# Methodology for Growth Rates: Life Expectancy and HALE

Healthy life expectancy (HALE) is a form of health expectancy that applies disability weights to health states to compute the equivalent number of years of good health that a newborn can expect. It adjusts overall life expectancy by the amount of time lived in less than perfect health. This is calculated by subtracting from the life expectancy a figure which is the number of years lived with disability multiplied by weighting to represent the effect of the disability. If: A = years lived healthily, B = years lived with a disability; then  $A+B$  = life expectancy;  $A+fB$  = healthy life expectancy, where f is a weighting to reflect disability level.

For the report, the following metrics were used:

Metric definition	Formula
Both Sexes Life Expectancy, CAGR - an indicator of life expectancy average annual growth over the last 6 years.	$(\text{Life expectancy 2016 value} / \text{Life expectancy 2010 value})^{(1/6)} - 1$ , where 6 is the number of years between the start and finish values.
Male Life Expectancy, CAGR - an indicator of male life expectancy average annual growth over the last 6 years.	$(\text{Male life expectancy 2016 value} / \text{Male life expectancy 2010 value})^{(1/6)} - 1$ , where 6 is the number of years between the start and finish values.
Female Life Expectancy, CAGR - an indicator of female life expectancy average annual growth over the last 6 years.	$(\text{Female life expectancy 2016 value} / \text{Female life expectancy 2010 value})^{(1/6)} - 1$ , where 6 is the number of years between the start and finish values.
Both Sexes HALE CAGR - an indicator of healthy life expectancy average annual growth over the last 6 years. It is a more useful and revealing metric compared with life expectancy CAGR.	$(\text{HALE 2016 value} / \text{HALE 2010 value})^{(1/6)} - 1$ , where 6 is the number of years between the start and finish values.

# Methodology for Growth Rates: Life Expectancy and HALE

Metric definition	Formula
Male HALE CAGR - an indicator of male healthy life expectancy average annual growth over the last 6 years.	$(\text{Male HALE 2016 value} / \text{Male HALE 2010 value})^{(1/6)} - 1$ , where 6 is the number of years between the start and finish values.
Female HALE CAGR - an indicator of female healthy life expectancy average annual growth over the last 6 years.	$(\text{Female HALE 2016 value} / \text{Female HALE 2010 value})^{(1/6)} - 1$ , where 6 is the number of years between the start and finish values.
Both Sexes HALE and Life Expectancy Difference, CAGR - an indicator of years of healthy life lost to disability average annual growth over the last 6 years.	$((\text{HALE 2016 value} - \text{Life expectancy 2016 value}) / (\text{HALE 2010 value} - \text{Life expectancy 2010 value}))^{(1/6)} - 1$ , where 6 is the number of years between the start and finish values.
Male HALE and Life Expectancy Difference, CAGR - an indicator of years of healthy male life lost to disability average annual growth over the last 6 years.	$((\text{Male HALE 2016 value} - \text{Male Life expectancy 2016 value}) / (\text{Male HALE 2010 value} - \text{Male Life expectancy 2010 value}))^{(1/6)} - 1$ , where 6 is the number of years between the start and finish values.
Female HALE and Life Expectancy Difference, CAGR - an indicator of years of healthy female life lost to disability average annual growth over the last 6 years.	$((\text{Female HALE 2016 value} - \text{Female Life expectancy 2016 value}) / (\text{Female HALE 2010 value} - \text{Female Life expectancy 2010 value}))^{(1/6)} - 1$ , where 6 is the number of years between the start and finish values.

To be regarded as a country with high life expectancy and HALE, it should have the maximum possible values in all aforementioned metrics, i.e. both sexes life expectancy, CAGR (6 years) must be greater than zero, HALE CAGR (6 years) must be equal to the greatest possible number, as it is the most important metric in the category.

The source for all the data for the analysis is WHO Life tables, National National Bureaus of Statistics.

# Methodology for Growth Rates: Other

The HDI was created to emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country, not economic growth alone. The HDI can also be used to question national policy choices, asking how two countries with the same level of GNI per capita can end up with different human development outcomes. These contrasts can stimulate debate about government policy priorities.

The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions.

<b>Metric definition</b>	<b>Formula</b>
Human Development Index Score, CAGR - a composite indicator of life expectancy, education, and per capita income average annual growth over the last 6 years.	$(\text{HDI 2016 value} / \text{HDI 2010 value})^{(1/6)} - 1$ , where 6 is the number of years between the start and finish values.

To be regarded as a country with a high Human Development Index, it should have the maximum possible value in the corresponding CAGR (>0). Countries with a high HDI value demonstrate efficient results and achievement in its social and economic dimensions.

The source for all the data for the analysis is Human Development Reports by the United Nations Development Programme.

# Methodology for Growths Rates of Ratios: Economy

**Gross Domestic Product** (GDP) is a broad measurement of a nation's overall economic activity. GDP is the monetary value of all the finished goods and services produced within a country's borders in a specific period. GDP includes all private and public consumption, government outlays, investments, additions to private inventories, paid-in construction costs, and the foreign balance of trade. **Adjusted net saving** is a relatively new measure of economic sustainability. It monitors whether savings and investment in a country compensate for the depreciation and depletion of physical and natural capital and pollution damages. **The Gini coefficient** measures the deviation of the distribution of income among individuals or households within a country from a perfectly equal distribution. A value of 0 represents absolute equality, a value of 100 absolute inequality.

Metric definition	Formula
GDP (per Capita, Current Prices), CAGR	$(\text{GDP per capita, Current Prices 2016 value} / \text{GDP per capita, Current Prices 2010 value})^{1/6} - 1$ , where 6 is the number of years between the start and finish values.
Adjusted Savings: Net National Savings (% of GNI), CAGR	$(\text{Net National Savings 2016 value} / \text{Net National Savings 2010 value})^{1/6} - 1$ , where 6 is the number of years between the start and finish values.
Income Gini Coefficient, CAGR	$(\text{Income Gini Coefficient 2016 value} / \text{Income Gini Coefficient 2010 value})^{1/6} - 1$ , where 6 is the number of years between the start and finish values.

For the country to be considered as a leader in economic development, two of the above metrics (GDP and Net Savings) should have the greatest possible values, i.e. GDP per Capita, Current Prices, CAGR (6 Years) must be greater than zero, as it would indicate the growing average living standards and economic well being. Income Gini Index CAGR inversely affects the income mobility and economic development (indicator should be minimized).

# Methodology for Growths Rates of Ratios: Healthcare Expenditure

Health spending measures the final consumption of health care goods and services (i.e. current health expenditure) including personal health care (curative care, rehabilitative care, long-term care, ancillary services, and medical goods) and collective services (prevention and public health services as well as health administration), but excluding spending on investments.

Metric definition	Formula
Current Health Expenditure per Capita (Current US\$), CAGR	$(\text{Healthcare Expenditure per capita 2016 value} / \text{Healthcare Expenditure per capita 2010 value})^{(1/6)} - 1$ , where 6 is the number of years between the start and finish values.
Public Health Care Expenditure (as % of GDP), CAGR	$(\text{Public Health Care Expenditure 2016 value} / \text{Public Health Care Expenditure 2010 value})^{(1/6)} - 1$ , where 6 is the number of years between the start and finish values.
Domestic Private Health Expenditure (% of Current Health Expenditure), CAGR	$(\text{Domestic Private Health Expenditure 2016 value} / \text{Domestic Private Health Expenditure 2010 value})^{(1/6)} - 1$ , where 6 is the number of years between the start and finish values.
Out-of-Pocket Expenditure (% of Current Health Expenditure), CAGR	$(\text{Out-of-Pocket Expenditure 2016 value} / \text{Out-of-Pocket Expenditure 2010 value})^{(1/6)} - 1$ , where 6 is the number of years between the start and finish values.

To be regarded as a country with high Healthcare Expenditure, all aforementioned metrics should tend towards the largest possible values. The sources for all the data for the analysis are OECD, National National Bureaus of Statistics, World Bank, WHO.

# Methodology for Growths Rates of Ratios: General health State

Measures of general health status provide information on the health of a population. Tracking trends in general health status can help identify where interventions have improved the health of a population or where interventions may be needed (e.g., by exploring causative factors and preventive measures).

Metric definition	Formula
Population of Adults with AIDs (%), CAGR	$(\text{Population of Adults with AIDs 2016 value} / \text{Population of Adults with AIDs 2010 value})^{(1/6)} - 1$ , where 6 is the number of years between the start and finish values.
Alcohol Consumption (per Capita), CAGR	$(\text{Alcohol Consumption per Capita 2016 value} / \text{Alcohol Consumption per Capita 2010 value})^{(1/6)} - 1$ , where 6 is the number of years between the start and finish values.
Prevalence of Overweight among Adults, BMI $\geq$ 25 (Age-Standardized Estimate) (%), CAGR	$(\text{Prevalence of Overweight among Adults Index 2016 value} / \text{Prevalence of Overweight among Adults Index 2010 value})^{(1/6)} - 1$ , where 6 is the number of years between the start and finish values.
Prevalence of Undernourishment (% of Population), CAGR.	$(\text{Prevalence of Undernourishment 2016 value} / \text{Prevalence of Undernourishment 2010 value})^{(1/6)} - 1$ , where 6 is the number of years between the start and finish values.

To be considered a country that provides for the above potential negative results, the above indicators should have the lowest possible value (potentially 0).

The source of all data for analysis is the World Bank, the National Bureau of Statistics.

# Methodology for Growths Rates of Ratios: Environment

Industries, households, cars, and trucks emit complex mixtures of air pollutants, many of which are harmful to health. Of all of these pollutants, fine particulate matter has the greatest effect on human health. Most fine particulate matter comes from fuel combustion, both from mobile sources such as vehicles and from stationary sources such as power plants, industry, households or biomass burning.

Air pollution is associated with a broad spectrum of acute and chronic illness, such as lung cancer, chronic obstructive pulmonary disease (COPD) and cardiovascular diseases. “By reducing particulate matter (PM) pollution from 70 to 20 micrograms per cubic metre ( $\mu\text{g}/\text{m}^3$ ), we can cut air pollution-related deaths by around 15%”, - WHO says. Particulate matter pollution is an environmental health problem that affects people worldwide, but low- and middle-income countries disproportionately experience this burden.

Metric definition	Formula
Ambient Air Pollution, Concentration of Fine Particulate Matter (PM2.5), CAGR	$(\text{Ambient air pollution, concentration of fine particulate matter PM2.5 (ug/m}^3\text{) 2016 value} / \text{Ambient air pollution, concentration of fine particulate matter PM2.5 (ug/m}^3\text{) 2010 value})^{(1/6)} - 1$ , where 6 is the number of years between the start and finish values.

To be considered a country that provides for the above potential negative outcome, the indicator should have the lowest possible value (potentially 0).

The source for all the data for the analysis is WHO.

# Methodology for Effectiveness Ratios

HALE (health-adjusted life expectancy) is a measure of population health that takes into account mortality and morbidity. It adjusts overall life expectancy by the amount of time lived in less than perfect health. It is calculated by subtracting from the life expectancy a figure which is the number of years lived with disability multiplied by weighting to represent the effect of the disability. The comparison of HALE CAGR to the financial indicators CAGR is crucial for understanding what value of health Expenditure is needed for the increase of Healthy Life expectancy. Also, it allows comparing the growth of these two indicators.

Metric definition	Formula
HALE CAGR/Current Health Expenditures per Capita (Current US\$), CAGR	$\frac{((\text{HALE 2016 value}/\text{HALE 2010 value})^{(1/5)}-1)}{((\text{Healthcare Expenditure per capita 2016 value}/\text{Healthcare Expenditure per capita 2010 value})^{(1/5)}-1)}$
HALE and Life Expectancy Difference CAGR/Current Health Expenditures per Capita (Current US\$), CAGR	$\frac{(((\text{HALE 2016 value}-\text{Life expectancy 2016 value})/(\text{HALE 2010 value}-\text{Life expectancy 2010 value}))^{(1/5)}-1)}{((\text{Healthcare Expenditure per capita 2016 value}/\text{Healthcare Expenditure per capita 2010 value})^{(1/5)}-1)}$
HALE CAGR/GDP per Capita CAGR.	$\frac{((\text{HALE 2016 value}/\text{HALE 2010 value})^{(1/5)}-1)}{((\text{GDP per capita, Current Prices 2016 value}/\text{GDP per capita, Current Prices 2010 value})^{(1/5)}-1)}$
HALE CAGR/Prevalence of Overweight among Adults, BMI $\geq$ 25 CAGR	$\frac{((\text{HALE 2016 value}/\text{HALE 2010 value})^{(1/5)}-1)}{((\text{Prevalence of Overweight among Adults Index 2016 value}/\text{Prevalence of Overweight among Adults Index 2010 value})^{(1/5)}-1)}$

To be regarded as a country with high HALE, the aforementioned metrics should have the greatest possible value, i.e. HALE CAGR (5 years)/Health Expenditure per capita (current US\$) should have the highest ratio. Special weighting is given to this metric as it signifies the extent to which increased health is producing longer lives, and it is, therefore, a crucial metric in the ranking of longevity national development plans.



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