Modern Growth Theories
Lecture 2

Dr Wioletta Nowak

- An introduction to modern economic growth
- Measures of economic growth and development

Economic Growth and Development

- **Economic growth** is the increase in the amount of the goods and services produced by an economy over time.
- It implies only an increase in quantitative output.

- **Economic development** is the increase in the standard of living in a nation's population with sustained growth from a simple, low-income economy to a modern, high-income economy.
- It refers to social and technological progress and involves improvements in a variety of indicators such as literacy rates, life expectancy, and poverty rates.

Economic Growth – Measures of Economic Growth

- *National Income and Its Composition, 1919–1938* – published in 1941

- **Gross National Product (GNP)** is the market value of all goods and services produced in one year by labour and property supplied by the residents of a country.

- **Gross Domestic Product (GDP)** is the amount of goods and services produced in a year, in a country. It is the market value of all final goods and services made within the borders of a country in a year.

Simon Kuznets (1901-1985)

1971- Nobel Memorial Prize in Economic Sciences

- Economic growth is measured as the percent rate of increase in real gross domestic product GDP (or GDP per capita).

Rate of economic growth

$$\frac{GDP_1 - GDP_0}{GDP_0}$$

where GDP_1 is GDP in current period,

GDP_0 is GDP in basic period.

Growth Rate and Welfare

Years	Country A	Country B	Country C
	1%	5%	10%
0	100	100	100
10	110.46	162.89	259.37
30	134.78	432.19	1744.94
50	164.46	1146.74	11739.09

GDP per capita and Population (World Total)

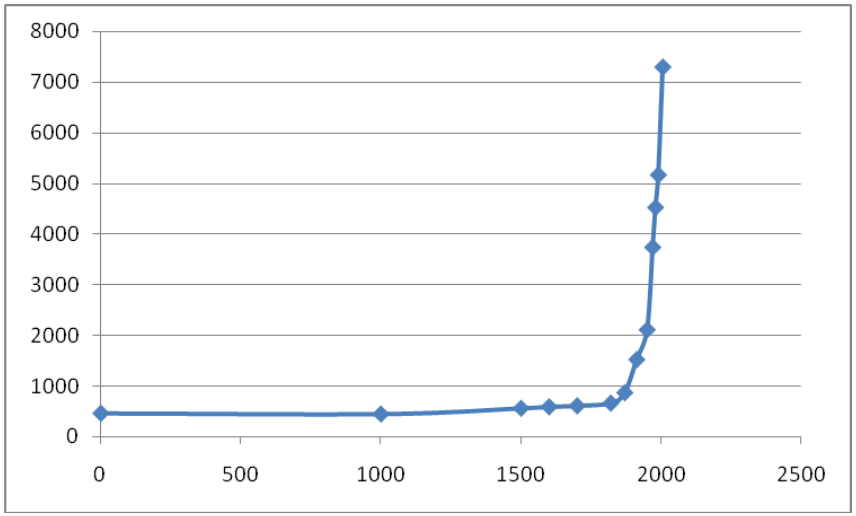
Source: *Statistics on World Population, GDP and Per Capita GDP, 1-2006 AD*, October 2008 (www.ggdc.net/maddison)

Year	GDP per capita (constant 1990 US$)	Population (in thousands)
1	467	225 820
1000	453	267 330
1500	566	438 428
1600	596	556 148
1700	615	603 490
1820	667	1 041 720
1870	873	1 271 916
1913	1 526	1 791 214
1950	2 113	2 525 501
1970	3 736	3 685 775
1980	4 521	4 433 174
1990	5 162	5 256 680
2006	7 285	6 496 812

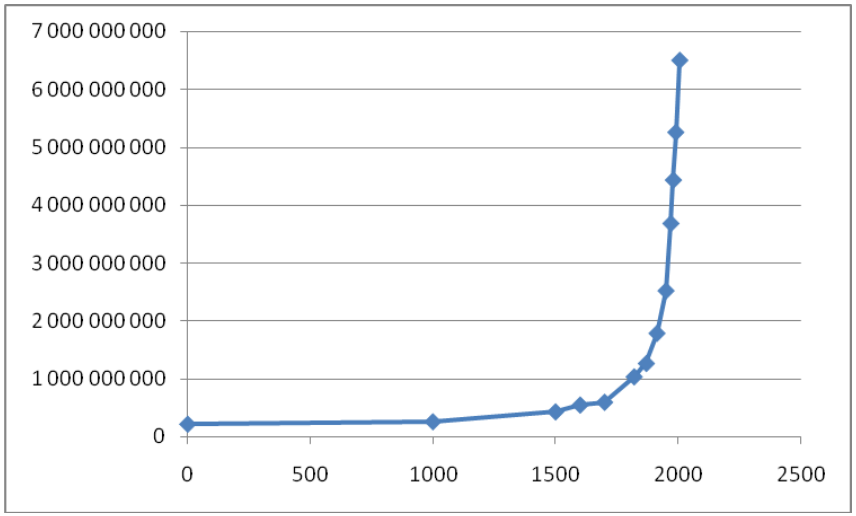
GDP per capita and Population (World Total)

Source: *Statistics on World Population, GDP and Per Capita GDP, 1-2006 AD*, October 2008 (www.ggdc.net/maddison)

GDP per capita (World Total)

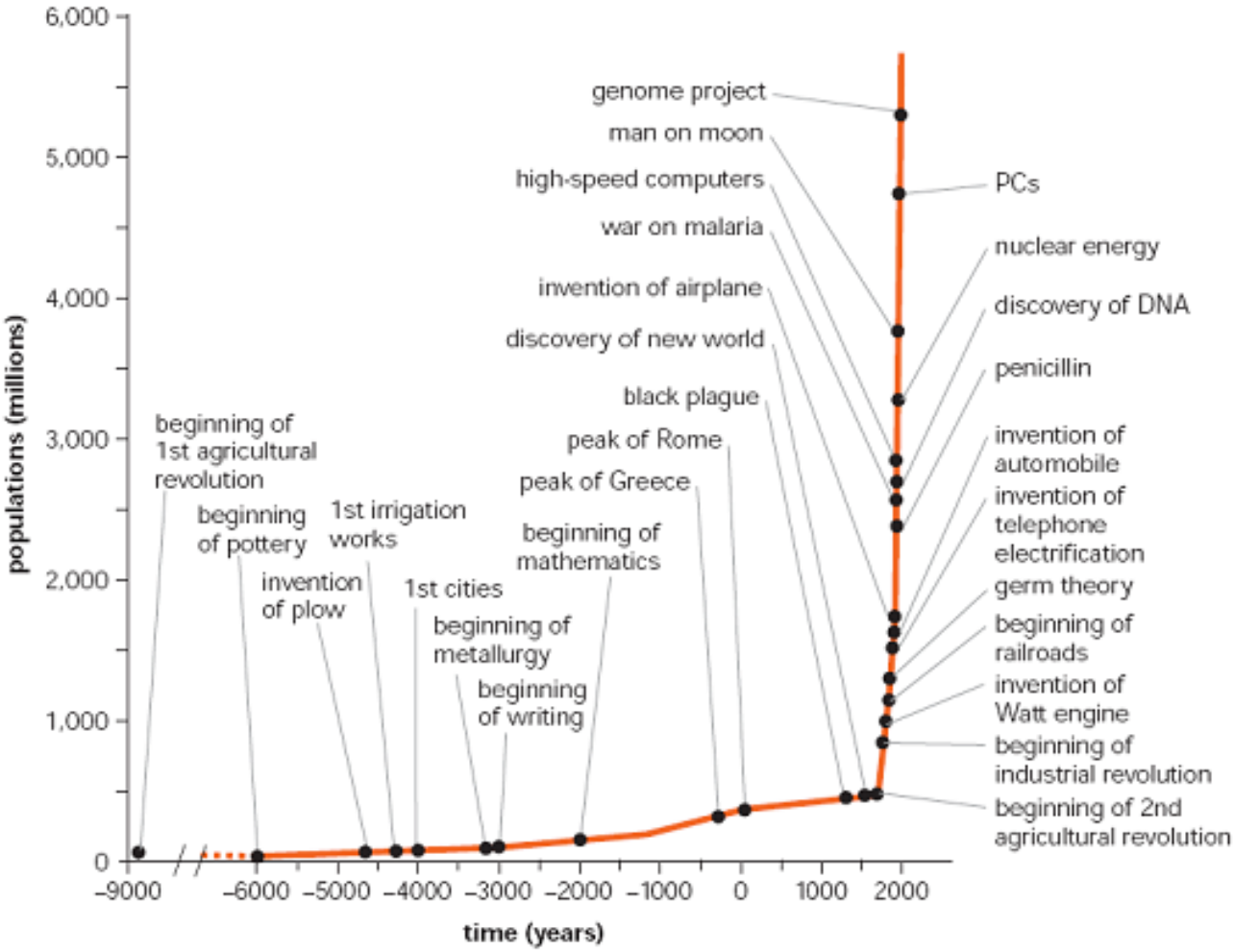


Population (World Total)



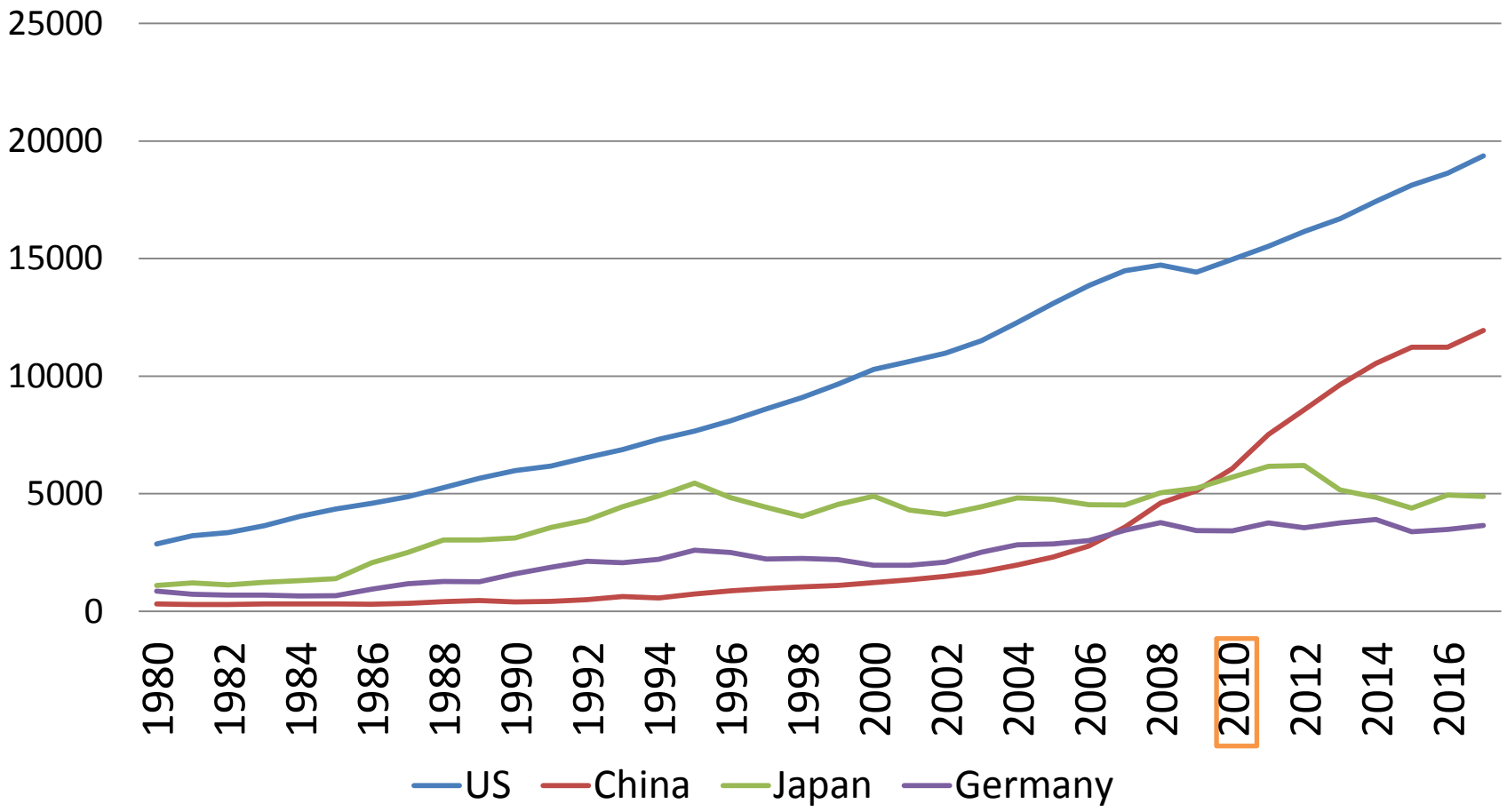
The Growth of the World Population and Some Major Events in the History of Technology

Source: *The Growth Report. Strategies for Sustained Growth and Inclusive Development*, 2008, (www.worldbank.org)



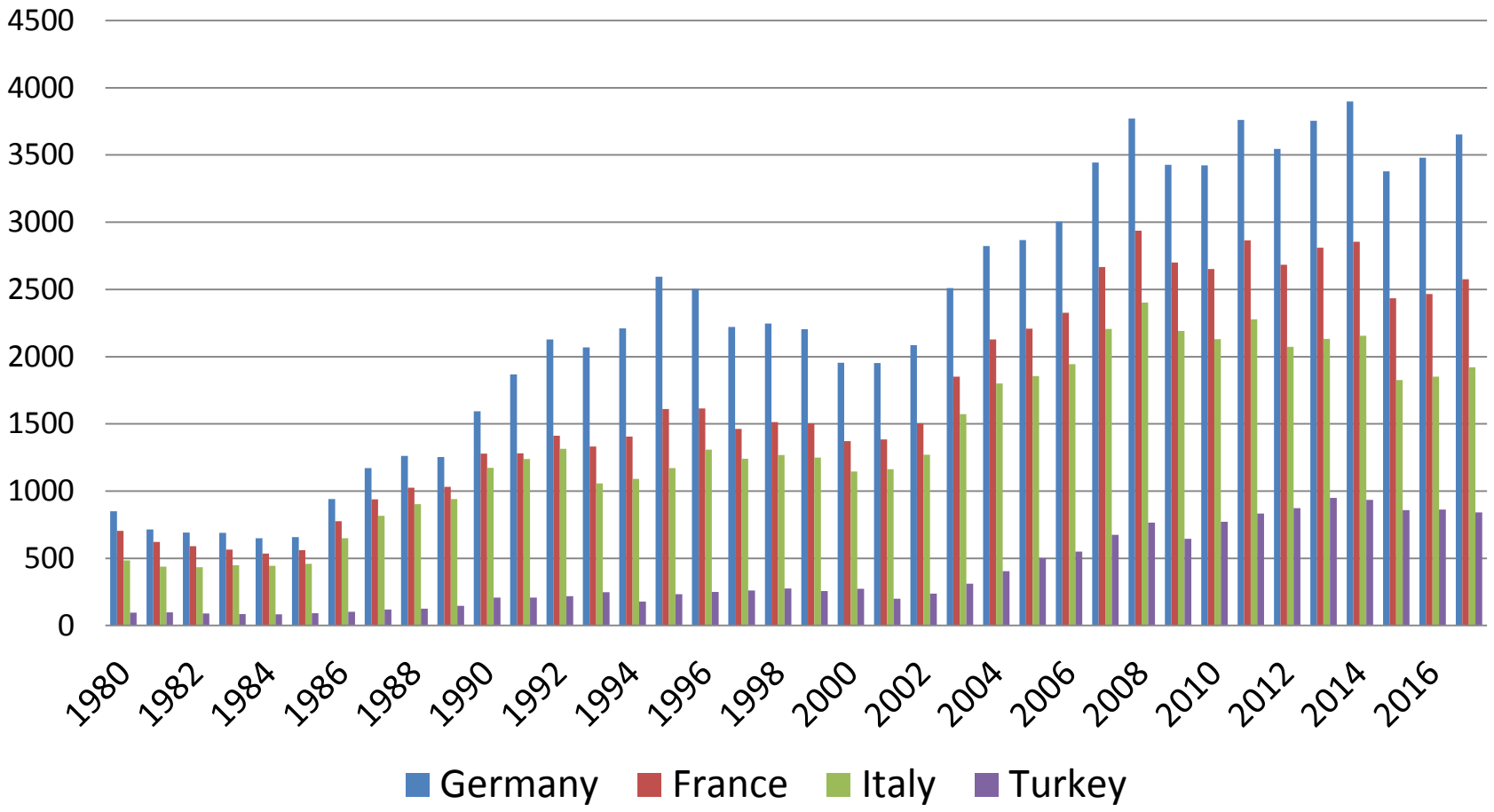
GDP, 1980-2017, (current prices, billions of USD)

Source: http://www.imf.org



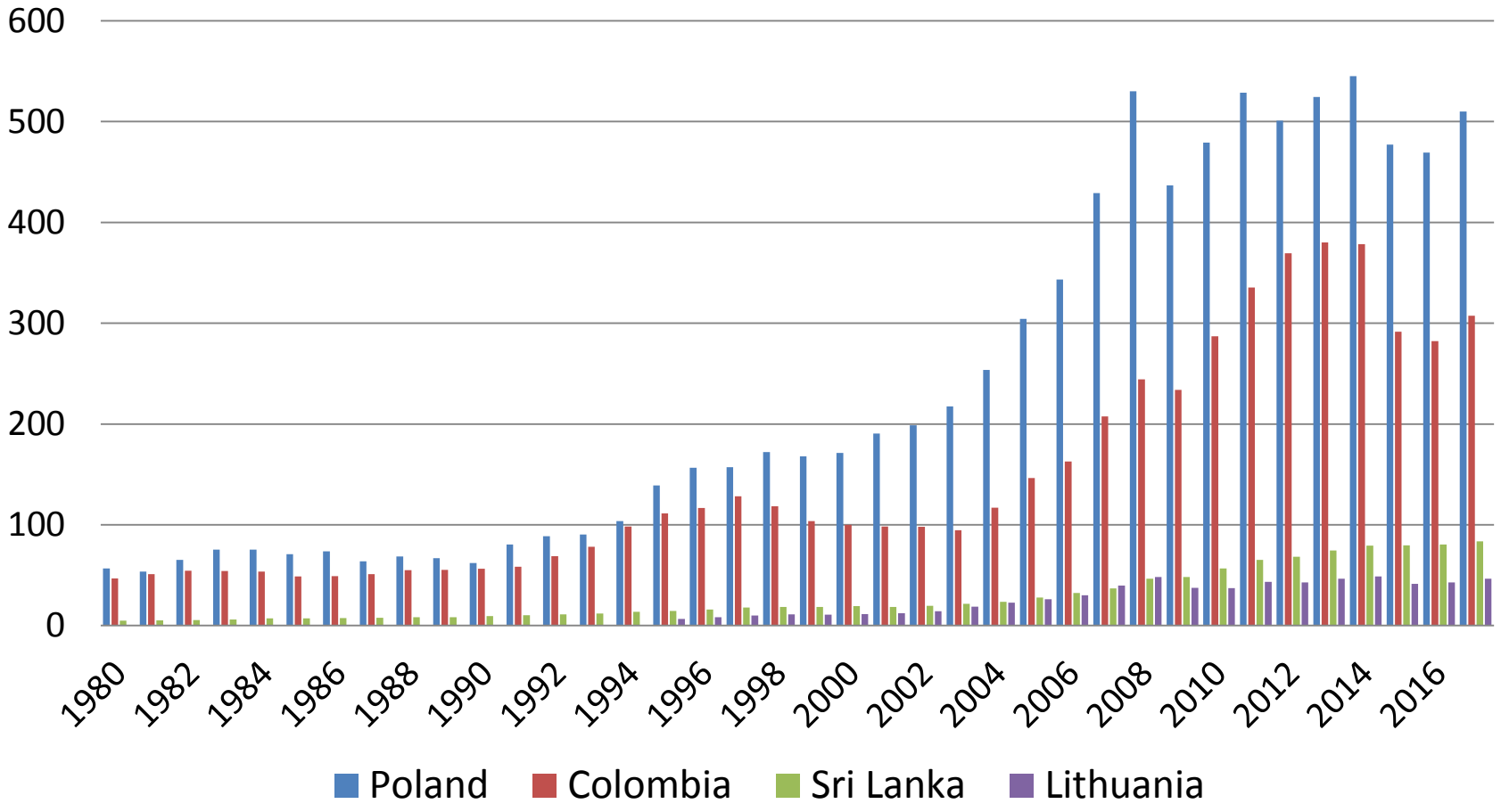
GDP, 1980-2017, (current prices, billions of USD)

Source: http://www.imf.org



GDP, 1980-2017, (current prices, billions of USD)

Source: http://www.imf.org



Why GDP as a measure of happiness and well-being party fails?

- GDP is an average. So even if most people in a country are worse off from one year to the next, GDP may increase if a few people are doing very well.

- GDP does not reflect what money is spent on in society. Simply, the more money is spent, the higher the GDP.

Examples:

- The US spends more money per capita on healthcare than any other developed country, and the quality by any measure longevity, morbidity, etc.) is lower.

- The more people are put in prison and the more prisons are built, the higher the GDP.

Prison population rate (per 100,000 of the national population), 2017

Source: World Prison Population List, 2017

Colombia	244	**Lithuania**	**268**
France	95	**Poland**	191
Germany	78	**Sri Lanka**	92
Italy	86	**Turkey**	220

Why GDP as a measure of happiness and well-being party fails?

- Failure to make qualitative distinctions.
- Failure to value natural, human, and social capital.
- Failure to value free time.
- Failure to value unpaid work.
- Failure to account for equity.

- Human Development Index (HDI)
- Measures of happiness in nations (Average Happiness, Happy Life Years)
- Happy Planet Index
- Gross National Happiness (GNH) – an alternative approach to progress

Human Development Index (HDI)

- The HDI was invented by Mahbub ul Haq and a group of development economists.

- The HDI has been used since 1990 by the United Nations Development Programme for its annual Human Development Reports.

- Mahbub ul Haq (1934-1998)

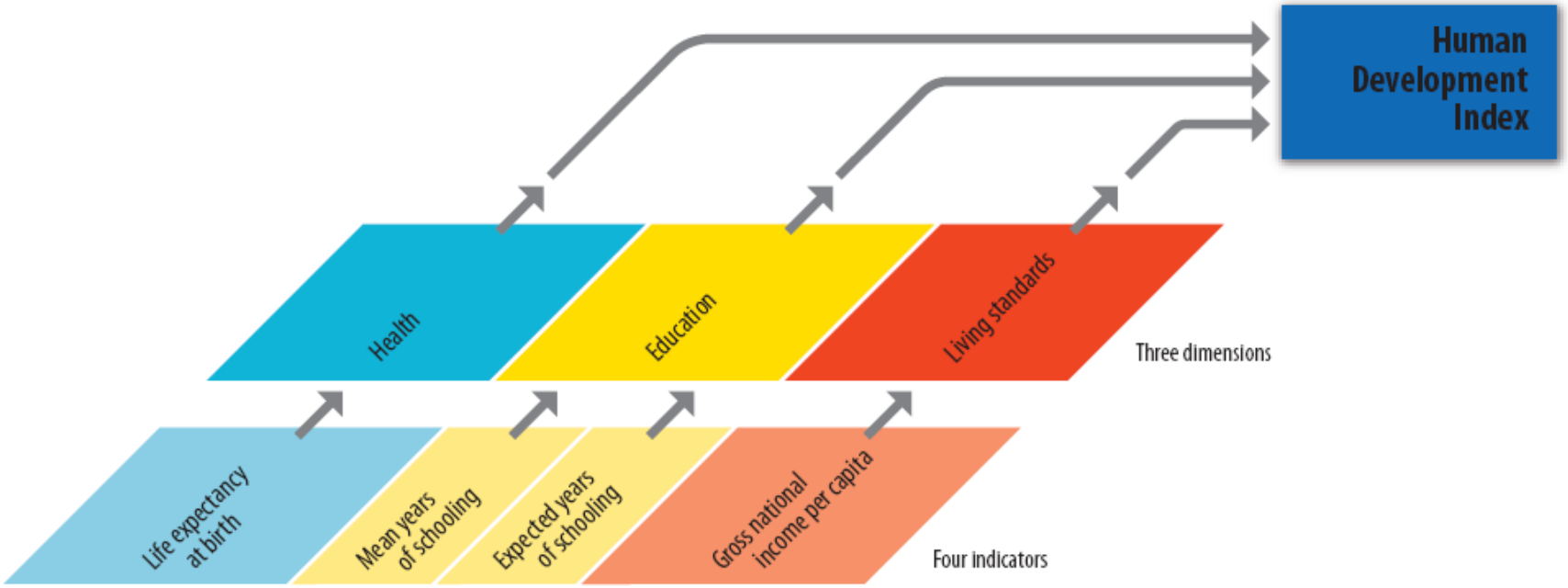
Human Development Index (HDI)

- Starting with the 2010 report HDI combines three dimensions

- A long and healthy life (measured by life expectancy at birth),
- Access to knowledge (measured by two indicators: Mean years of schooling and Expected years of schooling),
- A decent standard of living (measured by the GNI per capita expressed in purchasing power parity (PPP) US dollars).

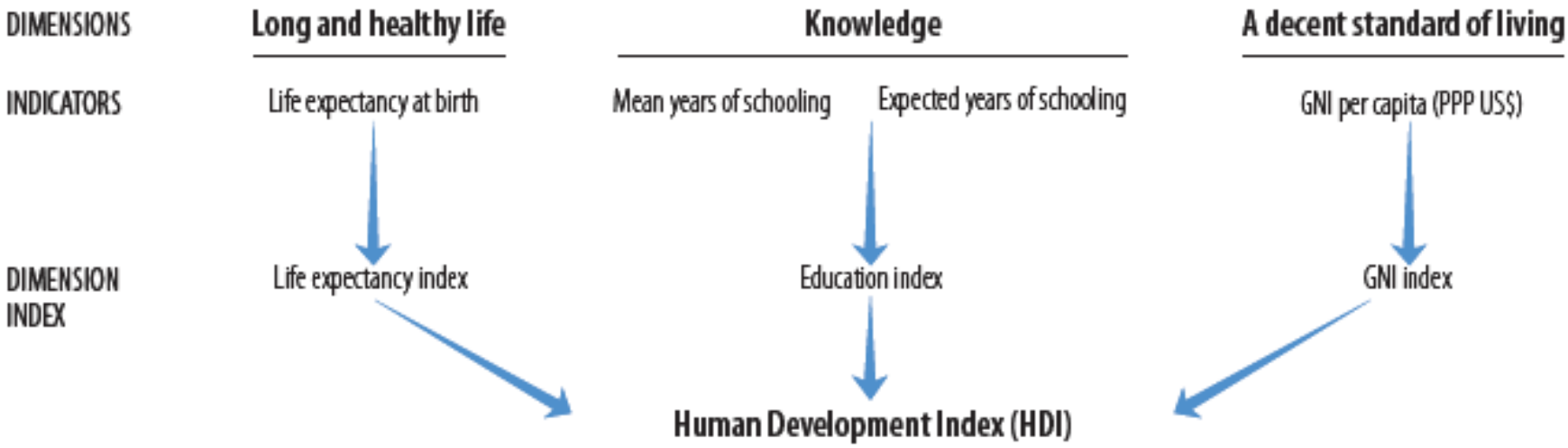
Components of HDI

Source: Human Development Report 2010 (http://hdr.undp.org)



Calculating HDI

Source: Human Development Report 2010 (http://hdr.undp.org)



These three dimensions are standardized to values between 0 and 1, and the geometric mean is taken to arrive at the overall HDI value in the range 0 to 1.

$$\text{Dimension index} = \frac{\text{actual value} - \text{minimum value}}{\text{maximum value} - \text{minimum value}}$$

$$\text{Income index} = \frac{\ln(\text{actual value}) - \ln(\text{minimum value})}{\ln(\text{maximum value}) - \ln(\text{minimum value})}$$

$$\text{HDI} = \sqrt[3]{\textit{Life expectation index} \cdot \textit{Education index} \cdot \textit{Income index}}$$

Goalposts for Calculating the HDI

Source: Human Development Report 2010 (http://hdr.undp.org)

Indicators	Observed maximum	Minimum
Life expectancy at birth	83.2 (Japan, 2010)	20.0
Mean years of schooling	13.2 (United States, 2000)	0
Expected years of schooling	20.6 (Australia, 2002)	0
Combined education index	0.951 (New Zealand, 2010)	0
Per capita income (PPP $)	108,211 (United Arab Emirates, 1980)	163 (Zimbabwe, 2008)

Example: Poland, 2010

Life expectancy at birth	76.0
Mean years of schooling	10.0
Expected years of schooling	15.2
Per capita income (PPP $)	17,803

HDI, Poland, 2010

1.Life expectancy index

$$\frac{76.0-20}{83.2-20}=0.8861$$

2. Education index

$$\frac{\sqrt{0.7576\cdot 0.7379}-0}{0.951-0}=0.7862$$

where:

- Mean years of schooling index $\frac{10.0-0}{13.2-0}=0.7576$
- Expected years of schooling index $\frac{15.2-0}{20.6-0}=0.7379$

3. Income index

$$\frac{\ln(17{,}803)-\ln(163)}{\ln(108{,}211)-\ln(163)}=0.7223$$

$$HDI=\sqrt[3]{0.8861\cdot 0.7862\cdot 0.7223}=0.795$$

HDI, 2015

Source: http://hdrstats.undp.org

Very high human development	0.949-0.800
High human development	0.796-0.701
Medium human development	0.699-0.550
Low human development	0.541-0.352

HDI, 2015

Source: Human Development Report, 2016; http://hdrstats.undp.org

Rank	Country	HDI	Rank	Country	HDI
1	Norway	0.949	**188**	Central African Republic	0.352
2	Australia	0.939	**187**	Niger	0.353
3	Switzerland	0.939	**186**	Chad	0.396
4	Germany	0.926	**185**	Burkina Faso	0.402
5	Denmark	0.925	**184**	Burundi	0.404
6	Singapore	0.925	**183**	Guinea	0.414
7	Netherlands	0.924	**182**	South Sudan	0.418
8	Ireland	0.923	**181**	Mozambique	0.418
9	Iceland	0.921	**180**	Sierra Leone	0.420
10	Canada	0.920	**179**	Eritrea	0.420
11	The US	0.920			

HDI, 2015

Source: Human Development Report, 2016; http://hdrstats.undp.org

Rank	Country	HDI	Rank	Country	HDI
95	**Colombia**	0.727	**37**	**Lithuania**	0.848
21	**France**	0.897	**36**	**Poland**	0.855
4	**Germany**	0.926	**73**	**Sri Lanka**	0.766
26	**Italy**	0.887	**71**	**Turkey**	0.767

Components of HDI, 2015

Source: Human Development Report, 2016; http://hdrstats.undp.org

Country	Life expectancy at birth (years)	Mean years of schooling	Expected years of schooling	Per capita income (constant 2011 US $ PPP)
Colombia	74.2	7.6	13.6	12 762
France	82.4	11.6	16.3	38 085
Germany	81.1	13.2	17.1	45 000
Italy	83.3	10.9	16.3	33 573
Lithuania	73.5	12.7	16.5	26 006
Poland	77.6	11.9	16.4	24 117
Sri Lanka	75.0	10.9	14.0	10 789
Turkey	75.5	7.9	14.6	18 705

World Database of Happiness

- Erasmus University Rotterdam

- Ruut Veenhoven (1942) is director of World Database of Happiness and founding director of the Journal of Happiness Studies

Measures of happiness in nations

Source: http://worlddatabaseofhappiness.eur.nl

Nation	**Average happiness, 2000-2009** Satisfaction with life (scale 0-10)	**Happy Life Years, 2000-2009**
Costa Rica	8.5	66.7
Denmark	8.3	65.0
Iceland	8.2	66.4
Switzerland	8.0	65.2
Togo	2.6	15.1
Tanzania	2.8	14.4
Burundi	2.9	14.3
Benin	3.0	16.7

Measures of happiness in nations

Source: http://worlddatabaseofhappiness

Nation	**Average happiness, 2005-2014** Satisfaction with life (scale 0-10)	**Happy Life Years, 2005-2014**
Colombia	7.9	58.3
France	6.4	52.4
Germany	7.2	58.4
Italy	6.6	54.5
Lithuania	5.8	42.1
Poland	6.8	51.7
Sri Lanka	5.1	37.6
Turkey	6.0	45.1

Happy Planet Index (HPI)

- HPI was introduced by New Economic Foundation in July 2006.
- The HPI reflected the average years of happy life produced by a given society, nation or group of nations, per unit of planetary resources consumed.
- Each country's HPI is a function of its average subjective life satisfaction, life expectancy at birth, and ecological footprint per capita.

Happy Planet Index (HPI)

- Now the HPI is one of the first global measures of sustainable well-being.
- It tells us how well nations are doing in terms of supporting their inhabitants to live good lives now, while ensuring that others can do the same in the future, i.e. sustainable well-being for all.
- HPI calculates the number of Happy Life Years (life expectancy adjusted for experienced well-being) achieved per unit of resource use.

$$\text{Happy Planet Index} \approx \frac{\text{Experienced well-being x Life expectancy}}{\text{Ecological Footprint}}$$

Happy Planet Index (HPI)

- The **ecological footprint** is a measure of human demand on the Earth's ecosystem. It represents the amount of biologically productive land and sea area needed to regenerate the resources a human population consumes and to absorb and render harmless the corresponding waste.
- If every person in the world consumed at the rate of the average Qatari, it would take 11.7 planet earths to sustain that lifestyle.

Source: The Happy Planet Index, 2016 Report

Rank	Happy Planet Index Score	
1	Costa Rica	44,7
2	Mexico	40,7
3	Colombia	40,7
4	Vanuatu	40,6
5	Vietnam	40,3
6	Panama	39,5
7	Nicaragua	38,7
World Average		26,4
138	Togo	13,2
139	Luxembourg	13,2
140	Chad	12,8

Source: The Happy Planet Index, 2016 Report

Rank	Experienced wellbeing	
1	Switzerland	7,8
2	Norway	7,7
3	Iceland	7,6
4	Sweden	7,6
5	Netherlands	7,5
6	Denmark	7,5
7	Finland	7,4
World Average		5,4
138	Syria	3,2
139	Benin	3,2
140	Togo	2,9

Rank	Life expectancy	
1	Hong Kong	83,6
2	Japan	83,2
3	Italy	82,7
4	Switzerland	82,6
5	Iceland	82,2
6	Spain	82,2
7	Australia	82,1
World Average		70,9
138	Sierra Leone	49,8
139	Lesotho	48,9
140	Swaziland	48,9

Source: The Happy Planet Index, 2016 Report

Rank	Ecological Footprint per capita (gHa)	
1	Luxembourg	11,7
2	Australia	10,7
3	Hong Kong	9,7
4	United States of Ame	8,9
5	Canada	8,3
6	Trinidad and Tobago	7,6
7	Oman	7,2
World Average Footprint		**3,3**
World Average Biocapacity		**1,7**
138	Afghanistan	0,8
139	Bangladesh	0,7
140	Haiti	0,6

Happy Planet Index (HPI), 2016

Source: The Happy Planet Index, 2016 Report

Rank	Country	HPI	Rank	Country	HPI
3	Colombia	40.7	**107**	Lithuania	21.0
44	France	30.4	**62**	Poland	27.5
49	Germany	29.8	**28**	Sri Lanka	33.8
60	Italy	28.1	**68**	Turkey	26.4

Gross National Happiness (GNH) – an Alternative Approach to Progress

- The term was coined in 1972 by Jigme Singye Wangchuck, the 4th King of Bhutan.

- *Gross National Happiness is more important than Gross National Product* (Jigme Singye Wangchuck, the 4th King of Bhutan, 1986 Interview with Financial Times).

Gross National Happiness

	Percentage contribution of sufficiency of each domain to overall happiness
Psychological well-being	11.97%
Time-use	10.45%
Community vitality	11.83%
Cultural diversity and resilience	9.91%
Health	14.07%
Education	9.06%
Ecological diversity and resilience	12.11%
Living standard	11.27%
Good governance	9.32%

- Economic growth
- Economic development
- Socio-economic development
- Sustainable development

Sustainable development

Economic sustainability

Sociopolitical sustainability

Environmental sustainability

Sustainable development

- New paradigm (pattern) an alternative to present models for society and economy.

- What is needed is development of new concepts that will mould industrial, social, and environmental interests into an integrated, harmonious system.

Environmental quality and development

Reasons for environmental damage

- Uncontrolled consumption of Earth's natural resources
- Excessive use of non-renewable energy resources

Major visible damages

- Population increase
- Diminishing stock of vital natural resources
- Deforestation leading to ecological imbalances
- Declining biodiversity
- Expanding deserts
- Erosion of soil and its fertility
- Loss of aquatic resources like fish
- Circulation of toxic compounds as a result of pollution across all resources like air, water, soil and food.

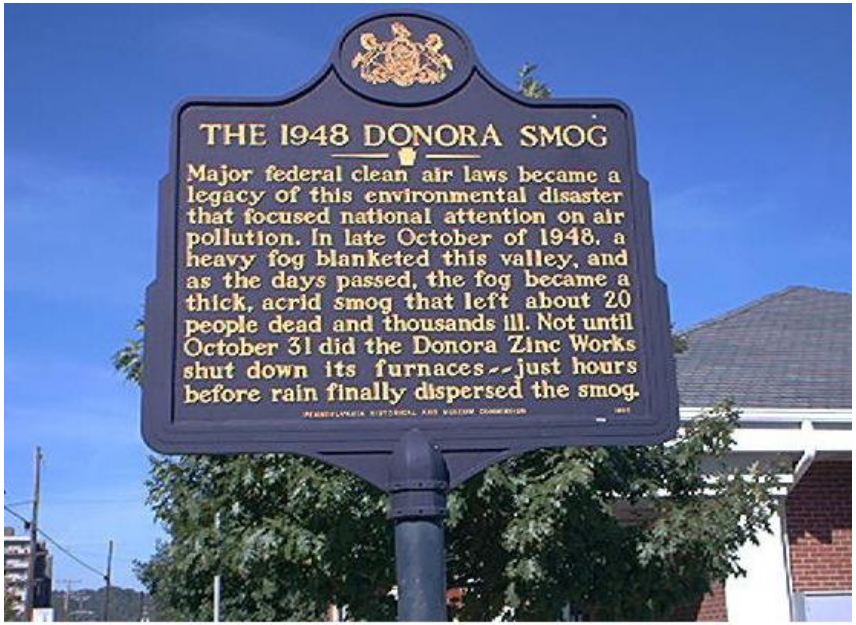
The smog inversion of 1948, Donora, Pennsylvania

- In October, an air inversion prevented industrial plant smoke and fumes from rising into the atmosphere above Donora.
- 27-31 October 1948 – 20 people dead, a third to one half of the town's population of 14, 000 residents had been sickened.
- A federal investigation into the disaster paved the way for *the Clean Air Act of 1963*, and laid the groundwork for the Environmental Protection Agency.
- One of the worst air pollution disasters in US (The New York Times, November 2, 2008).
- October 2008, the Donora Smog Museum.

The smog inversion of 1948, Donora, Pennsylvania

Source: http://www.donorapubliclibrary.org

- Major federal clean air laws became a legacy of this environmental disaster that focused national attention on air pollution. In late October of 1948, a heavy fog blanketed this valley, and as the days passed, the fog became a thick, acrid smog that left about 20 people dead and thousands ill. Not until October 31, did the Donora Zinc Works shut down its furnaces – just hours before rain finally dispersed the smog.



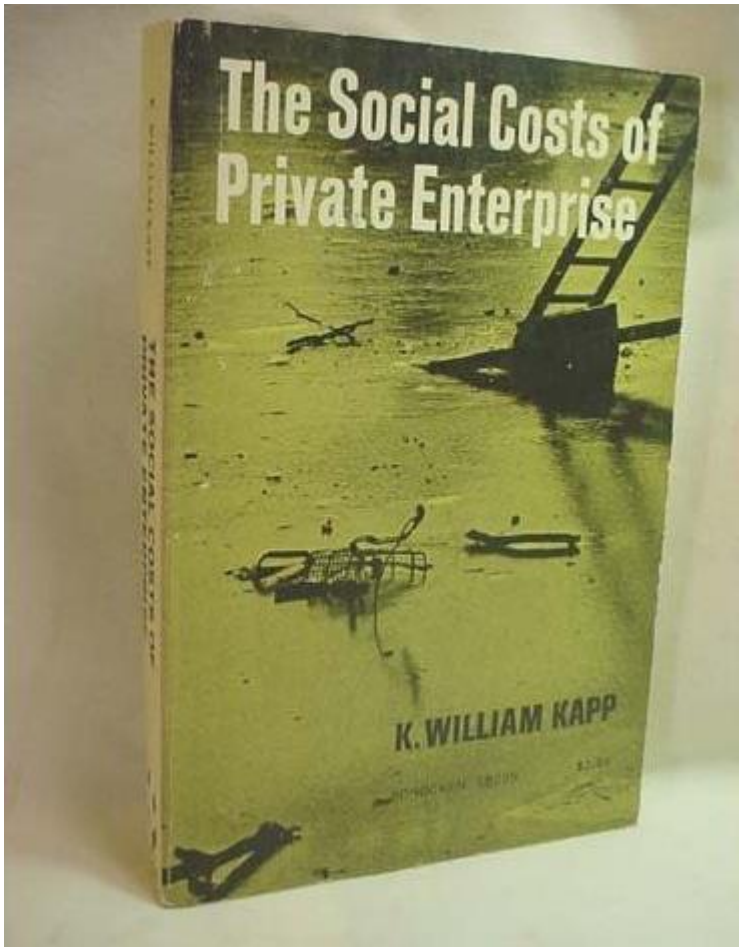
The Great Smog of London, 5-9 December 1952

- Caused by pollution and extreme cold.
- A Ministry of Health report estimated that 4,075 more people had died than would have been expected to under normal conditions and 100,000 more were made ill because of the smog's effects on the human respiratory tract.
- Clean Air Act 1956
- The worst air pollution event in the history of UK

Source: www.museumoflondon.org.uk

Karl William Kapp (1910-1976), ***The Social Costs of Private Enterprise***, Cambridge, Mass.: Harvard University Press,1950

- Kapp – one of the founders of ecological economics.
- Social costs – all direct and indirect losses suffered by third persons or the general public as a result of private economic activities.
- Cases of social costs under conditions of competitive economic life.
- The social costs of ineffective government when environmental or social justice are neglected.



Silent Spring (1962)

- Rachel Carson (1907-1964) an American marine biologist.
- The book documented detrimental effects of pesticides on the environment, particularly on birds.
- *Silent Spring* inspired widespread public concerns with pesticides and pollution of the environment.
- The book facilitated the ban of the synthetic pesticide DDT in 1972 in the United States.

DDT - **d**ichloro**d**iphenyl**t**richloroethane

25 Greatest Science Books of All Time by Discover Magazine, Dec. 2006

1. *The Voyage of the Beagle* by Charles Darwin (1845)
2. *The Origin of Species* by Charles Darwin (1859)
3. *Mathematical Principles of Natural Philosophy* by Isaac Newton (1687)
4. *Dialogue Concerning the Two Chief World Systems* by Galileo Galilei (1632)
5. *On the Revolutions of Heavenly Spheres* by Nicolaus Copernicus (1543)
6. *Physica (Physics)* by Aristotle (circa 330 B.C.)
7. *On the Fabric of the Human Body* by Andreas Vesalius (1543)
8. *Relativity: The Special and General Theory* by Albert Einstein (1916)
9. *The Selfish Gene* by Richard Dawkins (1976)
10. *One Two Three . . . Infinity. Facts and Speculations of Science* by George Gamow (1947)

25 Greatest Science Books of All Time by Discover Magazine, Dec. 2006

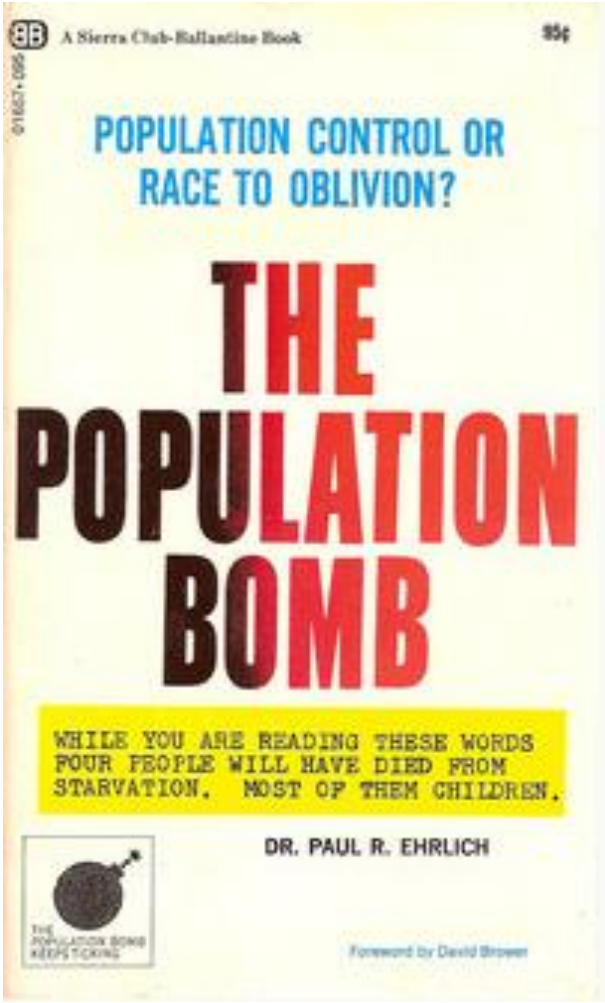
11. *The Double Helix: A Personal Account of the Discovery of the Structure of DNA* by James D. Watson (1968)
12. *What Is Life?* by Erwin Schrödinger (1944)
13. *The Cosmic Connection* by Carl Sagan (1973)
14. *The Insect Societies* by Edward O. Wilson (1971)
15. *The First Three Minutes* by Steven Weinberg (1977)
16. **Silent Spring by Rachel Carson (1962)**
17. *The Mismeasure of Man* by Stephen Jay Gould (1981)
18. *The Man Who Mistook His Wife for a Hat and Other Clinical Tales* by Oliver Sacks (1985)
19. *The Journals of Lewis and Clark* by Meriwether Lewis and William Clark (1814)
20. *The Feynman Lectures on Physics* by Richard P. Feynman (1963)

25 Greatest Science Books of All Time by Discover Magazine, Dec. 2006

21. *Sexual Behavior in the Human Male* by Alfred C. Kinsey et al. (1948)
22. *Gorillas in the Mist* by Dian Fossey (1983)
23. *Under a Lucky Star* by Roy Chapman Andrews (1943)
24. *Micrographia* by Robert Hooke (1665)
25. *Gaia* by James Lovelock (1979)

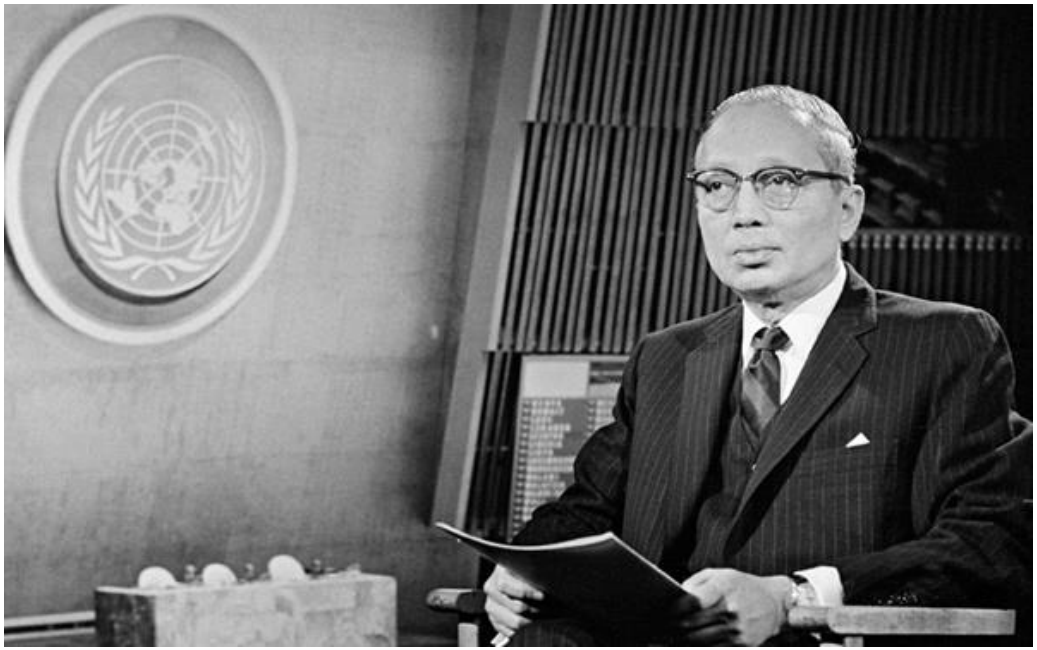
Paul R. Ehrlich (1932-)
The Population Bomb, 1968

- Overpopulation and environment problems.
- The world population under control.
- The growth rate of population should be reducing to zero or be negative.



U Thant's Report – *Problems of the Human Environment* (1969)

- **U Thant (1909-1974)** – the 3rd Secretary-General of the United Nations (1961-1971)



Deterioration of human environment may be related to three basic causes:

accelerated population growth,

increased urbanization,

an expanded and efficient new technology, with their associated increase in demands for space, food and natural resources.

The Club of Rome - *The Limits to Growth* (1972)

The Birth of the Club of Rome

- In April 1968, a small international group of professionals from the fields of diplomacy, industry, academia and civil society met at a villa in Rome.

- Invited by Italian industrialist **Aurelio Peccei** and Scottish scientist **Alexander King**, they came together to discuss the dilemma of prevailing short-term thinking in international affairs and, in particular, the concerns regarding unlimited resource consumption in an increasingly interdependent world.

The Club of Rome

- The Club of Rome is a not-for-profit organisation, independent of any political, ideological or religious interests.

- Its essential mission is *to act as a global catalyst for change through the identification and analysis of the crucial problems facing humanity and the communication of such problems to the most important public and private decision makers as well as to the general public*.

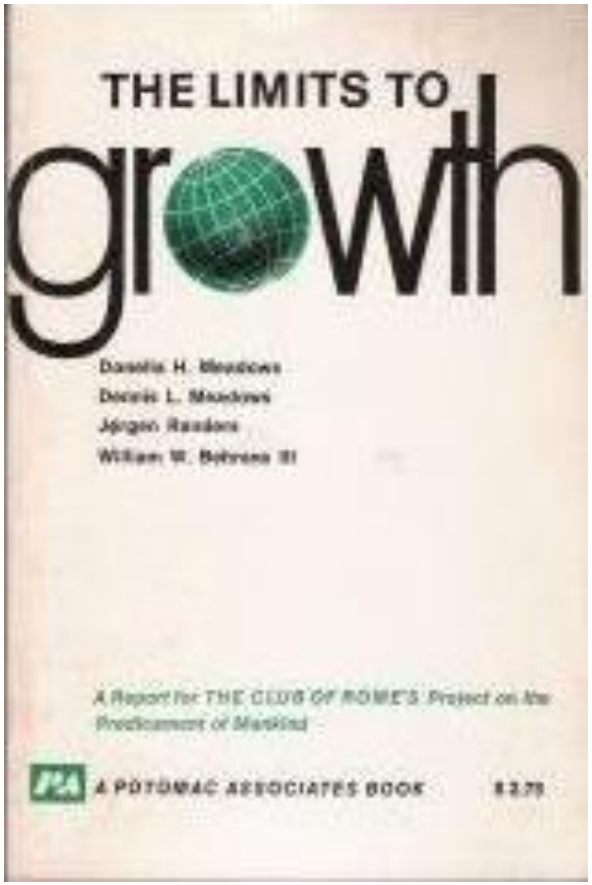
- There can be up to 100 full members of the Club of Rome. Together, they currently represent over 30 countries in five continents.

- Fundamental principles: holistic thinking, taking a global approach, a long-term perspective.

The Limits to Growth (1972) – the First Report of the Club of Rome

- Authors: Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III.

- The book was published in 30 languages and sold over 30 million copies.



The Limits to Growth (1972) – the First Report of the Club of Rome

- Authors used computer modeling to predict the consequences of a rapidly growing world population and finite resource supplies.
- The purpose - to explore how exponential growth interacts with finite resources. A study of the future if present growth continues.
- Five variables: world population, industrialization, pollution, food production and resource depletion.
- Conclusions: Possibly within as little as 70 years, our social and economic system will collapse unless drastic changes are made very soon.

- 1972 – Stockholm Conference – Declaration on the Human Environment
- 1987 – Brundtland Commission – World Commission on Environment and Development: *Our Common Future*
- 1992 – Rio de Janeiro, Brazil – U.N. Conference on Environment & Development
- 2002 – Johanesbourg – Declaration on Sustainable Development

Report of the World Commission on Environment and Development: *Our Common Future* (Brundtland 1987)

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

It contains within it two key concepts:

- the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and
- the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.

1992 United Nations Conference on Environment and Development

- The Rio conference was a significant milestone that set a new agenda for sustainable development.
- Human beings are at the center of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.
- The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.
- In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.