Beyond GDP - Measuring Progress

Inštitúte of Strategy and Analysis, Government Office of the Slovák Republic

June 2016

Gross Domestic Product (GDP) - a figúre reporting the market value of all final goods and Services produced over a certain tíme in a country. As an aggregate measure of production it equals to the sum of the gross values added of all resident institutional units that are engaged in production, i.e. it includes all priváte and public consumption, govemment outlays, investments and exports minus imports (measured in purchasers' prices) (OECD Glossary of Statistical Terms, 2001). GDP is a commonly used measure of a nation's economic productivity, reflecting the value added instead of total value of each transaction (so when a kilogram of Nutella is sold, its total value in purchasing prices minus production costs enter the GDP). Adjusted for inflation, it can be compared over tíme, and adjusted for purchasing power of different currencies, it can be compared across countries.

Broadly speaking, GDP reflects the overall economic activity of a nation. It has been used, however, to evaluate the economic health and collective well-being of a country - a higher overall income is equalized with greater progress and increased well-being. This undifferentiated approach has received a large amount of criticism over the pást decades, but its limits were already pointed out by one of the very designers of the concept. Šimon Abramovich Kuznets elaborates in his speech to the Congress in 1934 that

> 11 "the welfare of a nation can scarcely be inferred from a measure of national income. If the |: GDP is up, why is America down? Distinctions mušt be lcept in mind between quantíty and ¡¡ quality of growth, between costs and retums, and between the short and long run. Goals for J more growth should specify more growth of what and for what" (Kuznets, 1934).

The need for more differentíatíon conceming the type of growth desired has thus been expressed in the very first years of the GDP's prominence and has lead to a number of attempts to develop alternatíve measures, but none of them has come to a comparable acceptance so far (see below for examples). In the following, I will discuss the main weaknesses of the concept of GDP in measuring national wellbeing and progress, and offer some outsight on literatúre on existing alternatíve measures that háve been created so far.

Shortcomings of GDP

Quantity, not quality

One of the main concems in using GDP as an indicator of development is the fact that for GDP, every monetary transaction is assumed to add to national well-being. It does not matter if consumption increases because a heavy storm has destroyed a number of villages that háve to be rebuilt. Súch natural disaster, which decreases wellbeing due to damages of any type (physical, psychological, materiál, social) for the villagers, makes large reconstruction necessary, and all expenses enter the GDP positively. Also, if a shooting rampage in an elementary school increases the number of purchased hand guns in an area, this translates into an increased GDP. By not taking into account the non-monetary costs of súch a tragic event GDP fígures would indicate that a higher fŕequency and intensity of rampages conduce to the wellbeing of a nation, i.e. economic progress. "(■••) [EJxpenditures triggered by crime, accidents, toxic waste contamination, preventable natural disasters, prisons and corporate fraud count the samé as socially productive investments in housing, education, healthcare, sanitation, or mass transportation (Talberth et al. 2006, 2). The figúre does not distinguish between transactions that enhance wellbeing and transactions that diminish it. GDP is a "measure of economic quantity, not economic quality or welfare, let alone social or environmental well-being" (Costanza 2009, 10). Talberth et al. illustratively write about perverse results of GDP as a measurement of overall wellbeing:

> "Consider these: GDP increases with polluting activities and then again with clean-ups. Pollution is a double benefit to the economy since GDP grows when we manufacture toxic 1 Chemicals and again when we are forced to clean them up". (2006, 2)

Put differently, the GDP commits the error to treat all defensive and rehabilitative expenditures as income. Economic activities aiming at the defense of a country's citizens from side-effects of pást and present economic activities are erroneously included (Lawn 2003, 109). Lawn's alternatíve approach leans heavily from the Hicksian definition of income[1] as elaborated below.

No market price - no valne

Further, by sticking to market prices of consumed/produced goods and Services, the measure is unable to capture anything that has no market price. "GDP includes primarily those items that háve readily quantifiable monetary value. This is seen by some as being a very 'objective' measurement, but it really reflects the relative social importance of rebuilding materiál infrastructure after WW II" (Costanza 2009, 26). The whole informal or non-cash economy is ignored (Talberth 2006, 2). "[VJaluable economic activity" súch as elderly čare or child čare that is not carried out by a paid work

[1] "The purpose of income calculations in practical affairs is to give people an indication of the amount which they can consume without impoverishing themselves. Following out this idea, it would seem that we ought to define a man's income as the maximum value which he can consume during a week, and still expect to be as well off at the end of the week as he was at the beginning" (J. Hicks 1939, 172)

force but by a family member does not enter the accounts as added value while commercial Services do. Arguably, excluding súch non-marketed economic activity for the sake of simplicity and precision of the measure, Kuznets again fears misuse of GDP which comes along providing the image of an objective and precise tool: "[w]ith quantitative measurements especially, the definiteness of the result suggests, often misleadingly, a precision and simplicity in the outlines of the object measured. Measurements of national income are subject to this type of illusion" (Kuznets 1934, pp 5-6).

The income of today, not tomorrow

Thirdly, the focus on economic quantity raises the concern that this emphasis "encourages depletion of social and natural Capital and other policies that undermine quality of life for future generations" (Costanza 2009, 10). Just as economic activity that does not také plače on the market, the Services and benefits provided by the world's ecosystem are not considered. Súch Services include biodiversity habitat, reducing flooding from severe storms, filtration to improve water quality in rivers and lakes or the sequestration of carbon dioxide and manufacture of oxygen, as described in Costanza et al. (2009, 9). These benefits are not priced and thus do not enter the equation as costs. This gives incentives to deplete natural resources faster than they are able to renew themselves.

It is worth mentioning here the idea of sustainability was put forward by John Hicks in 1946, who explicitly links today's income with the income of tomorrow. From the perspective of national income, the question mušt be: how múch can be produced and consumed without undermining the capacity to produce and consume the samé amount in the future (J. Hicks 1946)? The aspect of sustainability is taken up by major political institutions and introduced into the policy-making process, as for example the joint attempts of the European Parliament and European Commission illustrate - in their "Beyond GDP" project the weaknesses of the GDP as a measure of progress and wellbeing are recognized and the use of altemative indicators in policy making is promoted. "Although commonly used as an indicator of well-being, GDP is a measure of economic performance reflecting production expressed in monetary terms" (Widuto 2016, 1), conceding that the GDP does not "account for the environmental and social costs of growing production, it does not reflect social inequalities and - even though commonly used as a proxy - it does not necessarily equal the level of well-being" (Widuto 2016, 2). The approach of the Beyond GDP project includes a strong emphasis on the *quality* of growth, recognizing that "growth alone cannot deliver wider benefíts to society due to market failures (súch as income inequalities) and negatíve externalities (súch as pollution)" (Widuto 2016, 2). The linked "Bringing Alternatíve Indicators into Policy" project (BRAINPOol) funded by the European Union offers a well surveyed and categorized overview on existing altemative measures[2] and run interesting čase studies (see Seaford 2013). Having a look at the resulting report is strongly recommended (Hák 2012), it reviews and evaluates indicators and its uses, paying careful attention to the intention of each of the indicator producers and promoters.

[2] Available for download at http://www.brainpoolproject.eu/indicators-and-initiatives/, accessed 25 June 2016

Also the World Bank contributes to the 'Beyond GDP' discussion and comes up with an alternatíve indicator, the Adjusted Net Saving ANS, which is shortly described below as an example for attempts to measure progress beyond GDP.

Income - no matter for whom

Another crucial shortcoming of the Gross Domestic Product is that is totally leaves aside distributional (in-)equality. "If personál consumption expenditure does not change from one year to the next but the distribution of income deteriorates, the economic welfare enjoyed by society as a whole is likely to fall because the marginal benefit uses of the rich is less than the marginal benefit uses of the poor" (Lawn 2003, 112). Lawn suggests to weight personál consumption expenditure according to changes in income distribution in order to reflect its true contribution to a country's economic welfare. Súch adjustment is performed in the Index of Sustainable Economic Welfare (ISEW, see Guenno/Tiezzi 1998) which was further developed as Genuine Progress Indicator (GPI, see Redefining Progress 1995, Talberth et al. 2007).

The threshold ejfect

When attempting to measure the quality of life, the so called threshold effect has been observed (Max-Neef 1995, Talberth et al. 2007). "[Wjhen macroeconomic systems expand beyond a certain size, the additional cost of growth exceeds the flow of additional benefits", Lawn (2003, 105) describes it. At a certain threshold point growing income (higher materiál wellbeing) is levelled out again by non-monetary costs (decreasing overall wellbeing). McKibben (2007) gives an exhausting overview of findings conceming these costs súch as increased income inequality, loss of leisure time, natural Capital depletion, lower community cohesion, and several other dimensions of human happiness, psychic income and social pathologies (suicide, depression, divorce, healthy relationships etc.).

Alternatíve Measures

In response to these shortcomings of GDP as a measurement of progress and wellbeing, several additional tools háve been developed. Costanza et al. (2009, 10) classify four different types of indexes developed:

1. Indexes correcting the existing GDP
2. Indexes measuring aspects of well-being directly
3. Composite indexes combining multiple approaches
4. Indicator suites

Although, as Costanza et al. (2009) state, these measures háve serious deficits as well because they are constructed as abstracted indicators, "some can and are being used to infonn local and regional decisions". This can be already seen and evaluated as an advancement from misusing national income and economic growth figures as a measure of wellbeing (Costanza 2009 et al., 11). At the heart of the debate remains the question whether new approaches should improve, replace or supplement GDP. If

one assumes GDP not to be a true measure of wellbeing at all then it would be only straightforward to erase it completely from the list. It could also be argued that it is more straightforward to continue using GDP but adjust it for assets it does not account for. Goossens, Mäkipää et al. (2007, 60) bring forward the argument that despite being a poor tool, GDP nonetheless fulfills crucial roles in macroeconomic policy, thanks to its simplicity, linearity and universality.

1. Corrected GDP

The fírst type of indexes classified by Costanza et al. (2009) uses Gross Domestic Product as basic foundation and adds or substracts quantities to address identifíed deficiencies of GDP. This indicates that qualitative items súch as environmental depletion háve to be quantifíed. Here it becomes clear already that these alternatíve indexes suffer from the diffículty to monetarize qualitative values (consider air pollution, noise pollution, resource depletion, community cohesion or a society's optimism). Also, the designers of an index háve to decide which items are harmful for and which are contributing to welfare/wellbeing/progress. An example for súch an attempt is the GPI (General Progress Indicator) mentioned earlier in this review. Personál consumption data provides the base from which deductions are made for income inequality, costs of crime, environmental degradation, and loss of leisure. Likewise, additions account for increased wellbeing from Services from consumer durables, the public infrastructure and the gains from volunteering and housework (see Talberth et al., 2007).

Another example is a measure developed by the World Bank which credits wealth and savings as a factor of sustainable development. It strongly refers to the dimension of sustainability of growth, as prominently argued for by the UN World Commission on Environment and Development back in 1987, drawing the picture of a "new era of economic growth, one that mušt be based on policies that sustain and expand the environmental resource base" (UN Brundtland Report 1987). The Adjusted Net Saving indicator (ANS) follows the idea that saving (or changes in wealth) is crucial for sustainability and that wealth is not only the value of produced assets. "It includes natural resources, healthy ecosystems, and human resources" (World Bank 2012, 2; for an exhaustive introduction into the concept see World Bank 2011). It is savings that make wealth growth possible, and they are crucial to sustain or increase wealth levels for future generations. They argue that when assessing the level of sustainable development it is essential to include as well the depletion of natural resources (which is not visible in the conventional national accounts). To adjust for this, the ANS includes the change in value of a specified set of assets, i.e. the "investment/disinvestment in different types of Capital". These types include produced, human and natural Capital (World Bank 2011, 150). To be precise, the designers of the index include public expenditure on education (which is assumed to increase future wealth), depletion of natural resources and further enviromnental damage (both assumed to decrease future wealth). For defmitions and data sources employed see World Bank (2011, 150-56).

2. *Measure wellbeing directly*

The second group of indicators which does not také into account national income at all uses instead direct measures of environmental or social activities, wellbeing, or tracks changes in forms of Capital other than of economic náture (environmental, social, human). As examples can be named the Ecological Footprint developed by the World Wide Fund for Náture (WWF) (see Wackemagel/Rees 1996) or Gross National Flappiness originally developed in Bhutan (see Ura/Galay 2004).

Conceming indexes targeted at subjective wellbeing directly, Costanza et al. (2007, 2009) argue that "objective measures súch as life expectancy, rates of disease and GDP are only proxies for well-being that háve been identifíed through the subjective judgment of decision-makers", so they state that súch distinction between objective and subjective is actually "illusory",

3. *Composite indexes*

The third group of alternatíve measures are composite indexes which attempt to combine several indicators into one single figúre. Probably the most well-known and prominently applied composite index is the Fluman Development Index (HDI). The HDI comprises life expectancy at birth to indicate longevity and other aspects of wellbeing (nutrition, health), literacy rate and school enrollment to account for knowledge levels, and, finally, reál GDP per capita to reflect access to a decent štandard of living. Despite of its frequent use, which might be explained by its linear and outright character similar to the GDP, is has received large amount of criticism. One issue is conceptual: does the HDI really capture the concept of human development? Dasgupta and Weale (1992), for instance, criticize it for ignoring important dimensions súch as political and civil spheres, nor does it include inequality measures (as lamented by Ram 1992). Further methodological concems are raised, criticizing incomplete data, measurement errors, conversion errors and biases (see e.g. Srinivasan 1994, Murray 1993, UNDP 1993). Another crucial problém concems the aggregation procedures and technical limitations (i.e., the weighting and adding up of components, see Desai 1991, Hopkins 1991,). And finally, the HDI is frequently criticized for redundancy: its components (life expectancy, literacy rate, and national income per capita) are highly correlated with each other. "Intuitively, a necessary, although not suffícient, property of a good composite indicator is that its components are themselves insignificantly correlated", McGillivray (1991, 1462) proposes. If that is not the čase then the additional insights of a composite measure háve to be seriously questioned (see amongst others Srinivasan 1994, Cahill 2005, Caplan 2009).

4. *Indicator suites*

The final group of indicator suites report several variables instead of composing many indicators into one index. Súch suites can be applied and interpreted more flexibly by the user. An example is the National Income Satellite Accounts, published jointly by the International Monetary Fund IMF, the Organization of Economic Cooperation and Development OECD, the Statistical Office of the

European Communities Eurostat and the World Bank (see Handbook of National Accounting 2003). Another example are the Calvert-Henderson Quality of Life Indicators, covering 12 areas of wellbeing (see Henderson/Lickerman 2000).

Setting the Goal of the Measure

"Indicators are intended to provide infonnation about a systém—its current condition, how that condition has changed or will change over time, and the condition of and changes in the forces affecting the systém. By **choosing particular indicators, one is also defining what is important— one is defining goals",** Costanza et al. (2009, 23, emphasis added) write. Their simple but important suggestion is: "use the appropriate indicators for the appropriate task" (ibid, 31).

In generating a new index for socioeconomic development we háve to fmd a clear answer to the question: what are the goals of our index? Which purpose is it supposed to save and, especially, whom is it aimed to (researchers/policy-makers/broader public...)?

Also, as has become clear throughout this review, several terms are circulating on what should be measured at all (progress, societal progress, social wellbeing, national wellbeing, development, life quality, social welfare etc.). What do we want to capture when speaking about socioeconomic development? This, again, is closely linked to the intention of the index and mušt be defined carefully.

References

Cahill, M.B., 2005. Is the Human Development Index Redundant? Eastem Economic Journal 31(1), pp. 1-5

Caplan, B., 2009. *Against the Human Development Index,* Library of Economics and Liberty, May 22, http://econlog.econlib.org/archives/2009/05/against_the_hum.html. Accessed 25 June 2016

Commission on Growth and Development. 2008. *The Growth Report: Strategies for Sustained Growth and Inclusive Development.* Washington, DC: World Bank.

Costanza, R., d'Arge, R. et ah, 1997. The value of the world's ecosystem Services and natural Capital. *Náture* 387: 253—260.

Costanza, R., Fisher, B., et al. 2007. Quality of life: An approach integrating opportunities, human needs, and subjective well-being. *Ecological Economics* 61: 267-276.

Daly, H., 1996. *Beyond Growth: The Economics of Sustainable Development.* Beacon Press, Boston.

Daly, H., Cobb, J., 1989. *For the Common Good.* Beacon Press, Boston.

Dasgupta, P., Weale, M., 1992. On measuring the quality of life, *World Development* 20, pp. 119-131.

Desai, M. (1991). Human development. Concepts and measurement, *European economic Review* 35, pp. 350-357.

Doessel, D.P., Gounder, R., 1994, Theory and Measurement of Living Levels: Some Empircal Results for the Human Development Index, *Journal of International Development* 6(4), pp. 415-435.

Guenno, G., Tiezzi, S., 1998. An Index of Sustainable Economic Welfare for Italy. *Working Paper 5/98.* Fondazione Eni Enrico Mattei, Milan.

Goossens, Y., Mäkipää, A. et ah 2007. *Alternatíve Progress Indicators to Gross Domestic Product (GDP) as a Means Towards Sustainable Development.* Brussels: European Parliament, Policy Department Economic and Scientifíc Policy.

Hamilton, C., 1999. The genuine progress indicator: methodological developments and results from Austrália. *Ecological Economics* 30, pp. 13-28.

Hák, T., 2012. *Review report on Beyond GDP indicators: categorisation, intentions and impacts,* BRAINPOoL project.

Henderson, H., Lickerman, J. et ah, 2000. *Calvert-Henderson Ouality ofLife Indicators: A New Tool for Assessing National Trends.* Bethesda, Maryland: Calvert Group.

Hicks, J., 1939. *Value and Capital.* Oxford: Clarendon Press.

Hicks, J., 1946. *Value and Capital, Second Edition.* Oxford: Clarendon Press.

Hicks, D. A., 1997. The Inequality-Adjusted Human Development Index: A Constructive Proposal. *World Development* 25, pp. 1283-1298.

Hicks, N., Streeten, P., 1979. Indicators of Development: The Search for a Basic Needs Yardstick, *World Development* 7, pp. 567-80

Hopkins,M.(1991). Human development revisited: A new UNDP report. *World Development* 19, pp. 1469-1473.

Kuznets, S. 1934. *National Income 1929-1932.* A report to the U.S. Senáte, 73rd Congress, 2nd Session. Washington, DC. US Government Printing Office.

Lawn, P., Sanders, R., 1999. Has Austrália surpassed its optimal macroeconomic scale: finding out with the aid of ‘benefiť and ‘cosť accounts and a sustainable net benefit index. Ecological Economics 28, 213_229.

Max-Neef, M. 1995. Economic growth and quality of life: a threshold hypothesis. *Ecological Economics* 15(2): 115-118.

McGillivray, M., 1991. The Human Development Index: Yet Another Redundant Composite Development Indicator? *World Development* 19, pp. 1461-1468.

McKibben, B. 2007. *Deep Economy: The Wealth of Communities and the Durahle Future.* New York: Time Books.

McGillivray, M. and White, H., 1993. Measuring development? The UNDP's Human Development Index. *Journal of International Development.* 5(2), pp. 183-192.

McGranahan, D., 1995. Measurement of development: Research at the UN’s Research Inštitúte for social development. *International Social Science Journal* 143, pp. 39-57.

Morse, S., 2003. For better or for worse, till the human development index do us part? *Ecological Economics* 45, pp. 281-296.

Murray, J. L., 1993. Development data constraints and the Human Development Index. In: D. G. Westemdorff and D. Ghai (eds), *Monitoring Social Progress in the 1990s,* pp. 40-64.

Nardo, M., Saisana, M., Saltelli, A., Tarantola, S., Hoffman, A., Giovannini, E., 2008. *Handbook on constructing composite indicators: Methodology and user guide.* OECD publishing.

Neumayer, E., 2000. On the methodology of the ISEW, GPI, and related measures: Some constructive suggestions and some doubt on the threshold hypothesis. *Ecological Economics* 34, 347- 361.

Noorbakhsh, F., 1998. A Modified Human Development Index. *World Development* 26, pp. 517-528

Ram, R., 1992. International inequalities in human development and reál income, *Economics Letters* 38 ,pp. 351-354.

Redefming Progress, 1995. *Gross production vs genuine progress. Excerpt from the Genuine Progress Indicator: Summary ofData and Methodology.* Redefming Progress, San Francisco.

Seaford, C., 2013. *Report on residts on action research: barriers to the use of alternatíve (‘Beyond GDP) indicators in policy making and how they are being overcome and can be overcome.* BRAINPOoL project.

Srinivasan, T.N., 1994. *Human development: a new paradigm or reinvention of the wheel?* New Haven, Conn.: Yale University, Economic Growth Center.

Talberth, D. J., C. Cobb, Slattery, N., 2007. *The Genuine Progress Indicator 2006: A Tool for Sustainable Development.* Oakland, Califomia: Redefming Progress.

United Nations Development Programme (UNDP), *2015 Human Development Report 2015.* Human Development Report Office UNDP, New York

United Nations Development Programme (UNDP), *1993 Human Development Report 1993.* Human Development Report Office UNDP, New York

United Nations, European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development and World Bank, 2003. *Handbook of National Accounting - Integrated Environmental and Economic Accounting 2003,* Studies in Methods, Šerieš F(61), Rev.l (Handbook of National Accounting 2003)

Ura, K. and Galay, K. (eds), 2004. *Gross National Happiness and Development.* First International Seminár on Operationalization of Gross National Happiness, Thimphu, Bhutan: The Centre for Bhutan Studies.

Veenhoven, R. 2008. *World Database of Happiness: Continuous Register ofScientific Research on Subjective Appreciation ofLife.* Erasmus University Rotterdam.

Venetoulis, J., Talberth, J., 2006. Refíning the ecological footprint. *Environment, Development, and Sustainability* 10(4), pp. 441-^469.

Wackemagel, M. and W. E. Rees. 1996. *Our Ecological Footprint: Reducing Human Impact on the Earth.* Gabriola Island, BC: New Society Publishers.

Widuto, Agnieszka, *Beyond GDP: Regional development indicators,* European Parliament Briefmg February 2016

World Bank, 2006. *iVhere is the Wealth ofNations? Measuring Capital for the 21stCentury,* Washington, DC: The World Bank.

World Bank, 2011. *The Changing Wealth ofNations: Measuring Sustainable Development in the New Millennium,* Washington, DC: The World Bank.

World Bank, 2012. *Adjusted Net Saving (ANS),* Contribution to Beyond GDP 'Virtual Indicator Expo[r], Environment Department, The World Bank.

World Commission on Environment and Development, 1987. *Our Common Future.* Oxford: Oxford University Press. (UN Brundtland Report 1987)

Appendix 1: List of Alternatíve Measures instead of GDP

author index		covered topics	indicators (if available)	covered periód	subject	comment	aim
United Nations Commission on Sustainable Development	SDI Sustainable Development Indicators						
		Poverty		2001-2007		easy to adjust	influence policymakers, parctitioners and politicians (esp national evel)
		Governance					
		Health					
		Education and Demographics					
		environment (natural hazards, atmosphere, land, oceans, seas and coasts, freshwaterand biodiversity)					
		economics					
		global economic partnership					
		consumption and production patterns					
WWF	Ecological Footprint						
	tracks humanity's competing demands on the biosphere by comparing human	areas required to provide renewable resources ppl use		1996-2010, bianually	ail countries, political groupings		aimed at policymakers, parctitioners and politicians (esp national evel)
		plus areas occupied by infrastructure					
	demand against the regenerative capacity of the planét	plus areas required for absorbing waste					
Eurostat	Sustainability Indicator Set						
		Socio-economic development	GDP growth rate	1990-2011, 2yrs periód		adaptable, standardised štatisti cal	aimed at policy-makers and politicians, provide info to broader public
		Susatinable consumption and production	resource productivity				
		Social inclusion	Risk-of-poverty exclusion				
		Demographic changes	Employment of older workers			quality data	
		Public health	healthy life years, life expectancy				
		Climate change and energy	green house emissions, renewable energy				
		sustainable transport	consuption of transport relative to GDP				
		natural resources	common bird index, fish catches outside safe biological limits				
		global partnership	official development assitance				
		good governance					
Daly/Cobb	ISEW Index of Sustainable EconomicWelfare						
renamed 6PI in 2006, see described in detail below		quality' economic activity: attempt to measure the portion of economic activity whichd elivers genuine increases in our quality of life					
		privāte consumption expenditures	from national accounts				
motivation: account f or current environmental issues as well as long-term sustainable use ofnatural resources and ecosystems (Costanza 2009,12)		adjusted for (multiplied by) income inequality (gini, Atkinson etc.)	e.g. Atkinson index				
		plus value of domestic labor	number of hours worked times shadow price				
		plus non-defensive publicexpenditures					
		minus defensive privāte expenditures					
		plus/minus Capital adjustments					
		minus costs of environmental degradation					
		minus depreciation of natural Capital					
UN Development Programme	HDI Human Development Index						
		standard of living	GDP p.c.	annually	177 countries		
		health	life expectancy at birth				
		education	educational levels (average years of schooling for adults aged 25 years and more, expected years of schooling for children of school				
Lunaria- Sbilanciamoci! campaign	QUARS Regional index on Alternatíve Quality of Life Indicators						
Lunaria is part of the "Project webaxy/item ?100 and the pdfs WEALTH LSED		environment		2003	Italy	potential to be used at Europeanlevel, see factsheet "LUNARIA QUARS" for detailed data	provide indicator framework to reveal regional attributes and disparities
		economy and labour					
		rights and citizenship					
		equal opportunities					
		education and culture					
		health					
		participation					

author	'ndex	covered topics	indicators (if available)	covered periód	subject	comment	aim
Redefining Progress (Talberth, Cobb, Slattery)	Genuine Progress ndicatorGPI						
motivation: extend GDP measure (currentincome) by thesustainability ofthat income, "measuring whether progress is a result ofliving off the interest of community Capital or spending it down " (Costanza 2009,12)		³ersonal Consumption expenditures on goods and Services			US, Finland	method: add up the columns [they all are monetary	
		Income distribution (Gini and IDI, discounting personál consumption)	weighted personál consumption = [personál consumption/income distribution)*100				
		value of household work and parenting	Eisner's estimates based on the Michigan survey data (1985) + Labor Statistics				
see Talberth, Cobb, Slattery 2006, The Genuine Progress Indicator2006		Value of highereducation (benefitsto society)	Moretti (2004): social spillover effect equals $16,000 per year per college-educated worker, multiplied by number of people 25 yrs and older that had completed at least 4yrs of college. Data:US Census Bureau Current Population Surveys.				
		Value of Volunteer Work	Population Surveys: total number of hours volunteered, multiplied by the independent sector estimate of the value of an hour of volunteer time (Independent Sector, 2006)				
		Services of consumer durables (benefit from how long a durable item lasts: benefit from the Services of household capital minus the cost which equals the initial purchase price)	sum of depreciation rate and interest rate of the value of net stock of cars, appliances and furniture at the end of each year, as estimated by Bureau of Economic Analysis, minus actual expenditures on consumer durables (taken from National Income and Product Accounts)				
		Services of Highways and streets	net stock of federal, state and local government streets and highways from 1950 to 2004 * 7,5% (see explanation p.11)				
		Cost of Crime (-)	estimates of these costs by the Bureau of Justice Statistics National Crime Survey + expenditures on crime prevention as estimated by Laband/Sophocleus (1992) and reports issued by Security Distributing and Marketing				
		Loss of Leisure Time (-)	annual working hours in 1969 (year with greatest leisure since 1950, based on annual working hours induding housework of labor force participants, as estimated by Leete-Guy/Schor,1992) minus number of work hours minus 10 daily hours of discretionary time (sleep, maintenance)				
		Cost of Underemployment (-) to workers+families, community and society (chronically underemployed, discouraged, involuntary part time, otherwise constrained)	hours of underemployment, based on Leete-Guy/Schor's estimates on the number of "unprovided hours" of work by constrained workers, times number of estimated constrained or underemployed workers (Economic Policy Inštitúte, Bureau of Labor Statistics) times average reál wage				
		Cost of Commuting (-)	monetary costs of commuting (Statistical Abstract of the US and BEA's National Income and Product Accounts) + nonmonetary costs (time lost): number of people employed * estimated annual number of hours per woker spent on commuting * $8,72 (see p.12). Data: Leete-Guy/Schor 1992 household survey on time use, National Household Transportation Survey.				
		Cost of Household Pollution Abatement ( )	household expenditures on equipment súch as air and water filters, extrapolated and estimated data based on Bureau of Economic Analysis, Vogan 1996.				
		Cost of Automobile Accidents (-)	fatality and injury statistics (Statistical Abstract, National Center for Statistical Analysis)* estimate of their economic losses (National Safety Council)				

author	index	covered topics indicators (if available)		covered period	subject	comment	aim
Redefining Progress (Talberth, Cobb, Slattery)	Genuine Progress Indicator GPI						
motivation: extend GDP measure (current income) by the sustainability of that income, "measuring whether progress is a result of living off the interest of community Capital or spending it down" (Costanza 2009,12)		Costof Water Poliution (-)	damage to water quality, damage from siltation (see fortheirestimation methods based on different literatúre P-13)				
		Costof AirPollution (-)	change in air quality relative to the year of 1970 (estimates based on index of air pollution levels, based on EPA 1998 data) * estimated cost of air pollution in 1970, see p.14				
		Cost of Noise pollution (-)	damage caused by noise pollution in 1972 (estimated $4bln)*annual additional noise polution estimates (I %yearly)				
see Talberth, Cobb, Slattery 2006, The Genuine Progress Indicator 2006		Lost of Wetlands (-)	Assumed baseline of wetland loss prior to 1950 + (annual wetland loss * $914 (value of an acre of wetland, as estimated by Woodward/Wui 2000)). Data: US Fish and Wildlife Service, extrapolated				
		Loss of Farmland (-)	1. Average estimated value per acre for lost ecosystem Services (studies as summarized by Ready et al 1997) * index to inflate/deffate value (due to relative scarcity) * acres lost. 2. Soil depletion, erosion: estimated productivity losses of $.86 per ton of cropland erosion * annual erosion				
		Loss of Primary Forests and Damage from Loggin Roads (-)	1. acres lost (different sources) * $134/acre, as estimated by Costanze et al (1997), 2. total miles of forest roads * estimated cost of damages to forests caused by roads (changes overtime, own estimates)				
		Depletion of Nonrenewable Energy Resources (-)	costs of biomass fuel production (as an estimate of renewable energy replacement costs) *nonrenewable energy consumption				
		Dioxide Emissions Damage (-)	tons of overshoot carbon emitted * $93 (average estimated economic damage as found in Tol 2005, metá analysis of 103 studies)				
		Cost of Ozóne Depletion (-)	U.S. share of cumulative world production of CFCs (Chlorofluorocarbons, cause damage to ozone layer) * $49,669/metrictonne (own estimate)				
		Net Capital Investment (+)	increases in the stock of Capital available per worker = net stock of privaté nonresidential fixed reproducible Capital mínus Capital requirement (amount necessary to maintain the samé level of Capital per worker, equals %change in lavór force * stock of Capital from previous year)				
		Net Foreign Borrowing (+) (measure of the long-term viability of economy: net lender or net borrower?)	Net change in international investment position = annual change of (U.S. investments overseas mínus foreign investments in the U.S.)				

author	index	covered topics	'ndicators (if available)	covered subject periód	comment	aim
Centre for Bhutan Studies, Kahneman	Gross National Hapiness	emotional wellbeing health tíme use and balance education cultural vitality and diversity good governance ecology community vitality standard of living		2005,2007, Bhutan 2	could serve as inspiration for the development of similartools	guide to policy making
World Bank	Adjusted Net Savings ANS (Genuine Saving)	Produced Capital Natural Capital (-) Human Capital (+) (intangible assets)	GDP gross national saving minus consumption of fixed capital =net national saving estimated depletion of natural resouces, estimated damages from carbon dioxide and particulate emissions current public expenditure on education			
Office for National Statistics GB	Measuring National Wellbeing Programme	Personál wellbeing relationships health job satisfaction security issues, housing, community personál finance nationaleconomic performance governance natural environment	*description of their indicators used*	GB		provide politicians with data relating to human wellbeing
Gallup and Healthways	Gallup-Healthways Wellbeing Index	Life Evaluation Emotional Health Physical Health Healthy Behavior Work Environment Basic Access	*deducted by the means of a survey conducted by phone interviews*	2007-2012 US annually		improve policy-making, focusing on a detailed level

WB 2006, Where is the wealth of nations? => increased wealth in a country is primarily the result of an increase in intangible wealth (HC+SC, i.e. formai+informaiinstitutions), see Costanza 14

see World Bank 1997, Expanding the measure of wealth. weak sustainability assumption: the dedine in the value of any asset can be potentially offset by increases in other assets values

for an extensive explanation see World Bank 2011, Thechanging wealth of nations, pp. 150-156. See also World Bank Environment Department 2012, Contribution to Beyond GDP

For Indicator Suites (rather than composite measures) see Costanza et a12009

Appendix 2: List of Available Indicators

							Alternatives				
		Start Year	End Year	coverage	Source	fiteinnw	Source	Unit	Start Year	End Year	
Economic indicators	GDP bi 11 i on €200	1980	2012	nuts3	Cambridge Econometric	GDP-pop-GDPpc					
	population 1000 person	1980	2012	nuts3	Cambridge Econometric	GDP-pop-GDPpc					
	GDP p.c. €2005 per in	1980	2012	nuts3	Cambridge Econometric	GDP-pop-GDPpc	Eurostat	millionC, €p	2000	2014	nuts2 GDP
	GVA, total + by sectors million €20C	1980	2012	nuts3	Cambridge Econometric	GVA	Eurostat	million €	2000	2014	nuts2
GVA peremployed person, total -thousand €2 Hours worked, total + by sectors million hou		1980	2012	nuts3	Cambridge Econometric	GVApc					
Labor productivity, total + by sect thousand €2		1980	2012	nuts2	Cambridge Econometric	NUTS2+Hours+Worked					
	Gross fixed Capital formation, tot million €20 GFCF share of GDP, total + by sect	1980	2012	nuts2	Cambridge Econometric	Labor Productivity					
	Employment, total + by sectors 1000 person	1980	2012	nuts2	Cambridge Econometric	NUTS2+Gross+Fixed+Cap N UTS 2+Gross+Fal+Formation	Eurostat	million €	2000	2012	nuts2 Gross Fixed Capital formation by sectors
	Youth employment % of corresp	1980	2012	nuts2	Cambridge Econometric	NUTS2+Employment	Eurostat	1000 person	2000	2014	nuts3 employment by sectors
	Compensation of employees €200Sm	1999	2015	nuts2	Eurostat	yth employment					
	Unemployment rates, total + by s %	1980	2012	nuts2	Cambridge Econometric	NUTS2+Compensation+of+employees					
	Long term unemployment thousand pe	1999	2015	nuts2	Eurostat	unemprates					
	Youth unemployment rate ;%ofcorresp	1999	2015	nuts2	Eurostat	LTunemp					
	Youth longterm unemployment % of corresp	1999	2015	nuts2	Eurostat	yth unemployment					
		1999	2015	nuts2	Eurostat	yth LT unemp					
Socio economic indicators	Gini index (atdisposable income,[0-I]	2010,2011		nuts2	OECD	income_distribution					
	Quintile share ratio (S80/S20) for ratio betwe	2013,201		nuts3	OECD	income_distribution					
	Disposable household income, Resula	2000	2013	nuts2	Eurostat	hhincome					
	Severe material deprivation rate % of popula	2003	2015	nuts2	Eurostat	severe materiál deprivation					
	Risk of poverty orsodal exclusior% of popula	2003	2015	nuts2	Eurostat	povertyrisk-sodal-exclusion					
	household with very low work in|% of popula	2003	2015	nuts2	Eurostat	hhold low work intensitv					
	Secondary distribution of househ million €	2000	2014	nuts2	Eurostat	2ndary hhincome distribution					
	rooms per person average	2003	2015	nuts2	Eurostat	no rooms					
	family type and size persons	2011	2011	nuts3	Eurostat	family type+size 2011					
	Housing arrangements persons	2011	2011	nuts2	Eurostat	Housing arrangement 2011					
	Maritial status, by category persons	2011	2011	nuts2	Eurostat	Maritial status 2011					
	Elderiy population %shareofp	1990	2012	nuts3	OECD	elderiy_pop					
	Privâte vehicles rate per 1000 inh	1990	2012	nuts2	OECD	safety ind					
Health indicators	Infant mortality rate ratio oftota	1990	2014	nuts2	Eurostat	infantmortality rate	OECD	Deaths per 1	1990	2013	nuts2 mortality-lifeexp
	Life expectancy at birth years	1990	2014	nuts2	Eurostat	lifeexpectancy	OECD	years	1990	2014	nuts2 mortality-lifeexp
	Death rate, total + by causes (e.g. crude death	1994	2010	nuts2	Eurostat	death_rates+causes					
	Youth death rate crude death	1990	2014	nuts2	OECD						
	Peri-neonatal mortality (late foet number	2013	2013	nuts2	Eurostat	peri-neonatal mortality					
	Physicians rate per 1000 inh	1990	2012	nuts2	OECD	safety ind					
Innovation	EPO patent applications number	1977	2012	nuts3(M)	Eurostat	Patent applications by metropoiitan regions(N3)					
—	EPO patent applications per million	1990	2012	nuts3(M)	Eurostat	nuts3(M) Patent_applications_by_metropoi n regions(N3)					
	Biotechonologic EPO patent appli number	1977	2012		Eurostat	it biotech patent applications by tropolitan regions(N3)					
	Biotechonologic EPO patent appli per million	1990	2012	nuts3(M)	Eurostat	biotech patent applications by metropoiitan regions(N3					
	Hi-tech EPO patent applications number	1977	2012	nuts3(M)	Eurostat	hitech patent applications by metropoiitan regions(N3)					
	Hi-tech EPO patent applications per million	1990	2012	nuts3(M)	Eurostat	hitech patent applications by metropoiitan regions(N3)					
	EU trade mark applications numberf, n	1996	2015	nuts2	Eurostat	EU trade mark applications					
	Human resources in Science &tec 1000 person	1999	2014	nuts2	Eurostat	HRST Human resources Science techn					
	Job vacancy rate number of j	2008	2015	nuts2	Eurostat	job vacancies					
Education	R&D expenditure, total + by sectcC per inhabi R&Dpersonell i%ofemplo	1990 2000	2013	nuts2	Eurostat	R&D_expenditure					
			2013	nuts2	Eurostat	R&D_personnel					
	students, total-f by sex number, sh	1998	2012	nuts2	Eurostat	no+share of students					
	students by educational level number	2013	2014	nuts2	Eurostat	no students by educational level					
	students aged 15-24: participatior % of corres	2001	2012	nuts2	Eurostat	EducParticipationRate					
	students aged 25-64: participatioi % of corres	2001	2012	nuts2	Eurostat	EducParticipationRate					
	NEET rate (young people neither % of	2000	2015	nuts2	Eurostat	youngppl					
Structural Business Statist 17 year old students % of corres		1998	2012	nuts2	Eurostat	17yrstudentshare					
Business demography	15-64 aged population by educati %	1992	2015	nuts2	Eurostat	educ levels					
	active enterprises in t number	2008	2013	nuts2	Eurostat	Business demography					
	persons employed in active entei number	2008	2013	nuts2	Eurostat	Business demography					
	enterprises newly born in t-3 hav	2008	2013	nuts2	Eurostat	Business demography					
	net business population growth %change	2008(201	2013	nuts2	Eurostat	Business demography					
	death rate %share of a	2008 (201	2013 (201	nuts3	Eurostat	Business demography					
	business churn (death rate +	2008(201	2012	nuts2	Eurostat	Business demography					
	share of 3yéar old enterprises %	2008(201 1	2013	nuts2	Eurostat	Business demography					
	local units, by sectors number	1995	2007	nuts2	Eurostat	SBS nuts2006					
	people employed number	1995	2007	nuts2	Eurostat	SBS_nuts2006					
	wages and salaries ?	1995	2007	nuts2	Eurostat	SBS nuts2006					
	employment growth %change	1995	2007	nuts2	Eurostat	SBS nuts2006					
	gross investment in tangible goot ?	1995	2007	nuts2	Eurostat	SBS nuts2006					
	investment per person employec ?	1995	2007	nuts2	Eurostat	SBS nuts2006					
	local units, by sectors number	2008	2013	nuts2	Eurostat	SBS					
	people employed number	2008	2013	nuts2	Eurostat	SBS					
	wages and salaries ?	2008	2013	nuts2	Eurostat	SBS					
	employment growth %change	2008	2013	nuts2	Eurostat	SBS					
Safety indicators	Intentional homicide rate numberper	1990	2012	nuts2	OECD	safety ind	Eurostat	Recorded	2008	2010	nuts2 crimes
	Mortality rate dueto transport ac number per	1990	2011								
	Motorvehicule theft rate numberper	1990	2012								
	victims in road accidents, killed + persons, pe	1990	2014	nuts2	Eurostat	road acddents victims					
Environmental indicators	C02emissions percapita kg per inhat	2005, 2008	2005, 200	nuts2	OECD	safety ind					
	C02 emissions per capita from en tonnes per	2005, 2008	2005, 200		OECD	safety ind					
	C02 emissions per capita from tri tonnes per	2005, 2008	2005, 200		OECD	safety ind					
	Population exposed to particules persons	2010	2010	nuts2	OECD	safety ind					
	Volume of municipal waste kgpercapit	1994	2011	nuts2	OECD	safety ind	Eurostat	kg per inhab	2000	2012	nuts2 municipal waste_p.c.
Amenities	population connected to publicw%	2005	2013	nuts2	Eurostat	access_publicwatersupply					
	Population connected to wastewate%	2000	2013	nuts2	Eurostat	access_wastewatercoll					
	Air transport of freight lOOOt	1993	2013	nuts2	Eurostat	ed air transport freight					
	Airtransport of passengers lOOOpassen	1993	2013	nuts2	Eurostat	air					
	Maritime transport of freight lOOOt	1997	2013			maritime transport freight					
	Maritime transport of passengers 1000 passen	1997	2013	nuts2	Eurostat	maritime transport passengers					1
	Households with broadband acce % of househ	2006	2015	nuts2	Eurostat	broadband_access					
	Publictransport millionsoff	2000	2013	nuts2	Eurostat	transport_passengerkm					
	Navigable canals km	1990	2014	nuts2	Eurostat	transportation networks					
	Motorways km, km per	1990	2014	nuts2	Eurostat	transportation networks					
	Otherroads km	1990	2014	nuts2	Eurostat	transportation networks					
	railway lines km, km per	1990	2014		Eurostat						
	Stock of passengercars per 1000 inh	1990	2014	nuts2	Eurostat	passengercars					
Other indicators	new residents in the región comi persons	1982	2012	nuts2	OECD	intrareg_migration					
	persons who left the región to re: persons	1982	2012	nuts3	OECD	intrareg_migration					