Chapter 3: Typology of indicators

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3.1 Introduction

Indicators are used in many areas of economic, social and environmental statistics as a useful way to summarise and present information. In many cases, a variety of different types of indicators can be applied, ranging from simple, single-variable indicators to more complex composite indicators that bring together information from a number of different sources or areas into one common measure. Some indicators are "leading" and aim to predict the development of a certain phenomenon, such as economic growth; some indicators will be coincident or lagging compared to the phenomena that they try to estimate. The existing definitions and terms have been developed over time for different uses. The definitions of composite indicators and sentiment indicators are not always understood in the same way. Furthermore, the indicators themselves may be based on different methods.

Before discussing the types of indicators covered by these recommendations, it is helpful to have a common understanding of the term *indicator*. The term is used in a number of domains and can have quite different meanings. For the purposes of these recommendations, the term indicator is defined as "*a summary measure related to a key issue or phenomenon and derived from a series of observed facts or reported perceptions, attitudes or expectations.*" This definition is similar to the definition used by Eurostat (2014) but has been expanded to explicitly include sentiment indicators. In this definition, series refers to any collection of data, not necessarily a time series. An indicator may be any summary measure of the data – a mean, count, percentage, etc. National Statistical Offices (NSOs) produce a large variety of indicators, but only some of these are covered by these recommendations. These recommendations cover sentiment indicators and composite indicators. Special attention is paid to sentiment and composite indicators that exhibit leading properties. Most traditional statistics, such as the gross domestic product and the consumer price index, are not included in the scope of these recommendations because they do not fall into these categories as defined below. Furthermore, the role of NSOs in their production is well-established, and a wealth of international standards and recommendations on these kinds of indicators already exists for NSOs to draw upon.

Sentiment indicators and composite indicators are not mutually exclusive categories. An indicator may be classified as both a sentiment indicator and a composite indicator – the European Commission's

Economic Sentiment Indicator (ESI) is one example. Sentiment indicators may also be used as components in a composite indicator. An important consideration for both sentiment indicators and composite indicators is the presence or absence of a reference series, *a series that an indicator aims to approximate or predict*. Indicators with reference series may exhibit a leading, coincident or lagging relationship with the reference series.

The following sections discuss sentiment and composite indicators in further detail and set out definitions of other key terms used in these recommendations. Section 3.2 discusses sentiment indicators, and makes the distinction between sentiment indicators with reference series and sentiment indicators without reference series. Section 3.3 defines composite indicators and is structured similarly to Section 3.2: composite indicators with reference series and further divided into composite leading indicators, composite coincident indicators and composite lagging indicators. Finally, the section discusses composite indicators without reference series.

The chapter draws upon the *Handbook on Constructing Composite Indicators* (OECD, 2008), *Towards a Harmonised Methodology for Statistical Indicators* (Eurostat, 2014) and the *Handbook on Cyclical Composite Indicators* (UNSD, Eurostat and the Conference Board, forthcoming).

3.2 Sentiment indicators

In the past, indicators that involve subjective assessment on the part of the respondent were widely considered outside the purview of official statistics. But national statistical offices have become increasingly involved in producing these kinds of indicators in recent years. A number of countries produce indicators based on business and consumer tendency surveys that rely on questions about perceptions or expectations of the future. In 2013, the European Union Statistics on Income and Living Conditions instrument added an ad hoc module on subjective well-being, which included questions on life satisfaction, happiness and overall well-being. According to Eurostat's *Quality of Life, Facts and views*, "Subjective measures such as life satisfaction and meaning of life today are considered as reliable measures backed by international studies and guidelines. Subjective measures have also turned out to be relatively consistent with objective indicators which function as external validators."[1]

Sentiment indicators encompass these kinds of "subjective" indicators and are defined as follows:

> ***Sentiment indicators*** *are indicators that rely on the opinions, attitudes or expectations of respondents.*

Table below provides an overview of the types of sentiment indicators that official statisticians may encounter, including some examples.

[1] Eurostat (2015), Quality of life, Facts and views, Publications Office of the European Union, Luxembourg. See http://ec.europa.eu/eurostat/statistics-explained/index.php/Quality_of_life_in_Europe_-_facts_and_views_-_overall_life_satisfaction#Life_satisfaction

Table 3.1 Types of sentiment indicators

	With reference series			Without reference series
	Leading	Coincident	Lagging	
Sentiment indicators	Production expectations over the next 3 months, as available in business tendency surveys			Life satisfaction and happiness in Europe

Sentiment indicators can be grouped according to whether they have a *reference series*. Some sentiment indicators have reference series to compare them with, for example the quarterly GDP growth rate. In such cases, the indicator will exhibit a leading, coincident or lagging relationship with the reference series. Other indicators do not have reference series, for example indicators of life satisfaction, in which case the concepts of leading, coincident and lagging do not apply.

Broadly speaking, there are two main types of sentiment indicators of interest to national statistical offices. The first type is *economic sentiment indicators*, which are generally produced from business and consumer tendency surveys. Examples include consumer confidence indicators and business production expectations. Indicators of consumer confidence are common in many countries, but may be compiled in very different ways. They can be produced from a special consumer survey, the regular household expenditure survey or a mix of different sources. It should be noted, however, that in the European Union and OECD countries, business and consumer confidence indicators have been largely harmonized.

The second type of sentiment indicators is *socio-economic sentiment indicators*, which typically involve asking individuals about how they perceive different aspects of their life, such as their job or income, family or health situation. The indicators may be based on special surveys or the information may be collected through e.g. existing household surveys.

Chapter 4 presents recommendations on compiling and producing sentiment indicators.

Examples

Type	Economic	Socio-economic
Sentiment indicator	Employment expectations, consumer and business confidence indices, European Commission's Economic Sentiment Indicator (ESI)[2]	Job satisfaction, perceived usefulness of training, belief that country is on the right track.

[2] The ESI is also a composite indicator. Consumer and business confidence indices may also be considered composite indicators (see Chapter 4).

3.2.1 Sentiment indicators with reference series

Some sentiment indicators have reference series. In other words, they are produced with the explicit intention of approximating or predicting another indicator. Sentiment indicators that have reference series may exhibit a leading, coincident or lagging relationship with their reference series. As the concept of a reference series is of particular interest for composite indicators, a more detailed discussion of reference series and indicators' relationships to them is presented in Section 0 Composite indicators. In fact, many of the sentiment indicators that have reference series are also composite indicators, such as the ESI, which uses GDP growth as its reference series.

3.2.2 Sentiment indicators without reference series

Some sentiment indicators aim to measure a phenomenon directly and do not attempt to track the movements of another indicator. These indicators do not have reference series. Sentiment indicators in the social statistics domain, such as indicators of happiness or job satisfaction, generally do not have reference series.

3.3 Composite indicators

A composite indicator is created when individual indicators are combined into a single measure. Composite indicators are often used to measure multidimensional and in many cases abstract concepts, which cannot be captured by single indicators. Examples include composite indices of well-being or happiness or business cycle indices, summarizing a range of different indicators into one number in order to simplify interpretation. The definition of composite indicator used for these recommendations follows the OECD definition[3]:

> *A **composite indicator** is formed when individual indicators are compiled into a single index, on the basis of an underlying model of the multi-dimensional concept that is being measured.*

The indicators that make up a composite indicator are referred to as *components* or component indicators. The production of composite indicators involves choices regarding which component indicators to include and how to weight or aggregate them. Those steps can be subject to criticism related to the subjectivity of choices associated with them.

Table below provides an overview of the different types of composite indicators that exist, along with examples of each type.

[3] See http://stats.oecd.org/glossary/

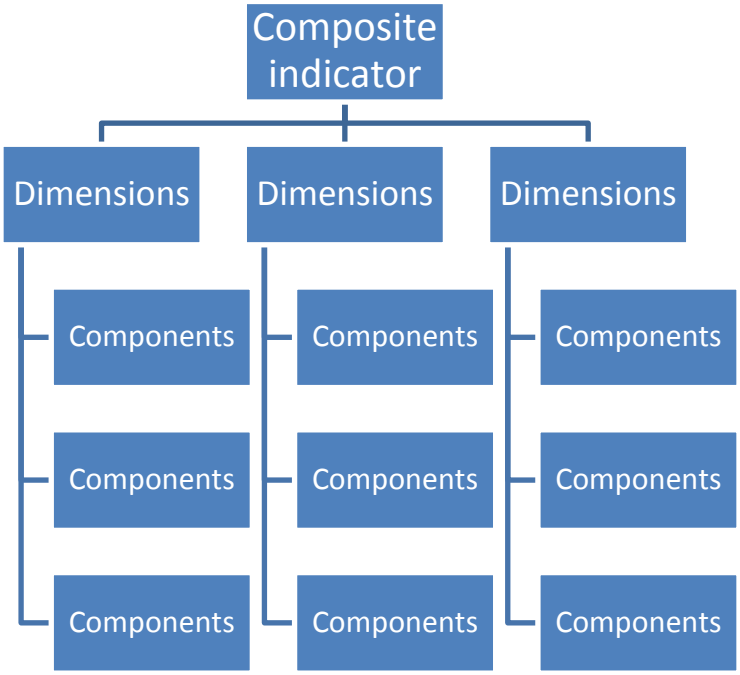
Table 3.2 Types of composite indicators

	With reference series			Without reference series
	Leading	Coincident	Lagging	
Composite indicators	OECD Composite Leading Indicators (CLIs), Conference Board Leading Economic Indexes, IFO Business Climate Index	Economic Sentiment Indicator (ESI) produced by the European Commission, EuroCoin, Factor model based on quantitative data for the GDP growth estimate	The Conference Board Lagging Economic Index (LAG)	The Affect Balance Scale (ABS), OECD Better Life Index (BLI), OECD measure of job quality, UNDP Human Development Index (HDI)

Just as sentiment indicators can be grouped according to whether they have a reference series and their relationship (leading, coincident or lagging) with it, so too can composite indicators. In fact, the distinction is rather important for composite indicators, as a composite indicator's ability to track its reference series provides a basis for impartial comparison of different sets of component indicators, normalization procedures and weighting schemes.

A composite indicator may include several *dimensions*, where the dimensions represent different domains or aspects of the phenomenon being measured. For example, a composite indicator of well-being may cover dimensions such as income, employment, health and education. If the composite indicator covers more than one dimension it is usually compiled in two steps. In the first step, component indicators within each dimension are aggregated or weighted together into one indicator for the dimension. In the second step, the indicators of the dimensions are aggregated into a composite indicator. Often, different methods are used to weight components within a dimension from those used to combine the dimensions in order to arrive at the composite indicator. For example, in UNPD's Human Development Index, three dimensions are defined: a long and healthy life, knowledge and a decent standard of living. Within the knowledge dimension, component indicators are arithmetically averaged. The dimensions themselves are then geometrically averaged to yield the final index (see Box 3.2).

Figure 3.1 Dimension approach to constructing composite indicators



Type	Examples
Composite indicator	UNDP Human Development Index (HDI), OECD Composite Leading Indicators (CLIs), European Commission's Economic Sentiment Indicator (ESI)[4]

Chapter 5 discusses composite economic indicators in greater detail, and Chapter 6 presents an in-depth discussion of composite socio-economic indicators.

Box 3.1 Relationship with the concept being measured

An important consideration when selecting components to include in a composite indicator is whether changes in the component indicators have an easily interpretable, linear relationship with the concept being measured. In other words, if a component indicator increases, it should be understood what the implication is for the concept. For example, a higher life expectancy means an increase in the human development index produced by the UNDP.

In many cases, however, single indicators do not exhibit a clear, linear relationship with the concept being measured, even though they may be highly relevant to the concept. These kinds of indicators are not suitable for inclusion in a composite indicator. For example, in UNECE's framework for measuring

[4] These Economic Sentiment Indicators are produced by the European Commission's Directorate-General for Economic and Financial Affairs (DG ECFIN) and member states.

quality of employment, the relationship between the indicators proposed and employment quality is not always straightforward.[5] One of the indicators, for instance, measures the number of days not worked due to strikes and lockouts. While this indicator is clearly relevant to employment quality, an increase does not necessarily mean a decrease in employment quality. An increase could reflect a reaction to negative working conditions, but it could also reflect increased freedom to negotiate with employers. For this reason, it would not be suitable to include this indicator in a composite indicator for quality of employment.

Certain indicator typologies include a distinction between input and output indicators. Input indicators are defined as indicators that measure material resources used in a policy or project, and output indicators are defined as indicators that measure the goods or services that result from the policy or project (Eurostat 2014). When constructing a composite indicator that is related to policy, it could be useful to check for effects of input and output indicators (see Chapters 5 and 6).

It is worth mentioning that an alternative to combining component indicators into a single composite indicator is to present the components individually in dashboards or scoreboards. This approach aims to provide an overall picture of a given phenomenon while avoiding weight assignment and loss of information from combining multiple indicators.[6]

3.3.1 Composite indicators with reference series

In some cases, composite indicators are produced in order to provide information similar to a reference series at a lower cost, more rapidly, or at more frequent intervals. In other cases, a composite indicator may be produced in order to predict how its reference series will behave in the near future.

In practice, most composite indicators that have a reference series are economic indicators. Many of them use various transformations of GDP (e.g. growth rate of GDP) or key short-term statistics (e.g. growth rate of industrial production) as their reference series. If an indicator has a reference series, it may exhibit a leading, coincident or lagging relationship with its reference series. The distance from a reference series[7] is a common way to determine whether the choice of component indicators and weighting scheme or aggregation method for a composite indicator are appropriate.

Composite leading indicators

Composite leading indicators aim to estimate or predict the development of a given reference series. Most composite leading indicators are economic indicators.

[5] See the *Handbook for Measuring Quality of Employment*, http://www.unece.org:8080/index.php?id=41346&L=0

[6] One example of such a scoreboard is the European Commission's Macroeconomic Imbalance Procedure (MIP) scoreboard, which consists of several macroeconomic indicators in order to identify imbalances in member states' economies. See http://ec.europa.eu/eurostat/web/macroeconomic-imbalances-procedure/indicators

[7] Measuring distance from a reference series requires first defining how distance is measured – or choosing a distance metric. The L^2 norm, which corresponds to the usual sense of distance between two points on a graph, is a common choice.

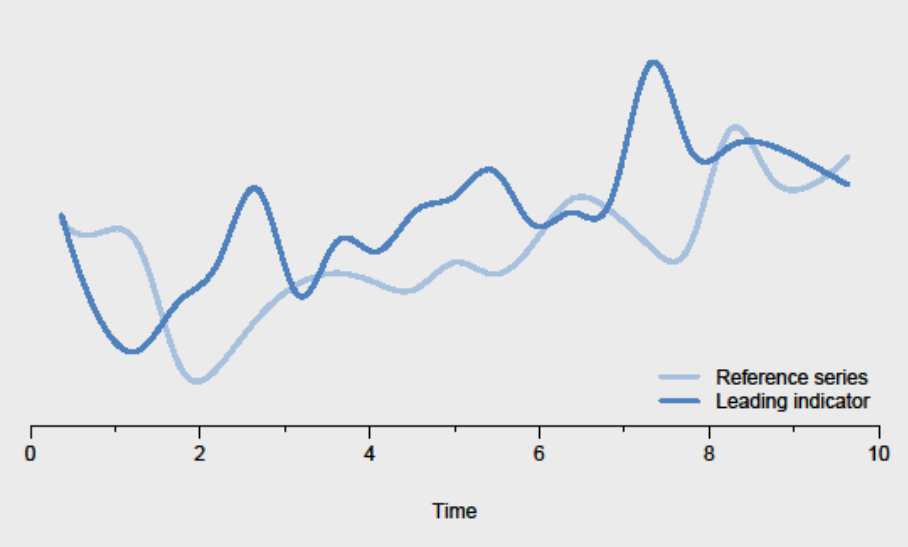
> *A **composite leading indicator** is a composite indicator that aims to anticipate the movements of its reference series.*

Examples of composite leading indicators are the OECD's Composite Leading Indicators and the Conference Board's Leading Economic Index (LEI). Admittedly, finding indicators that exhibit clear and consistent leading relationships with their reference series may be difficult in practice.

Type	Examples
Composite leading indicator	OECD Composite Leading Indicators (CLIs), Conference Board's Leading Economic Indexes (LEIs)

Another way to think about leading indicators is that a leading indicator at time *t* is most highly correlated with its reference series at time *t+k*, where *k>0*. Figure below shows what a typical leading relationship might look like. A peak or trough of the leading indicator at time *t* roughly corresponds to a peak or trough of the reference series at time *t+1*.

Figure 3.2 A leading relationship



It is important to note that an indicator that is released earlier or more frequently than its reference series is not necessarily a leading indicator. For example, many countries produce Industrial Production Indices (IPIs) on a monthly basis and GDP on a quarterly basis. While the IPI will be released before GDP estimates and can thus give an idea about the movement of GDP before its release, the IPI and GDP are coincident indicators because their movements generally occur at the same time.

Composite coincident indicators

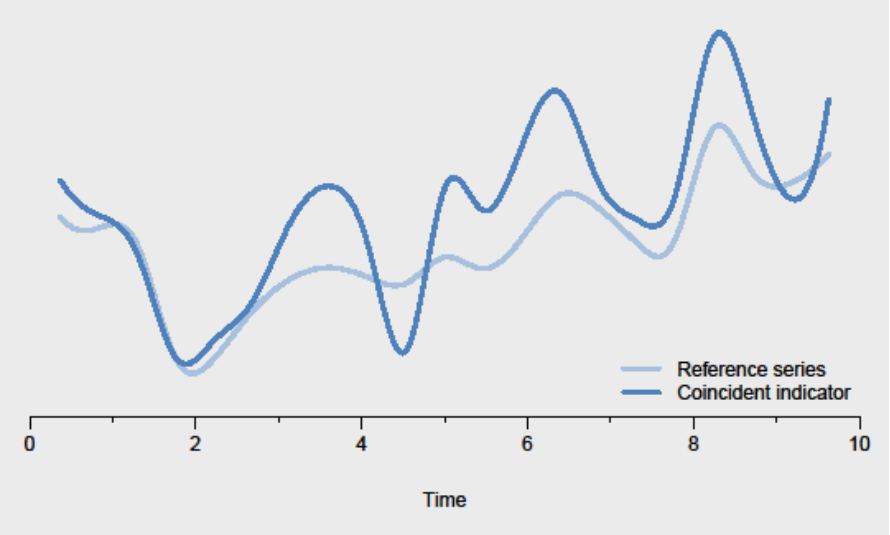
Composite coincident indicators aims estimate a current development or phenomenon. For instance, a composite coincident economic indicator would change at roughly the same time as overall economic activity.

> *A **composite coincident indicator** is a composite indicator whose movements occur at the same time as those of its reference series.*

Type	Examples
Composite coincident indicator	Conference Board's Coincident Economic Indexes (CEI)

Another way to think about coincident indicators is that a coincident indicator at time *t* is most highly correlated with its reference series at time *t*. Figure below shows what a typical coincident relationship might look like. The peaks and troughs of the coincident indicator occur at roughly the same time as those of the reference series (though the magnitude of the peaks and troughs differs).

Figure 3.3 A coincident relationship



Composite lagging indicators

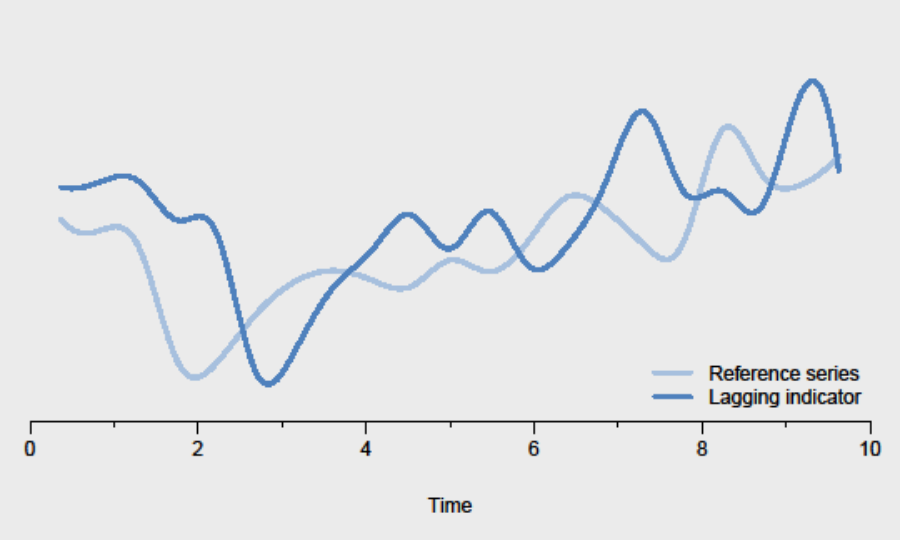
Finally, there are composite indicators whose movements follow the movements of their reference series after a delay.

> *A **composite lagging indicator** is a composite indicator whose movements follow those of its reference series.*

Type	Examples
Composite lagging indicator	Conference Board's Lagging Economic Indexes (LAGs)

Many lagging indicators are produced because of their intrinsic value, and their lagging relationship with other phenomena is secondary. Another way to think about lagging indicators is that a lagging indicator at time *t* is most highly correlated with its reference series at time *t-k*, where *k>0*. Table below shows what a typical lagging relationship might look like. A peak or trough of the lagging indicator at time *t* roughly corresponds to a peak or trough of the reference series at time *t-1*.

Figure 3.4 A lagging relationship



3.3.2 Composite indicators without reference series

Just as there are sentiment indicators without reference series, so too are there composite indicators without reference series. These composite indicators aim to measure a phenomenon directly and do not attempt to track the movements of another indicator. Examples of composite indicators that do not have reference series are the UNDP HDI or the OECD Better Life Index. The main goal of these indicators is to assess the evolution of a phenomenon, for example well-being, between different points in time, or to create a ranking across countries or regions at a given point in time.

It can be difficult to reach agreement on methods of component selection, normalization and weighting for these kinds of indicators. However, Chapter 6 provides guidance or references to internationally agreed guidelines to assist national statistical offices in dealing with components of composite indicators without reference series.

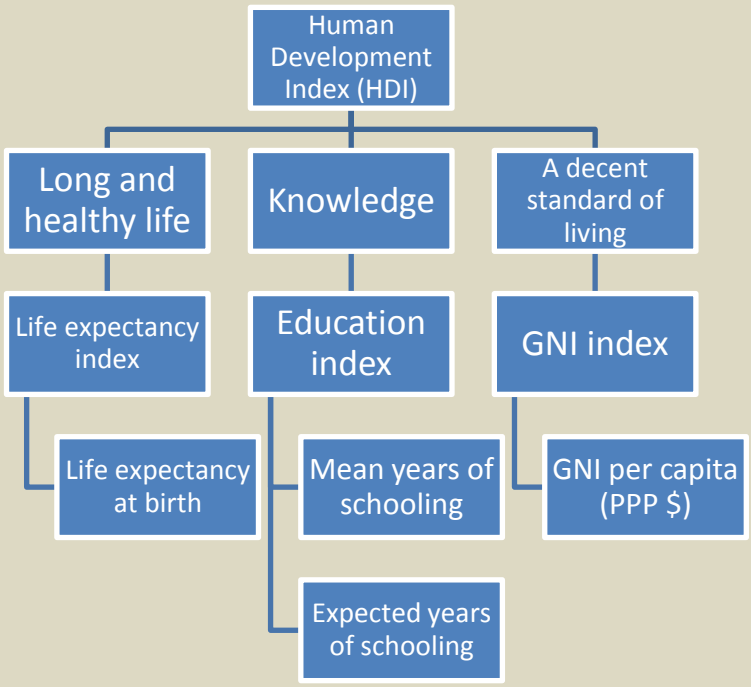
In practice, most composite indicators that do not have reference series will be social, socioeconomic or environmental indicators (see Chapter 6 for discussion of composite socio-economic indicators). Sustainable development indicators, which span multiple domains, also lack reference series.

Box 3.2 The UNDP Human Development Index (HDI)

One well-known example of a composite indicator that does not have a reference series is the Human Development Index (HDI), which is produced by the United Nations Development Programme (UNDP). The HDI is a summary measure of human development based on three dimensions: a long and healthy life, knowledge and a decent standard of living. For each dimension, one or two indicators are normalized to form indices. The geometric mean of the resulting indices is then taken to form the HDI.

Figure 3.1 Constructing the HDI[8]

[8] This figure is a reproduction of a figure that appears in the technical notes of the 2015 Human Development Report. See http://hdr.undp.org/sites/default/files/hdr2015_technical_notes.pdf



Here, the life expectancy and GNI indices are not composite indicators, since they are simply single indicators that have undergone a normalization procedure. The education index, however, is a composite indicator, since it combines two indicators denominated in different units. While mean years of schooling and expected years of schooling may both appear to be denominated in the same unit (years), a mean year of schooling is a different unit from an expected year of schooling[9]. Combining the two indicators therefore involves a decision about weighting (in this case, the decision was made to weight both equally).

Same HDI, different components

One drawback of using composite indicators is the loss of information that occurs when one composite indicator is used rather than a set of single indicators. In 2014, for example, both Cyprus and Qatar had HDI scores of 0.85, despite considerable differences in the component indicators. GNI per capita in Qatar was more than four times higher than it was in Cyprus in 2014 ($123,124 compared to $28,633).[10] This disparity was cancelled out by differences in life expectancy and mean years of education – adult Cypriots stayed in school for 2.5 years longer than Qataris on average (11.6 years versus 9.1 years), and life expectancy was 2 years longer in Cyprus than it was in Qatar (80 years versus 78 years).

[9] Data for mean years of schooling and expected years of schooling come from the United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute for Statistics. Mean years of schooling is the average number of years of education received by people ages 25 and over, whereas expected years of schooling is the expected number of years of education a child who is entering school can expect to receive, assuming enrollment patterns persist.

[10] In 2011 PPP$. Data obtained from http://hdr.undp.org/en/data