UNECE

Guidelines on producing leading, composite and sentiment indicators

UNITED NATIONS

UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE

Guidelines on producing leading, composite and sentiment indicators

United Nations
Geneva, 2019

This publication is issued in English only.

United Nations publication issued by the United Nations Economic Commission for Europe.

ECE/CES/STAT/2019/2

ISBN: 978-92-1-117219-5
eISBN: 978-92-1-004517-9
Sales No.: E.20.II.E.5

Preface

Over the last decade there has been a growing interest in the potential of leading, composite and sentiment (LCS) indicators to shed new light on the social and economic development of societies. They are often referred to by the media and play a growing role in societal discussions and in policy decision-making.

LCS indicators offer a powerful way of communicating statistical information and of reaching out to users of statistics. The indicators can provide relevant and timely information on aspects of the economy and the society that are not covered by more conventional statistics. They can also provide information on complex phenomena in a simple and condensed form – for instance on current or expected economic development or on the well-being or sense of happiness of citizens.

While some statistical offices already have experience in compiling and disseminating LCS indicators, practices differ and they are new to many others. The Bureau of the Conference of European Statisticians, therefore, in 2016 established a Task Force to develop practical and operational Guidelines for offices that are producing or considering the production of LCS indicators. These Guidelines are the results of the work of the Task Force and were endorsed by the Conference of European Statisticians in June 2019.

The Guidelines introduce LCS indicators and explain their potential uses and the rationale for producing them. The Guidelines provide guidance to managers to aid their decision-making about whether and how to engage in the production of LCS indicators and give practical advice both for the compilation of LCS indicators and for their communication. While the Guidelines are targeted principally at national statistical offices, others interested in the compilation and use of LCS indicators will also find the Guidelines useful.

The Guidelines acknowledge and refer to existing international methodological handbooks and manuals, such as those prepared by Eurostat, the Organisation for Economic Co-operation and Development (OECD) and the United Nations Statistics Division.

Contents

1 Introduction

1.1 These Guidelines provide guidance to statistical offices on their possible roles in developing and producing leading, composite and sentiment (LCS) indicators and give practical and operational guidance to statistical offices that produce or consider producing LCS indicators. Existing examples of good practice are also referenced. This chapter serves as an introduction to the Guidelines. Section 1.1 gives a brief introduction of leading, composite and sentiment indicators and their use, the possible roles of statistical offices in the production of such indicators. Section 1.2 outlines the purpose of the Guidelines and how to use them. Section 1.3 provides an overview of initiatives of the Conference of European Statisticians to develop guidelines on LCS indicators. Section 1.4 gives an overview over the Guidelines. Section 1.5 presents topics for further work and research. Acknowledgements of authors and contributors to the Guidelines are provided in Section 1.6.

1.1 Background

1.2 Leading, composite and sentiment (LCS) indicators cover a broad and diverse group of statistical measures, which in different ways provide information about the society and its individuals:

- *Leading indicators* aim to anticipate the development of a reference series – for example, to predict the cycles of industrial production or gross domestic product (GDP). Leading indicators are constructed based on one or often several individual indicators, which taken together are found to have a leading property compared to a chosen reference series.
- *Composite indicators* are constructed to measure complex, or multidimensional, phenomena by combining individual indicators into one single measure by simple averaging or more advanced statistical methods.
- *Sentiment indicators* are compiled to reflect the perceptions, attitudes or expectations of groups of respondents, e.g. different groups of individuals, households or businesses. They are usually based on qualitative surveys asking about the opinion on past, present or future developments.

1.3 LCS indicators offer information on a range of topics that are not covered by what may be considered traditional official statistics, or which typically have not been covered by national statistical offices (NSOs). Moreover, LCS Indicators may also provide information on complex issues in a relatively simple or condensed form, which appeals to many users of statistics. This includes policy makers and the media, who increasingly refer to LCS indicators.

1.4 Over the last decade, there has been a growing demand for LCS indicators, which are becoming still more common in different areas of statistics. They include business cycle analysis, measurement of well-being and sentiment indicators expressing the confidence or the expectations of businesses or households regarding economic developments, or households' perception of their happiness or safety. LCS indicators are also becoming more common for international comparisons to assess country performance and are increasingly used for policy making.

1.5 The demand has been driven by evolving user needs for indicators that are easier to compare, provide information in condensed form and shed light on areas traditionally not covered, or not covered well, by most NSOs. Many LCS indicators are produced by data providers other than NSOs. Some LCS indicators can be compiled relatively quickly and hence give earlier indications of developments than can be found in traditional statistical series. The development is facilitated by the growing abundance of data, processing power and IT tools, which makes the production of LCS indicators much easier than in the past.

1.6 There are different practices among countries, as well as different views on the role of NSOs in the production of LCS indicators. Some NSOs consider LCS indicators out of their scope, or do not see

them as a priority. Some NSOs also fear that engaging in the production of LCS indicators may harm their credibility.

1.7 Other NSOs have significant experience in producing LCS indicators or are considering the possibility to engage in the production of LCS indicators. NSOs can ensure that indicators are produced based on the *Fundamental Principles of Official Statistics*[1] and, by disseminating the indicators improve users' perception of the relevance and value of official statistics. It can also be argued that if statistical offices do not use their data and expertise to produce these indicators, they may be produced by other organisations not adhering to the principles of official statistics. Such organisations may not invest the necessary resources to ensure the production of high-quality indicators, nor disseminate sufficient documentation of data sources and methods.

1.8 There are therefore ongoing questions: Should NSOs leave the production of LCS indicators to other organisations, or should they take a greater role in their development and production? Should NSOs be more active in providing data and offering their expertise to other organisations producing LCS indicators, in the interests of quality control?

1.2 The purpose of the Guidelines

1.9 The Guidelines have two key purposes:

1. To give guidance to NSOs in deciding whether to engage in production of LCS indicators

LCS indicators are new to many NSOs and it may not be clear whether or how the NSO should engage in the compilation and communication of such indicators. Accordingly, after discussion of the typology of LCS indicators and their various characteristics in Chapter 2, Chapter 3 presents a structured framework to help NSOs reach decisions, having regard to individual circumstances each faces.

2. To give guidance on producing LCS indicators

For NSOs that already produce LCS indicators or decide that they will in the future, the Guidelines provide operational guidance on the compilation and communication of LCS indicators. That is the subject matter of Chapters 4-7. They introduce the different types of indicators, outline the basic steps for their construction and give guidance on how to communicate the indicators. The annexes include examples of the construction of LCS indicators. The Guidelines do not provide detailed methodological or technical guidance for the construction of LCS indicators. Instead, references are made to existing methodological handbooks and manuals such as provided by OECD, Eurostat and United Nations Statistics Division (UNSD), in particular the *Handbook on Constructing Composite Indicators* (OECD, 2008) and the *Handbook on Cyclical Composite Indicators* (EU & UNSD, 2017a).

1.10 It is important to note that leading, composite and sentiment indicators are not three distinctive and mutually exclusive groups of indicators. For instance, a composite indicator may also be a leading indicator, and a sentiment indicator may be constructed as a composite indicator. In these Guidelines, leading indicators are not presented as a separate group of indicators but considered a subset of composite and sentiment indicators. Hence, Chapter 4 on sentiment indicators and Chapters 5 and 6 on composite indicators also discuss leading sentiment and leading composite indicators. For ease of reference, the group of leading, composite and sentiment indicators is referred to as LCS indicators throughout the Guidelines.

[1] https://unstats.un.org/unsd/dnss/gp/fundprinciples.aspx

1.11 These Guidelines do not deal with individual quantitative indicators that may be interpreted or used as sentiment or leading indicators. For instance, inventory statistics, building permits statistics, car sales statistics or industrial production indices may be used as indicators of business expectations, or as early indicators of the business cycle. The role of NSOs in their production is well-established and a wealth of international statistical standards and recommendations is available. For the same reason, the Guidelines do not deal with traditional statistical measures, such as the gross domestic product (GDP) or the consumer price index (CPI). The Guidelines also do not discuss the compilation of indicators based on use of traffic sensor information, mobile telephone traffic or information from social media. While such information may be used to compile e.g. early or leading indicators, they were not considered in scope of the Guidelines.

1.3 Initiatives by the Conference of European Statisticians

1.12 In response to the growing importance of LCS indicators, the Bureau of the Conference of European Statisticians (CES) in 2014 undertook an in-depth review of leading, composite and sentiment indicators to discuss the role of official statistics in this context. As a basis for the in-depth review, the UNECE Secretariat carried out a survey on country practices in producing LCS indicators and received replies from 38 CES countries. The survey confirmed different practices and different views on the involvement of NSOs in the production of LCS indicators. The Bureau concluded that exchange of experiences and best practices would be valuable. The Bureau also found that the area lacks international coordination and identified a need to achieve a common understanding of the role of NSOs in this area, as well as for guidance for NSOs that produce or consider producing LCS indicators.

1.13 The CES plenary session in April 2014 confirmed a large interest in LCS indicators but also different views on to what extent NSOs should engage in the production of LCS indicators. The Conference concluded that further discussion would be useful both of the challenges in compiling and disseminating LCS indicators and to clarify the responsibilities and boundaries of NSOs. To follow up on the decision of the Conference, an international seminar on the role of NSOs in producing LCS was organised in December 2015 in Geneva. The seminar discussed the role of official statistics and NSOs in producing LCS indicators as well as methodological and practical issues related to their compilation and dissemination.

1.14 In early 2018, the Guidelines were sent for interim consultation to give CES members an opportunity to review the draft Guidelines and provide comments and suggestions for further improvements. 45 countries, international organisations and research institutions replied to the interim consultation. Based on the received comments the Task Force summitted a revised version of the Guidelines to the CES Bureau in October 2018, where the Bureau asked UNECE to conduct a final consultation with CES members.

1.15 The final round of consultation was carried out from December 2018 to March 2019. UNSD extended the consultation globally to countries that are not members of the CES. A total of 70 replies were received from NSOs of 62 countries, four international organizations and two research institutes. In spring 2019, the Task Force updated the Guidelines to incorporate the comments and suggestions received in the final round of consultation. The final version of the Guidelines was endorsed by the CES plenary session in June 2019.

1.4 Overview of the Guidelines

1.16 The Guidelines are structured in seven chapters and eight Annexes. Each chapter can be read separately, while the reader should be familiar with the main concepts used, which are described in Chapter 2. The Guidelines include national and international good practice examples presented throughout the chapters and in the annexes.

1.17 *Chapter 2* presents a typology of LCS indicators. The typology defines and explains the different types of indicators and provides examples of the main indicator types. The typology focuses on sentiment and composite indicators. For both, a distinction is made between indicators with a reference series and indicators without a reference series. Leading indicators are not dealt with as a separate group of indicators but considered a subset of composite and sentiment indicators.

1.18 *Chapter 3* discusses the role of NSOs in producing LCS indicators. It discusses the challenges and potential benefits for NSOs to which these give rise. Using the *Fundamental Principles of Official Statistics* as a starting point, it presents a structured decision-making process for NSOs to follow, having regard to their specific circumstances. The steps in the decision-making include: engagement with users and stakeholders; an analysis of possible strengths, weaknesses, opportunities and threats (SWOT); and consideration of pros & cons of LCS indicators. Checklists of issues to consider are provided. Where the decision is that LCS indicators should be produced, the chapter highlights issues related to quality assurance and communication of the indicators.

1.19 *Chapter 4* presents sentiment indicators. The chapter focuses on single sentiment indicators and makes the distinction between economic and socio-economic sentiment indicators. For both groups, compilation procedures and analysis are presented, including comparisons with reference series. Issues related to international comparability are also briefly addressed.

1.20 *Chapter 5* provides an overview of composite economic indicators. It covers the most commonly used models for composite economic indicators and provides guidance on their compilation. It highlights issues and pitfalls of which NSOs should be aware when constructing the indicators. A distinction is made between *cyclical indicators* and *structural indicators*. The chapter presents in a condensed form the steps involved in the production of a cyclical composite economic indicator, based on the *Handbook for constructing composite indicators* (OECD, 2008) and the *Handbook on Cyclical Composite Indicators* (EU & UNSD, 2017a).

1.21 *Chapter 6* focuses on composite socio-economic indicators. It provides background and highlights differences from composite economic indicators discussed in Chapter 5. It presents the main steps for constructing a composite socio-economic indicator: setting-up the conceptual model of the indicator; selection of dimensions and indicators; data treatment; multivariate analysis; normalisation of data; weighting and aggregation; and validation. Aggregating over different dimensions, lack of reference series and lack of a common unit of measurement (as given in monetary units for economic indicators) bring in additional challenges in the construction of socio-economic indicators that are discussed.

1.22 *Chapter 7* discusses the communication and dissemination of LCS indicators, which are key for success. As discussed in Chapter 3, communication needs to begin at the outset of the process to ensure maximum user value and engagement and such that the design of the LCS indicators can best reflect user need and expertise. Communication needs to continue throughout the compilation progress to ensure user ownership and understanding. Chapter 7 relates to post production communication and dissemination issues. It lists the specific challenges involved in the dissemination of LCS indicators and gives guidance on the targeting of user groups and how to communicate the indicators in the right context and in line with the principles of official statistics

1.23 *Annex A* provides guidance on how to compare economic sentiment indicators with their reference series, which serves as a supplement to Chapters 4 and 5. *Annexes B-G* include country examples of the production of leading, composite and sentiment indicators by Mexico, Netherlands, Spain, Sweden and Turkey. *Annex H* provides the example of the Active Aging Index.

1.5 Topics for further work and research

1.24 During its work, the Task Force noted a number of topics where further work and research would be useful. These are listed and briefly described below.

Sharing of experiences and good practices among countries

1.25 LCS indicators are still new to many NSOs and countries are at different stages with regards to the production of these types of indicators. It is, therefore, important to continue sharing experiences and good practices among countries and organisations concerning both conceptual, methodological and measurement issues and challenges related to the communication of LCS indicators. To this end, it would be useful to organise international seminars or workshops to exchange experiences and good practices on LCS indicators and their compilation, ideally focusing on specific topics (e.g. economic or socio-economic indicators). Special workshops and seminars designed to help countries with less developed statistical systems may also be useful. As part of the exchange of experiences, the possibility of establishing a website with a repository of relevant material for countries to consult should be considered.

Mapping of country practices

1.26 Methods and practices in compiling LCS vary much across countries. It would be useful with a mapping exercise to have an overview of which NSOs, or other organisations, produce what types of LCS indicators, and which methods and practices are used. This would be helpful to identify good practices and where, eventually, more guidance would be useful.

Developing a statistical framework for measuring well-being

1.27 Several existing frameworks for measuring well-being exist, the OECD Better Life Index, for instance. However, these are linked to various policy agendas or to specific goals. It would be useful to develop a purely statistical framework for a composite indicator on well-being to assist NSOs that would find this useful. The framework could include a proposal for a conceptual model delineating well-being and suggesting the dimensions of the indicator and possible individual indicators for each dimension. For each indicator, guidance could be provided on definitions, data sources and calculation methods. The framework could also give guidance on the weighting and aggregation of the dimensions and the individual indicators.

Social capital and well-being

1.28 Social capital and how to measure it has attracted much interest in recent years, as reflected, for instance, in the OECD Measurement of Social Capital Project and Question Databank. The concept of social capital is partly overlapping with that of well-being. It would be useful to clarify the relations between these two concepts and investigate, for example, what indicators may be used for the compilation of both social capital and well-being.

Exploitation of data sources

1.29 NSOs may be reluctant to engage in the production of LCS indicators because of lack of resources to develop the indicators and ensure continuous production. It would, therefore, be useful to investigate the possibilities of exploiting potential data sources including existing registers, surveys, big data and other data available from internet and how information from different sources may be utilized to produce LCS indicators. As part of this it would also be useful to discuss how to simplify survey questionnaires and reduce expensive interview surveys.

International comparability and SDGs

1.30 Some LCS indicators will fully serve their purpose only once they are internationally comparable (especially in the context of well-being and development). Hence, a special focus could be on standardizing LCS indicators and making them comparable. This would also be useful in relation to the SDGs which includes several sentiment indicators (for example Indicator 2.1.2 based on the Food Insecurity Experience Scale; Indicator 5.6.1 on women's participation in decisions on sexual relations, contraceptive use and reproductive health care; Indicator 10.3.1 on personal perception of harassment

and discrimination; and Indicator 16.1.4 on perceived security)[1]. Additionally, there are tier III SDG indicators (indicators where no internationally established methodology is yet available) that may be designed as LCS indicators, which must be evaluated case by case.

Other topics

1.31 A number of more specific topics would benefit from international work and could, for instance, be discussed at possible future meetings or workshops. These include a broad range of methodological and practical issues, including e.g. the development of sentiment indicators for the services producing sector; methods for weighting and aggregation; indicator performance over time; investigation of ranking techniques for ordinal (qualitative) variables; practical and operational guidance to assist countries in producing LCS indicators and; issues concerning the communication and use of LCS indicators.

1.6 Acknowledgements

1.32 The Guidelines were prepared by the UNECE Task Force on Leading, Composite and Sentiment Indicators. The Task Force worked mainly through audio conferences and exchange of emails. A designated web page was created for sharing of all relevant documents. The Task Force met face to face on 8-9 November 2016 in the Hague, the Netherlands.

1.33 The Task Force consisted of the following members: Erik Slentø (Denmark), Catherine Renne (France, until end 2016), Aron Kincses and Natalie Jamalia (Hungary), Daniel Roash (Israel), Fabio Bacchini and Roberto Iannaccone (Italy), Yuriko Yabuta Osorio (Mexico), Leendert Hoven, Frank van de Pol, Hans Schmeets (Netherlands), Monica Nelson Edberg (Sweden, until October 2017), Hans-Olof Hagén (Sweden, until December 2016), Arzu Eratak (Turkey), Gian Luigi Mazzi (Independent Expert), Rosa Ruggeri Cannata (Eurostat), Jeroen Boelhouwer (Netherlands Institute for Social Research), Pierre-Alain Pionnier (OECD), Ilaria DiMatteo (UNSD) Carsten Boldsen, Evan Brand, Evita Sisene and Albert Bredt (UNECE). The Task Force was chaired by Monica Nelson Edberg (Sweden) until October 2017. From November 2017 the Task Force was chaired by Erik Slentø (Denmark).

1.34 Colombia and France contributed with country examples that are included in the chapters. The annexes of the Guidelines include country case studies prepared by Mexico, Netherlands, Spain, Sweden, Turkey and the Active Ageing Index Project Team. Jan-Egbert Sturm and Klaus Abberger, KOF Swiss Economic Institute, Switzerland, George Kershoff, Stellenbosch University, South Africa, and Stefan Sperlich, University of Geneva, Switzerland contributed to the drafting of the Guidelines with useful comments and insights.

1.35 A big thank you to Joe Grice who carefully edited the Guidelines to ensure coherence and clarity across chapters.

[1] The full list of SDG indicators is available on https://unstats.un.org/sdgs/metadata/

2 Typology of LCS indicators

2.1 Introduction

2.1 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 and are not always used or understood in the same meaning. The following sections discuss sentiment and composite indicators in further detail and set out definitions of other key terms used in these Guidelines. To the extent possible the terms and definitions proposed in these Guidelines follows the terms and definitions of existing international handbooks and manuals.

2.2 Section 2.2 discusses the characteristics of indicators compared to other statistics. Section 2.3 discusses sentiment indicators and makes the distinction between sentiment indicators with reference series and sentiment indicators without reference series. Section 2.4 defines composite indicators and is structured similarly to Section 2.3: composite indicators with reference series are further divided into composite leading indicators, composite coincident indicators and composite lagging indicators. Finally, the section discusses composite indicators without reference series.

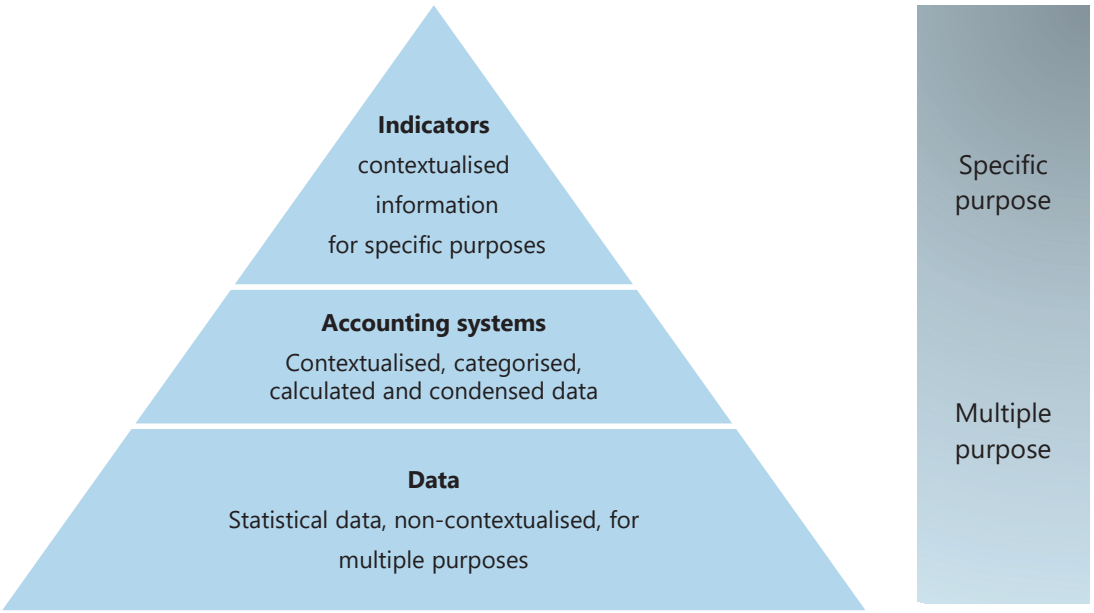
2.3 The chapter draws upon the *Handbook on Constructing Composite Indicators* (OECD, Handbook on Constructing Composite Indicators, 2008), *Towards a Harmonised Methodology for Statistical Indicators* (Eurostat, Towards a harmonised methodology for statistical indicators - Part 1: Indicator typologies and terminologies, 2014) and the *Handbook on Cyclical Composite Indicators* (EU & UNSD, 2017a).

2.2 Characteristics of indicators

2.4 Before discussing the types of indicators covered by these recommendations, it is helpful to have a common understanding of the term *indicator*. There is no internationally agreed definition of statistical indicator and the term is used in many 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 derived from a series of observed facts or reported opinions, attitudes or expectations*. In this definition, *series* refers to any collection of data, not necessarily a time series. The definition is similar to the definition used by Eurostat (2014) but has been expanded to explicitly include sentiment indicators (opinions, attitudes or expectations).

2.5 An indicator may be any summary measure of the data – a mean, count, percentage, etc., related to or based on a conceptual model or context on which it provides information, it is not simply basic statistical data. Indicators share characteristics with other statistical information that is compiled and disseminated by statistical offices but also have some distinctive features. Indicators can be described in terms of the knowledge management pyramid, also known as the data-information-knowledge pyramid (Figure 2.1).

Figure 2.1 **Data information knowledge pyramid**



Source: Adapted from Eurostat (2017a, p. 9)

2.6 The base of the pyramid consists of statistical data, e.g. from surveys and register data. This is multipurpose statistics that can have many different usages and is used as input to produce contextualized statistics at the next level.

2.7 The middle of the pyramid refers to contextualized and condensed data structured and calculated according to a conceptual model such as an accounting system and supplemented with metadata, as for instance the System of National Accounts. This information can still be used for different purposes.

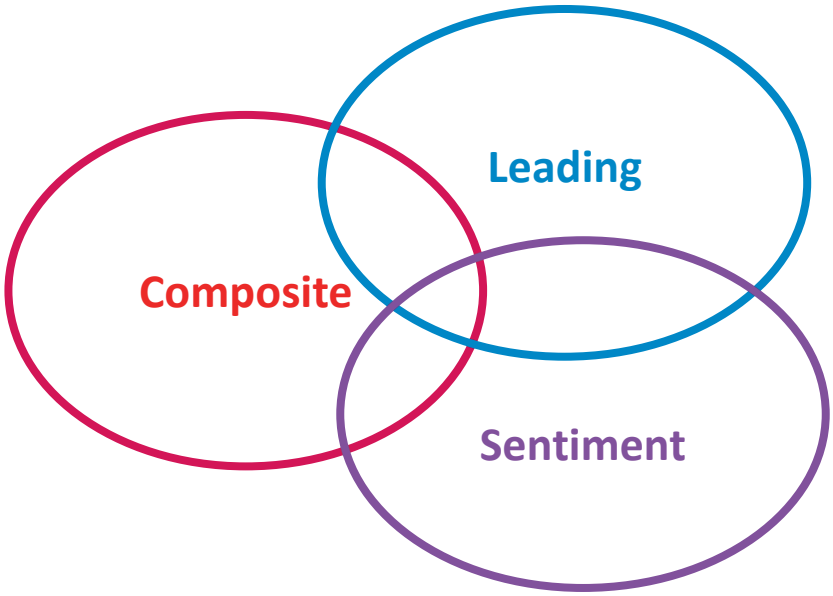
2.8 The Indicators level, on top of the pyramid, refers to contextual information, referring to a specific policy area or a given framework, which are developed to describe a specific phenomenon. This level includes leading, composite and sentiment indicators. These are not yet or only to some extent considered part of official statistics, even though some of these may be based on data series that come from official statistics. Communicating through indicators goes well beyond the simple dissemination of numbers since the communication of the context is crucial for the correct understanding and interpretation of the indicator.

2.9 The scope of these Guidelines and this typology is leading, composite and sentiment indicators, which may give the impression that these are distinctive types of indicators. However, the terms are not mutually exclusive, as illustrated in Figure 2.2. For example, an indicator could be both *composite* and *leading*, or *sentiment* and *leading*, or all three. The European Commission's Economic Sentiment Indicator (ESI) is an example of an indicator that may be classified as both a sentiment indicator and a composite indicator. Furthermore, composite indicators may include one or more sentiment indicators which make it difficult to draw a clear line between composite and sentiment indicators. Hence, the typology also does not make a distinction between sentiment composite indicators and non-sentiment composite indicators depending on whether all components are sentiment indicators or a mix of sentiment and non-sentiment indicators.

2.10 Both composite and sentiment indicators may be leading indicators aiming at predicting some likely future development but may also be constructed to estimate a current or past development or phenomenon. The *temporal* dimension of composite and sentiment indicators, whether they are supposed to estimate future, coincident or past phenomena, can be considered a characteristic of the indicators. For this reason, the typology does not deal with leading indicators as a separate group of indicators but consider these as subsets of composite and sentiment indicators. Hence, the discussion

of composite indicators also covers leading composite indicators and the discussions of sentiment indicators also cover leading sentiment indicators.

Figure 2.2 **Leading, composite and sentiment indicators**



2.11 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. For indicators without reference series it is not possible to make this distinction. Economic composite indicators, introduced in Chapter 5, usually have a reference series whereas socio-economic composite indicators, introduced in Chapter 6 usually do not have a reference series. Sentiment indicators, introduced in Chapter 4, may be of both types.

2.12 NSOs may be less familiar with producing indicators with no reference series. Usual techniques based on the minimization of a distance to the reference series cannot be used to construct the indicators and users may feel that some subjectivity is involved in their construction. Therefore, these types of indicators pose particular challenges to NSOs.

2.13 The typology does not cover individual *quantitative*, non-sentiment data series that may be interpreted or used as leading or sentiment indicators, such as e.g. inventory statistics, building permits statistics or statistics on forced closed downs of business. Although those variables can have leading (or other) characteristics, their quantitative nature and the fact that they are produced by the usual official statistical process place them outside the scope of these Guidelines. The typology also does not cover traditional statistical economic or socio-economic measures, such as the gross domestic product (GDP) or the consumer price index (CPI).

2.3 Sentiment indicators

2.14 In the past, indicators that involved 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. Many 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 "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." (Eurostat, 2015, p. 239).

2.15 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.*

2.16 Table 2.1 provides an overview of the types of sentiment indicators that official statisticians may encounter, including some examples.

Table 2.1 **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	Assessment of the current stock of finished products as available in business tendency surveys	Financial situation of the household over the last 12 months as available in consumer tendency surveys	Life satisfaction/ happiness in Europe

2.17 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.

Examples

Type	Economic	Socio-economic
Sentiment indicator	Employment expectations, consumer and business confidence indices, European Commission's Economic Sentiment Indicator (ESI)[1]	Job satisfaction, perceived usefulness of training, belief that country is on the right track.

2.18 Broadly speaking, there are two main types of sentiment indicators of interest to NSOs. 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 or be based on 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.

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

2.19 The second type 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.

2.20 Chapter 4 presents recommendations on compiling and producing sentiment indicators.

2.3.1 Sentiment indicators with reference series

2.21 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 2.4.1. 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.

2.3.2 Sentiment indicators without reference series

2.22 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 well-being or job satisfaction, generally do not have reference series.

2.4 Composite indicators

2.23 A composite indicator is created when individual indicators are combined into a single measure. Composite indicators are 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 to simplify interpretation and give more robust signals. The definition of composite indicator used for these recommendations follows the OECD definition[1]:

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

2.24 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. These steps can be subject to criticism related to the subjectivity of choices associated with them. Ideally, a composite indicator should be based on a theoretical framework or model, which allows individual indicators/variables to be selected, combined and weighted in a manner which reflects the dimensions or structure of the phenomena being measured.

2.25 Table 2.2 below provides an overview of the different types of composite indicators that exist, along with examples of each type.

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

Table 2.2 **Types of composite indicators**

	With reference series			Without reference series
	Leading	Coincident	Lagging	
Composite indicators	OECD Composite Leading Indicators[1] (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)	Conference Board Lagging Economic Indexes (LAG)	The Affect Balance Scale (ABS)[2], OECD Better Life Index (BLI)[3], OECD measure of job quality[4], UNDP Human Development Index (HDI)

2.26 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. This distinction is 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 and for the selection of normalization procedures and weighting schemes when constructing the composite indicator.

2.27 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, housing situation, health, education and others. When a composite indicator covers more than one dimension, it is usually compiled in two steps, as illustrated in Figure 2.3. In the first step, component indicators within each dimension are 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 into the composite indicator.

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

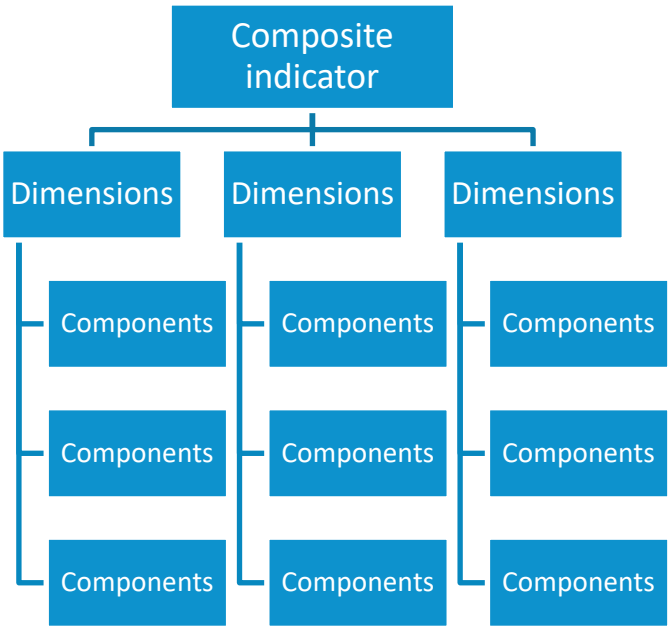
2.29 It should be noted that depending on the context and the level of aggregation, what for one composite indicator is considered a dimension, may be considered a composite indicator on its own in a different context. For example, employment may be one dimension in a composite indicator of well-being, but could also be considered a composite indicator on its own, consisting of dimensions such as income from employment, working time, safety at work, security of employment etc.

Type	**Examples**
Composite indicator	UNDP Human Development Index (HDI), OECD Composite Leading Indicators (CLIs), European Commission's Economic Sentiment Indicator (ESI)[5]

[1] See http://www.oecd.org/sdd/leading-indicators/
[2] See "The Affect Balance Scale: Subjective Approaches (3)" (Bradburn, 2015)
[3] See http://www.oecdbetterlifeindex.org/
[4] See http://www.oecd.org/statistics/job-quality.htm
[5] These Economic Sentiment Indicators are produced by the European Commission's Directorate-General for Economic and Financial Affairs (DG ECFIN) and member states.

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

Figure 2.3 **Dimension approach to constructing composite indicators**



2.31 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.[1]

Box 2.1 **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 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 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 quality of employment, the relationship between the indicators proposed and employment quality is not always straightforward (UNECE, 2015). 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.

2.4.1 Composite indicators with reference series

2.32 In some cases, composite indicators are produced 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 to predict how its reference series will behave in the near future.

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

2.33 In practice, most composite indicators that have a reference series are economic indicators. Many of them use various transformations of GDP (e.g. the growth rate of GDP) or key short-term statistics (e.g. the 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[1] 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

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

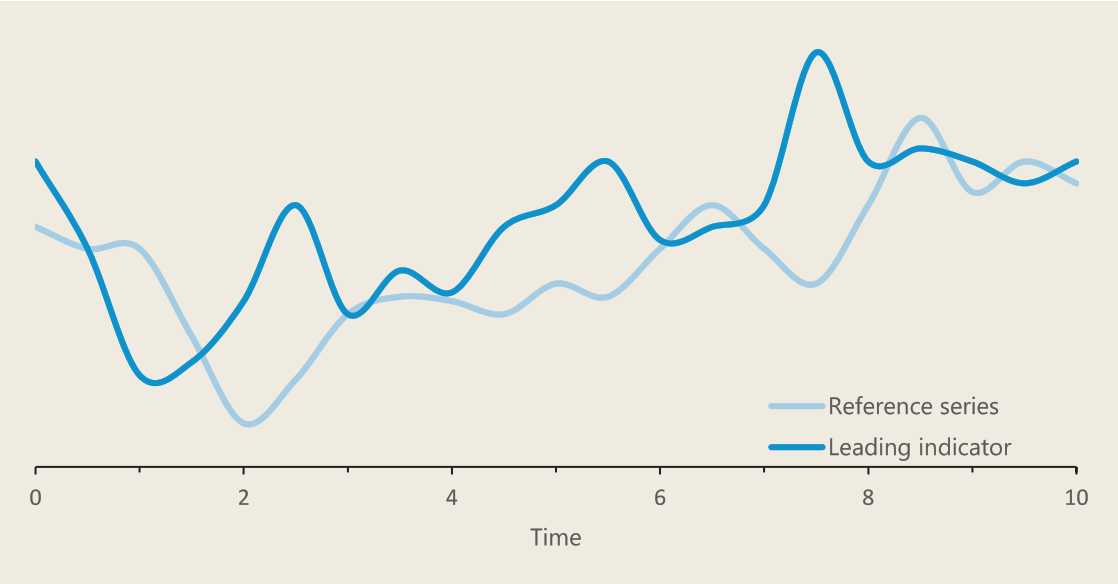
> *A **composite leading indicator** is a composite indicator that aims to anticipate the movements of its reference series.*

2.35 Examples of composite leading indicators are the OECD's Composite Leading Indicators (CLIs) and the Conference Board's Leading Economic Indexes. 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

2.36 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 2.4 shows what a typical leading relationship might look like with the example of a lead of one period. 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 2.4 **A leading relationship**



[1] 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.

2.37 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 according to the definitions of these Guidelines. For example, many countries produce a monthly or quarterly Industrial Production Index (IPI) and a quarterly GDP. While the IPI will be released before the GDP estimates and can thus give an idea about the movement of GDP before its release, the IPI and GDP are considered coincident indicators because their movements generally occur at the same time.

Composite coincident indicators

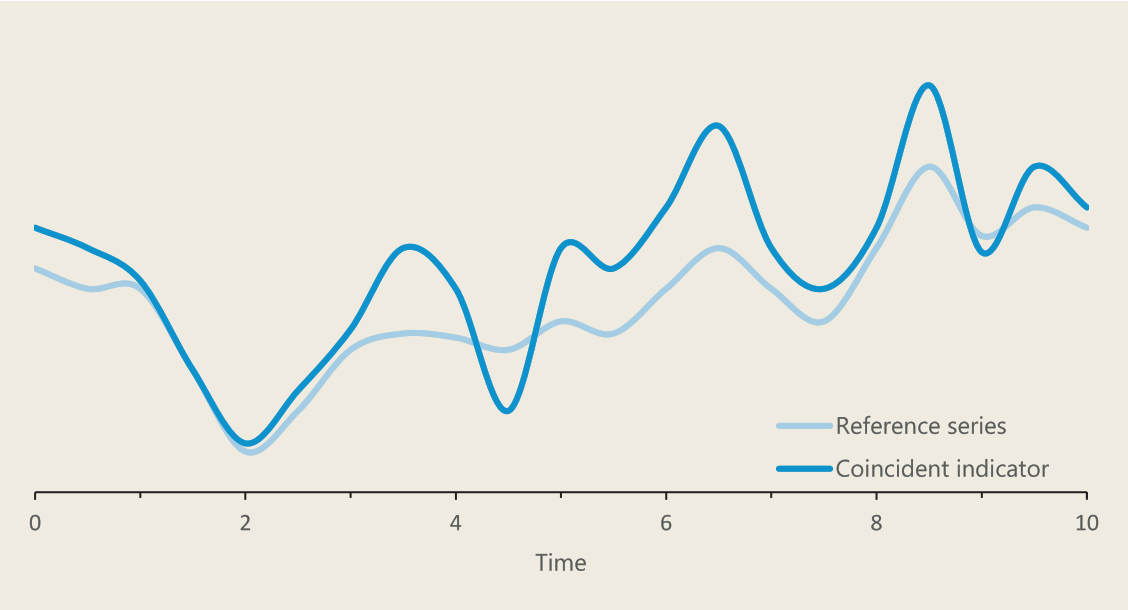
2.38 Composite coincident indicators aim at estimating a current development or phenomenon. For instance, a composite coincident economic indicator would change at roughly the same time as overall economic activity.

*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 (CEIs) EU commission's Economic Sentiment Indicator (ESI)

2.39 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 2.5 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 2.5 **A coincident relationship**



Composite lagging indicators

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

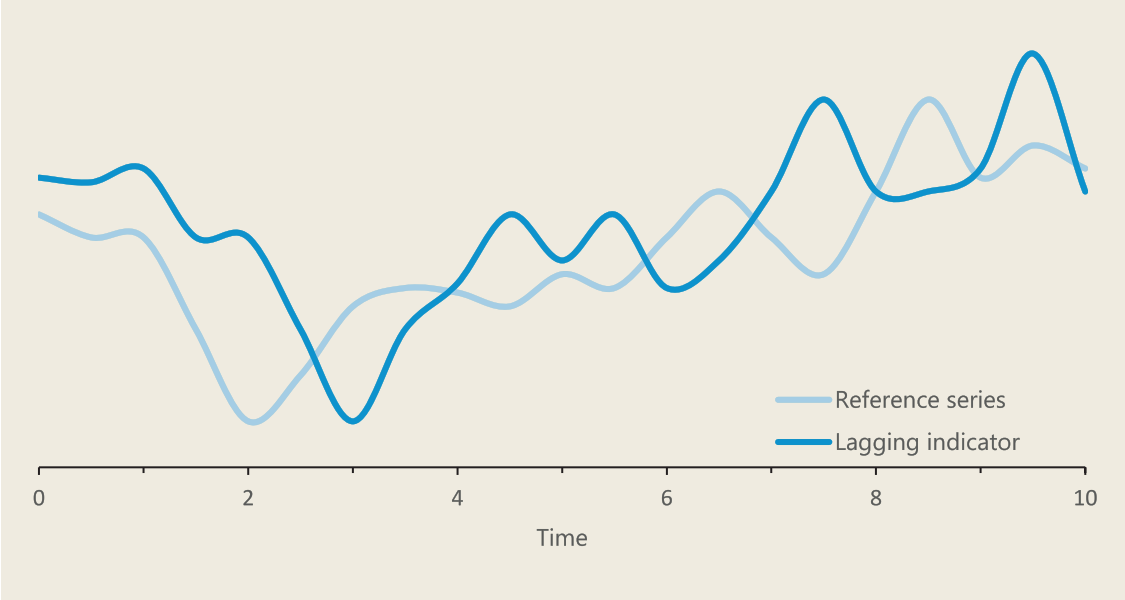
*A **composite lagging indicator** is a composite indicator whose movements follow those of its reference series.*

2.41 Many lagging indicators are produced because of their intrinsic value, and their lagging relationship with other phenomena is secondary. Lagging indicators may be used to validate movements in coincident or leading indicators and may serve as input to analyses on structural imbalances or changes in the economy (The Conference Board, 2001).

2.42 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*. Figure 2.6 shows what a typical lagging relationship might look like in the case of a lag of one period. 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*.

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

Figure 2.6 **A lagging relationship**



2.4.2 Composite indicators without reference series

2.43 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. These phenomena are mainly not quantifiable by traditional measures and of a more abstract nature. Examples are the UNDP Human Development Index (HDI) or the OECD Better Life Index (BLI). 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.

2.44 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.

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

3 The role of statistical offices in producing LCS indicators

3.1 Introduction

3.1 The growing demand for and use of leading, composite and sentiment (LCS) indicators raises a number of challenges for national statistical offices (NSOs) in terms of their role in the production of such indicators, which involves both opportunities and risks.

3.2 Historically, most LCS indicators have been produced by other organisations than NSOs, including government organisations, research institutes, private bodies, or international organisations. However, today many NSOs have engaged in the production of LCS indicators or are considering whether to move into this area of statistical indicators.

3.3 Engaging in the production of LCS indicators is an opportunity to address changing user needs, gain visibility and demonstrate the relevance of official statistics by meeting societies' need for statistics produced according to the principles of official statistics. On the other hand, some may consider LCS indicators to be outside the scope of what NSOs should be producing. Measuring subjective or complex/multi-dimensional phenomena might not be seen as in line with the role of official statistics, and there is a risk that engaging in the production of such indicators may raise criticism and harm the trust in the NSO.

3.4 These issues should be addressed, notwithstanding the many and sometimes conflicting considerations they may bear. The Task Force recommends that each NSO should review its position, where that has not already been done. The circumstances that are relevant may differ from country to country and apply with varying force. Nevertheless, it is important to assess their implications carefully. The main purpose of this chapter is to give a structured framework for making that assessment, grounded in the *Fundamental Principles of Official Statistics*. It begins by reviewing the developing evidence.

3.5 Section 3.2 recalls some of the relevant implications of the *Fundamental Principles of Official Statistics*. Section 3.3 reviews recent developments in the growing and changing user needs insofar as they have a bearing on LCS indicators. Section 3.4 sets out a structured approach by which NSOs might decide whether to produce LCS indicators and, if so, by what means and in what form. Section 3.5 discusses key issues that arise, should the decision be made to compile and publish LCS indicators. Many of these are no different from those that arise in respect of any statistical products. But the discussion emphasises the importance of two dimensions - quality assurance and communication – that are especially relevant, given the relative novelty of LCS indicators as an NSO product.

3.6 The chapter draws in particular on *Towards a harmonised methodology for statistical indicators. Part 2: Communicating through Indicators*" (Eurostat, 2017a) in shaping the discussion in this chapter.

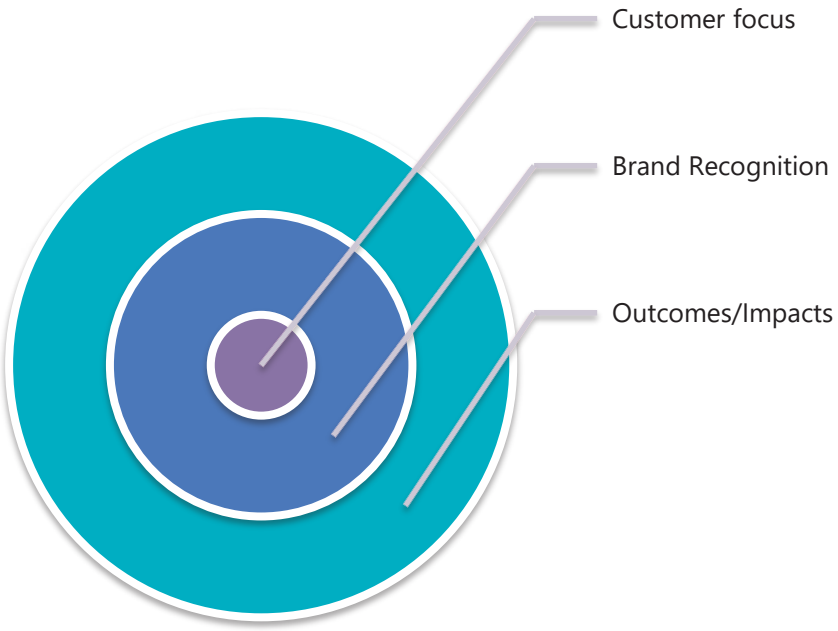
3.2 The role of official statistics

3.7 Producing official statistics to meet societies' needs for relevant, independent and reliable statistical information is a key purpose of NSOs. According to the *Fundamental Principles of Official Statistics*, official statistics should provide relevant and impartial statistics to be made available to citizens. NSOs need continuously to develop their statistics to reflect changes in society and to stay relevant.

3.8 Figure 3.1 illustrates three key dimensions of the value of official statistics. *Customer focus* is in the centre, underlining the responsibility of NSOs to meet society's need for relevant and impartial

information. *Brand recognition* means that statistics produced by NSOs (or others) according to the principles of official statistics is being recognized as impartial and reliable and of high quality. The *outcomes/impacts* dimension refers to the use of official statistics. The value added of official statistics increases with increasing use of the data. Hence, user needs should be in focus of the NSOs' planning and production of statistics.

Figure 3.1 **The dimensions of the value of official statistics**



Source: Adapted from UNECE (2018, p. 23)

3.9 The *Fundamental Principles of Official Statistics* do not spell out in detail what to be considered as official statistics, or how official statistics should be compiled or published. Also, the borderline of official statistics is not static. As societies change, NSOs need to review and then change the way in which statistics are produced and develop new statistics to remain relevant, while adhering to the principles of official statistics. Recent examples include, e.g. the frameworks to compile sustainable development indicators and for measuring quality of employment, areas in which NSOs have engaged by producing statistics only recently[1]. The development of the System of Environmental-Economic Accounting is another example of a framework that allows NSOs to engage in the production of statistics which earlier were not undertaken by NSOs.

3.10 However, what seems clear from the above is that the starting point in considering whether to engage in the production of LCS indicators should be an assessment of user needs and demands in relation to them. These needs and demands will vary from country to country. But, as the next section shows, clear general trends can be detected.

3.3 Growing and changing user needs

3.11 Over the last decades, user needs have evolved quickly reflecting technological and economic developments. In many areas such as well-being, business cycle indicators, environment and sustainable

[1] See "Measuring Sustainable Development" (UNECE, 2013), and "Handbook on Measuring Quality of Employment" (UNECE, 2015)

development policy makers and societies have demanded more and timelier data and new types of statistics.

Socio-economic indicators

3.12 The Stiglitz-Sen-Fitoussi Commission[1] on the measurement of economic performance and social progress looked beyond the traditional GDP measure and suggested areas where more statistical information is needed. The report concluded, among other things, that many aspects of well-being remain difficult or impossible to measure in monetary units and that greater importance should be given to develop qualitative and multi-dimensional measures of well-being. Some of these non-monetary indicators are objective but the report also recommends the use of subjective indicators. The Commission listed the following dimensions of well-being and quality of life that should be considered: material living conditions (income, consumption, and wealth), health, education, personal activities (including work), political voice, social connections and relationships, environmental conditions, and physical and economic security.

3.13 The work of the Stiglitz-Sen-Fitoussi Commission was followed by an increased interest in measuring well-being, satisfaction with quality of life (including quality of employment), happiness and other 'subjective' areas of life and society that may fall outside what has traditionally been considered in scope of many statistical offices. This, in turn, increased the demand for composite socio-economic indicators covering different dimensions and measures of subjective well-being and triggered comprehensive research directed towards new and more appropriate socio-economic indicators.

Economic indicators

3.14 Business and consumer tendency surveys, and resulting confidence indicators, have emerged since the 1960s. In the 1970s, the European Union established standard frameworks which the OECD adapted to the needs of emerging economies in the 1990s. The economic crisis in 2008-2009 revealed deficiencies in economic statistics then available and highlighted the need for timelier and better information. The need was to respond to the statistical challenges of growing complexity in the financial markets and the multiple issues presented by continuing globalisation. As a result of the economic crisis, a considerable amount of research has been devoted to further developing business cycle indicators, in particular to indicators intended to forecast economic turning points.

3.15 Obviously, societies will continue to change as will the demands from users of official statistics. Evidence-based decision making will increase the demand for coherent and relevant statistics at a national level. At the same time, continuing globalisation will increase the importance of the statistics being internationally comparable to enable comparisons between countries and regions.

3.4 Steps in decision making regarding LCS indicators

Step 1. User and stakeholder engagement

3.16 Official statistics have an intrinsic function of supporting well-based decision-making and well-informed public debate. Accordingly, an obvious first step is systematic consultation with users and other stakeholders. The first objective would be to determine what are the unfulfilled requirements for LCS indicators – to what extent would provision of such indicators help decision-makers or help inform public debate. One dimension of this would be how important existing gaps are to decision-makers or sections of society. A second would be how widespread are the unsatisfied demands.

3.17 Ideally, the development of indicators should be based on a wide consensus reached through a dialogue involving all relevant stakeholders and user groups. Potential groups that could be consulted

[1] For more information see the *Report by the Commission on the Measurement of Economic Performance and Social Progress* (Stiglitz, Sen, & Fitoussi, 2009)

depend on factors such as (1) the purpose of the indicator; (2) the institutional and political set-up and traditions of the country; (3) the policy priorities of the involved organisations; and (4) the time and resources available for the development of the indicator - though it is generally a mistake to economise too heavily on consultation.[1]

3.18 A second objective would be to help the NSO gain insight. Stakeholders and users should be consulted, not just about their needs but also to secure the benefits of experience and expertise. They may have views on, for example, which dimensions should be included in a composite indicator, which questions should enter a sentiment indicator, or which population or population groups should be in scope etc. Further, they may have expert knowledge in the specific area that the indicator aims to cover, and that NSOs can draw on. Those developing indicators also need to understand how and why indicators are being used, so they can be designed in a form that is understandable to users and meets their needs. Box 3.1 provides an example of an NSO actively engaging with stakeholders and citizens in the development of a composite indicator for well-being.

Box 3.1 **Developing well-being indicators in Israel**

The Israeli indicator of well-being, sustainability and national resilience

In 2012, the Israeli government adopted a resolution to develop indicators on well-being, sustainability and national resilience. The purpose was to have an understandable, updated and sound picture of the well-being of Israeli citizens in terms of a set of economic, social and environmental indicators. The indicators should provide information for policy making, whether by the government or other decision makers, and to the public for assessing progress and changes in well-being.

The development of the well-being indicators was led by a Steering Committee comprising representatives of the Office of the Prime Minister, the National Economic Council, the Ministry for Environmental Protection, the Ministry of Finance and the Central Bureau of Statistics. The Steering Committee was asked to decide what dimensions to include, appoint work teams for each dimension and present a recommendation to the government on which dimensions and indicators to include. To ensure broad consensus, a thorough consultation with stakeholders and the public in general was carried out. As part of this, online questionnaires were conducted as well as workshops and focus groups to get a feedback from the public. The online questionnaire asked respondents to rank proposed dimensions by their importance to quality of life and to suggest other dimensions that could be included or possible indicators to be used for the dimensions.

As a result of the consultation, 9 dimensions were selected: 1) quality of employment, 2) personal security, 3) health, 4) housing and infrastructure, 5) education and skills, 6) personal and social well-being, 7) environment, 8) civic engagement and governance, and 9) material standard of living. For each dimension, an expert team was established consisting of representatives of government departments, research institutions, civil society organisations and private sector organisations, to suggest 8 indicators for each dimension and the desired direction of change of each indicator. The work of each team was led by a relevant ministry. E.g. the work on material standard and living was led by the ministry of finance, and the work on education was led by the ministry of education.

Based on the proposal by the Steering Committee, the Israeli government adopted a resolution in 2015, requesting the Central Bureau of Statistics to publish annually the indicators of well-being, sustainability and national resilience. The indicators were first published in 2016. For the dimensions where it was found meaningful to compile a composite indicator, the composite indicator is compiled as the unweighted average of the individual indicators of the dimension. It was also decided to develop two additional dimensions: information technology; and leisure, culture and community. Indicators for these two dimensions have been established and were included in the release of the indicators in March 2017 comprising 11 dimensions.

The Publication "Well-being, sustainability and national resilience indicators" (CBS Israel, 2016) provides additional information and details. It is available on https://www.cbs.gov.il/en/Statistical/stat151_eng.pdf .

[1] See Eurostat (2017a), which provides addition explanations on two-way communication and interaction with users and stakeholders. The following paragraphs also draw on Eurostat (2017a).

3.19 For technical topics such as the measurement of economic performance, where a specific expertise is required, the relevant stakeholders could be limited to policy makers and experts in that domain. For other topics potentially engaging the society at large, such as measuring well-being or sustainable development, a much wider group than the technical experts should be involved. Stakeholders may thus also include citizens and non-governmental organisations (NGOs) representing different segments of society. Of course, official statisticians should remain impartial and politically independent in such consultations, as in any other activity.

Step 2. Analysis of strengths, weaknesses, opportunities and threats

3.20 A key input to the decision process in regard to LCS indicators should be an analysis of strengths, weaknesses, opportunities and threats (SWOT analysis). This will not itself generate automatic answers. But the framework does present a way of considering relevant factors in a systematic framework. Strengths and weaknesses are considered to catch factors that are *internal* to the organisation, while opportunities and threats generally relate to *external* factors.

Strengths include advantages of NSOs compared to other organisations in the production of LCS indicators. They relate to what puts the NSO in a better position than other organisations in terms of knowledge, IT, economic, legal or other factors.

Weaknesses cover internal factors that may prevent the organisation from engaging in the production of LCS indicators or make this difficult. Weaknesses may also be limitations, such as the need for NSOs to compile statistics according to the principles of official statistics, which on the other hand also presents a strength of NSOs.

Opportunities may come from changes in demand and in technologies, or changes in government policy related to official statistics. When assessing opportunities, it is useful to look at the organisation's strengths and ask whether these open any opportunities. Equally, examining weaknesses and the possibility of eliminating these may open opportunities.

Threats include external factors which one way or the other provide risks or obstacles to the NSO. This could include, for instance, negative reactions from users, activities of competitors or budget restrictions.

3.21 Table 3.1 below lists issues that would probably be of general interest to all or most NSOs. But, of course, it would need to be tailored for each NSO, taking more detailed and country specific factors into account.

Step 3. Consider pros and cons of LCS indicators

3.22 Table 3.2 summarises the main pros and cons of LCS indicators. This summary is of a general nature and the importance of the different pros and cons will vary according to national circumstances. The table lists the pros and cons that are particular to the three types of indicators. However, as explained in Chapter 2, leading, composite and sentiment indicators are not three distinctive groups of indicators. For instance, composite indicators may also be leading indicators and they may include sentiment indicators. Hence, potentially all pros and cons should be considered depending on the construction of the indicator in question.

3.23 It should be noted that many leading and composite indicators may be based on existing data. In this case, the indicators may be compiled at relative low costs, without additional data collection and avoiding increasing the response burden. As regards sentiment indicators, these may be based on data collected through existing surveys or separate surveys will need to be conducted. In either case, this will include additional costs and increase response burden.

Table 3.1 **SWOT analysis of the production of LCS indicators by NSOs**

Strengths	Weaknesses
- Brand of official statistics and general trust in NSOs as providers of impartial and high-quality statistics - Global set of existing recommendations and statistical competences that NSOs can draw on - Statistical and methodological expertise - Wide knowledge of and access to data sources - Efficient production by drawing on existing infrastructure and in-house data sources - Experiences in communicating statistical information - The use of existing tools and platforms for dissemination	- Possible conflicts with the role or priorities of NSOs, or limitations by national legislation - Lack of internationally agreed guidelines for some types of LCS indicators - LCS indicators may not live up to the existing quality standards of the NSO - Lack of resources to develop or regularly compile and communicate LCS indicators, which may require new methods and competences - Necessity to implement a suitable quality assurance programme

Opportunities	Threats
- Demonstrate the relevance and value of official statistics by producing needed LCS indicators - Meet emerging user needs, reach out to new user groups and gain visibility, while ensuring compliance with the principles of official statistics - Increase trust in the indicators and facilitate broader usage of these as tools for policy making and business decisions - Increased relevance of official statistics already produced, as input into LCS indicators - Opportunity to engage in or strengthen partnerships with other producers of LCS indicators - Increase expertise by using new IT-tools and new data sources	- Possible criticism of the NSO and reduced trust in official statistics if the LCS indicator is seen as non-compatible with the role of the NSO - Risk for the reputation of the NSO if the performance of the LCS indicator is poor - Possible higher risks of misinterpretation or misuse compared to other, well-established statistical series - Influence from outside the NSO on the production of LCS indicators could be a serious threat to the quality of the indicators and the general trust in the NSO - Budget restrictions

Step 4. Conduct option appraisal

3.24 Based on the material gathered from step 1 -3, a systematic option appraisal can be conducted to give basis for a considered way forward.

3.25 A first and critical step is to establish the range of options to be considered. These will include the following:

- A default option of take no action: do not produce LCS indicators.
- Engage in production of one or a range of LCS indicators.
- Engage in production of LCS indicators through cooperation with other organisations.

3.26 Having established the options to be considered, these can be systematically appraised based on the information collected in step 1-3. In particular, the results of the user/stakeholder engagement in Step 1 may provide information about the scale of the benefits from NSOs' engaging in the production of LCS indicators.

Table 3.2 **Pros and Cons of leading, composite[a)] and sentiment indicators**

	Pros	Cons
Composite	• Can summarize complex, multi-dimensional realities	• May send misleading information if poorly constructed
	• Are easier to interpret than a battery of many separate indicators	• Invite to simplistic conclusions
	• Facilitate communication with general public and promote accountability • Suitable to bring issues on the policy agenda • Help to construct/underpin narratives for lay and literate audiences • Enable users to compare complex dimensions effectively • Can be used to assess developments over time and for evaluating country performance	• The selection and weighting of dimensions and indicators could be the subject of political disputes • May disguise serious failings in some dimensions and increase the difficulty of identifying proper remedial action, if the construction process is not transparent • Lack of internationally agreed practices
Leading	• Can be used to give early warnings of changes in the business cycle	• May produce poor predictions/ forecasts
	• Can be used for forecasting possible turning points and recession/expansion phases	• May not over time maintain its leading quality compared to a given reference series
		• Underlying methodology may be questioned
Sentiment	• Can provide information of sentiment/subjective issues not elsewhere available	• May be criticized for being subjective, and not reflecting reality
	• Timely and present, which may be published in advance of any corresponding quantitative statistics	• Production and communication of the indicators may challenge the traditions and practices of the NSO
	• Simple in its messages, well-suited for communication	

[a)] The pros and cons of composite indicators which are listed here are based on OECD (2008, pp 13-14).

3.27 Information about the costs and benefits of the various options must be collected and summarised. As for other statistics, also the response burden must be considered. The information above should help indicate whether and to what extent there would be benefits from proceeding with any of the options, other than the "do nothing" one. That needs to be considered against the costs of proceeding and whether the former exceed the latter. Notwithstanding the extensive potential benefits from LCS indicators, the costs may exceed them or, even if the cost benefit equation is favourable, there may be greater benefits from using the funds for a different purpose.

3.28 The possibility of entering into cooperation or partnership with other organisations should be considered carefully. Partnership arrangements may be particularly relevant, if there are bodies with knowledge or expertise that the NSO does not possess in depth. For example, a trade body may have much greater knowledge of its firms and industries than an NSO would itself be likely to have. Options for partnerships might take several forms. One might be for the NSO to construct and publish LCS indicators jointly with the other institution, benefitting from their combined expertise. An alternative might be for the NSO to quality assure the statistical methodology by which the LCS indicators are produced but otherwise leave publication and responsibility for the indicators concerned with the partner body. Some NSOs, for example in Switzerland and the Netherlands, have found ways to cooperate with external research institutions to produce composite indicators. Box 3.2 provides an example of partnership arrangements undertaken by Statistics Sweden.

Box 3.2 **Strategic partnerships of Statistics Sweden**

Strategic partnerships. Most official statistics in Sweden are produced by Statistics Sweden. Official statistics not produced by Statistics Sweden are produced by other agencies adhering to the principles of official statistics, with whom Statistics Sweden cooperates. One example is the Economic Tendency Survey in Sweden, which is used for the compilation of several confidence indicators for the Swedish economy. These indicators are produced by the National Institute of Economic Research. The indicators are part of official statistics and part of the European Commission's Directorate General for Economic and Financial Affair's (DG ECFIN) business and consumer surveys. Statistics Sweden provides statistical and methodological support and advice to the National Institute of Economic Research to produce these indicators, including on the weighting of component series.

Source: The Swedish National Institute of Economic Research[1]

3.5 Compiling and communicating LCS indicators

3.29 If after the procedure suggested above, the decision is to proceed towards the compilation of LCS indicators – either by the NSO itself or in cooperation with a partner institution – the statistical production process needs to be put in place. In general terms, this is no different from a decision to proceed to producing any other statistics. The challenges involved and possible ways to overcome them are discussed further in Chapters 4 to 6. It is worth noting, however, there are particular issues concerning quality assurance and communication of LCS indicators that should be taken into account, which are highlighted below.

Quality assurance

3.30 Sound and adequate quality assurance is important for all statistical production. In principle, production of LCS indicators is no different in this respect. However, as relatively new products for NSOs, the reputational costs from failures of quality control could be substantial. Good quality assurance of LCS indicators is therefore of especial importance.

3.31 The development and the production of an LCS indicator would involve a number of processes and steps similar to those that would be used when developing other statistics:

- *Preparation:* In the preparation of the indicator it is crucial to develop a sound conceptual framework that can serve as a reference frame and on which the compilation of the indicator can be based. The conceptual framework should define the phenomenon to be measured and in the case of composite indicators outline the dimensions of the composite indicator. The preparation would also include selection of data series for the reference series and for the component series. As mentioned earlier, users and stakeholders should be involved when developing the conceptual framework.
- *Data processing:* Data will need to be checked and brought into suitable format. This process may involve imputation of missing observations, normalisation, smoothing or other manipulations of data series as well as weighting and aggregation where component series have to be aggregated into one composite measure.
- *Analysis:* The statistics, the indicator, will need to be carefully analysed, which would include evaluation of the indicator's robustness and sensitivity as well as its overall performance. This may also involve comparison with related statistical series.

3.32 For these processes and steps, suitable quality assurance should be in place. Different quality assurance frameworks for official statistics exist, such as provided by the UN, the European Statistical System or by the OECD. The frameworks cover institutional environment, statistical processes and statistical output, and list a number of criteria to be met to ensure the quality of statistical production. These frameworks diverge to some extent and provide different levels of detail, but essentially cover the

[1] See https://www.konj.se/english/publications/economic-tendency-survey.html

same criteria required to ensure that the statistics produced are relevant, timely and accurate and comply with the principles of professional independence, impartiality and objectivity.

3.33 A useful framework that describes steps and processes needed for producing official statistics is described under the Generic Statistical Business Process Model (GSBPM) [1]. It provides a standard framework and harmonised terminology to help statistical organisations modernise their statistical production processes.

3.34 While the production of LCS indicators should meet all criteria of official statistics, the following ones are particularly important to consider for the production of these indicators:

Institutional environment, Statistical processes

- Professional independence
- Impartiality and objectivity
- Methodological soundness

Statistical output

- Relevance
- Accuracy and reliability
- Coherence and comparability
- Accessibility and clarity
- Timeliness and punctuality

3.35 In many cases, what will be needed for LCS indicators may be no different from that required for production of other official statistical outputs. The importance of methodological soundness, however, for these relatively new forms of NSO outputs needs to be underlined. Before engaging in their production, NSOs need to consider and examine possible compilation methods to ensure that the indicators can be produced based on a sound methodology without jeopardizing the trust in official statistics or questioning the impartiality of the NSO. To this end, data sources and methods should be fully documented and made available to users to ensure transparency.

3.36 The production of, in particular, composite indicators may involve different units or departments of the statistical office. Responsibilities between and within departments must be agreed in advance taking available expertise and resources into consideration and a suitable organisation of the work processes must be established.

3.37 To the extent possible, indicators and their component series should be aligned with the scope and definitions of other statistics. For indicators with a reference series, scope and definitions should follow those of the reference series. For indicators without reference series, for example a composite indicator on well-being or a single sentiment indicator on households' perception of security or their economic situation, there is no measured statistic to target.

3.38 The quality of component series inevitable affects the quality of the composite indicator to which they contribute. So, to the extent possible, component series should be in line with agreed scope and definitions in the areas they are intended to cover. Component series may come from official statistics, in which case they should follow agreed definitions. When this is not the case, e.g. if the component series are produced by other organisations that do not follow agreed standards, differences in definitions and coverage should be considered before introducing the component series into the composite indicator. Using component series that are in line with existing definitions will improve the quality of the composite indicator and facilitate comparison with other related statistical series, even when there are no reference series.

3.39 Reference is recommended to available international methodological guidelines, such as those provided by Eurostat, the OECD and the UN.

[1] For more information, see https://statswiki.unece.org/display/GSBPM/Generic+Statistical+Business+Process+Model

Communication

3.40 Good communication is especially important for LCS indicators. This relatively new form of NSO outputs carries particular risks of misunderstandings that need to be countered.

3.41 Historically, communication was often seen as an activity at the end of the statistical value chain. Having compiled statistical outputs, how should NSOs inform users and potential users as to what was now available? But such an approach has been seen to have severe limitations. Communication is better seen as a continuing strand throughout the design, production and dissemination process.

3.42 In the context of LCS indicators, three key stages can be identified. The first relates to the active stakeholder and user consultation at the outset of the process, as already discussed above. From the NSO's point of view, this gives crucial input both as to whether indicators should be produced at all, but, if so, information as to the most helpful design. But it also puts users on notice as to what is being proposed, giving them the opportunity to consider how they might contribute experience and expertise to the endeavour.

3.43 The second stage for communication is during the design and production stages. A degree of iteration is liable to be needed as the exercise proceeds, which gives the opportunity for stakeholders and users to help shape matters. If the work is being carried out by some form of partnership arrangement, some such engagement is likely to happen automatically. But it is important to ensure all potential stakeholders have the option to contribute views. In this way, relevant expertise can be exploited fully but it will also help to maximise user ownership of the eventual LCS indicators that are published.

3.44 Thus, it is essential to establish an ongoing interaction between data producers and data users. Users, for instance policy makers, user groups or organisations, may assess the relevance of proposed dimensions and indicators for a given purpose, and statisticians can assess the measurability of dimensions and indicators in an iterative process. An ongoing dialogue with users is a key to producing high quality statistics that are also policy relevant, especially as indicators may change as scientific knowledge, policy concerns and data availability progress. It is worth mentioning that when indicators are used for monitoring a specific policy, the definition of the indicators should be kept constant to be able to assess the development over time, e.g. if the situation is moving towards a given target.

3.45 In summary, communication with stakeholders and users relates to the social function of indicator-based communication, which enables citizens to participate with a better-informed opinion in society's decision making. It opens statistics to the democratic process and enables users to have their say on the relevance of the statistical indicators. For instance, by being involved in the development of socio-economic indicator sets, citizens no longer play the role of passive users of statistics but become 'co-creators' of statistics. As a result, they may obtain knowledge allowing them to evaluate societal progress and to develop informed opinion. Interactivity plays a central role both at the early stage of developing the indicators and later at the stage of their dissemination. Advancements in information technology which allow for interactivity can facilitate this approach.[1]

3.46 The third stage of communication is the post production dissemination, presentation and explanation of the indicators. This will involve not only presenting the numbers but also interpreting their implications, within the context that they are to be used. In turn, that means conveying not just what the indicators do imply but also warning against drawing conclusions which the indicators will not bear. The process is likely to be the easier to the extent that the first two stages of the ongoing communication have been carried out well. More detailed discussion of these issues, together with recommendations, are contained in Chapter 7.

3.47 One option to be considered is whether to publish LCS indicators as *experimental statistics*. At an intermediate stage point in their development, it might for example, be the case that not all quality criteria can be met, or the NSO might simply want to have more experience of the potential issues arising

[1] Readers are referred to Eurostat (2017a) and Eurostat (2017b) for more information about interactive communication with users and use of IT communication tools.

from their publication and use. This would allow the NSO to gain experience and collect feedback from users and stakeholders, without putting its impartiality and professional reputation at risk. More information on this possibility can be found in Section 7.4.

3.48 It is important, however, to see experimental statistics status as a temporary stage in the development of LCS indicators and not just a convenient permanent compromise. Ultimately, a decision is needed as to whether such indicators are fit for purpose or not.

3.49 Finally, the ongoing stages of communication should themselves be seen as part of an iterative cycle. Responding to questions and challenges regarding the LCS indicators that have been published, in the context of the public debate, may well indicate areas where they could be further developed or refined to ensure their continued relevance and usefulness.

4 Sentiment indicators

4.1 Introduction

4.1 Sentiment indicators in this report are defined as indicators that reflect the opinions, attitudes or expectations of respondents.

4.2 They can be divided in two main groups: economic and socio-economic. Many economic sentiment indicators aim to give a picture of the current economic situation in terms of e.g. production, turnover or employment. Others reflect expectations about the future economic development, for instance the expected production or sale in the next month, or over the next quarter or year.

4.3 Socio-economic sentiment indicators are based on individuals' or households' assessments of their current situation, or their opinion on various issues or expectations about the future. This may include, for instance, their sense of well-being, satisfaction with the different aspects of life or their expectations or plans for the next year.

4.4 Both economic and socio-economic sentiment indicators have become more common and are used for a variety of purposes. Economic sentiment indicators are often used to provide early information about the economic situation before traditional economic statistics are available. Socio-economic sentiment indicators on well-being, the quality of life or aspects of quality of life, e.g. on health, education, family relations etc., provide information about households or individuals perception or expectation which is not obtainable elsewhere. These can usefully inform public discussion or policy decisions and planning.

4.5 This chapter focuses on the compilation of single sentiment indicators. This includes sentiment indicators based on a single question as well as sentiment indicators based on several questions within the same dimension, often obtained in the same survey, which can easily be aggregated or averaged into one single measure. An example would be a sentiment indicator of economic confidence based on three questions about the production in the previous, the current and the next quarter. The indicator would be a simple average of the three questions.

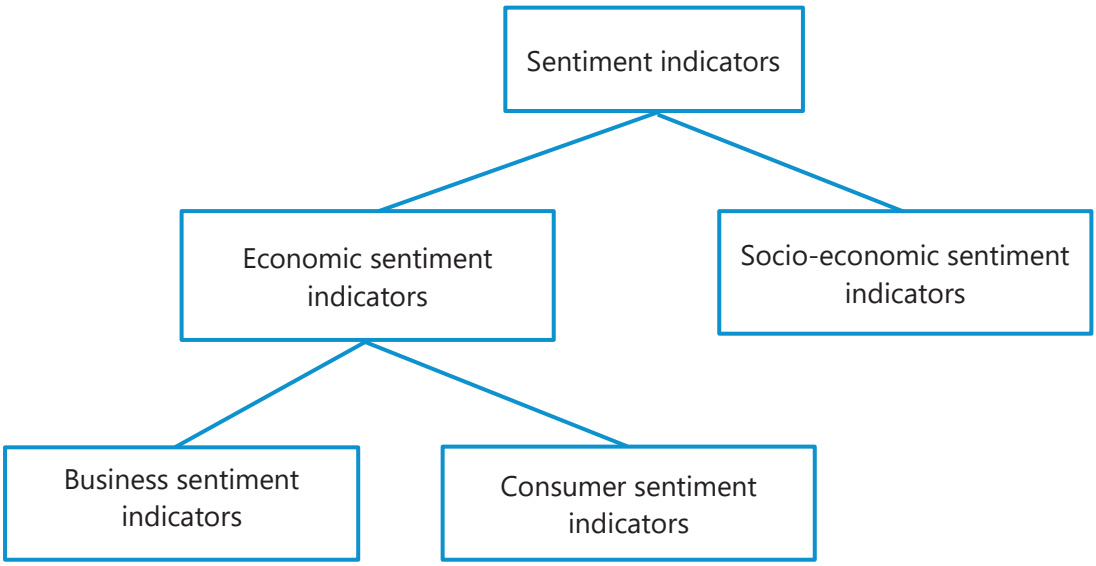
4.6 Single sentiment indicators may be used as component series in composite indicators, which span over different dimensions. Composite economic indicators and composite socio-economic indicators, which may include sentiment component indicators, are discussed in Chapter 5 and Chapter 6, respectively. Chapter 5 presents composite economic indicators based only on sentiment indicators.

4.7 Quantitative data in some cases may be used as estimates of the perception or expectation of individuals. For instance, retail sales collected via credit card transactions might be used to reflect consumers' confidence in the current economic situation, or investment statistics may be used as an indicator of business expectations. The use of single quantitative series for estimation of sentiments - perceptions or expectations – is not dealt with in these Guidelines.

4.8 Single sentiment indicators can be grouped in two main types, economic and socio-economic, as shown in Figure 4.1. Further, economic Sentiment indicators are sub grouped into Business Sentiment Indicators and Consumer Sentiment Indicators.

4.9 After the brief overview of sentiment indicators below, Section 4.2 discusses *economic sentiment indicators* and describes the two most frequent surveys which produce this type of indicator, namely *business tendency surveys* and *consumer tendency surveys*. The section also gives advice on comparison to reference series and how to determine if the indicator is leading, coincident or lagging. In Section 4.3 *Socio-economic sentiment indicators* are discussed. Section 4.4 discusses issues in relation to international comparability. Finally, Section 4.5 provides a summary of recommendations for producing sentiment indicators.

Figure 4.1 **Overview of types of Sentiment Indicators**



4.2 Economic sentiment indicator

4.10 Economic tendency surveys are the main data sources for economic sentiment indicators. Tendency surveys provide timely qualitative data thanks to pre-coded and relatively simple questionnaires. The type of the information collected allows for using data without doing advanced calculations, consistency checks within data or even cross-checks with external sources. The simple production process and the timeliness are two of the main characteristics of economic sentiment indicators.

4.11 There are two prominent types of economic tendency surveys; *business* tendency surveys and *consumer* tendency surveys. Typically, questions are of qualitative nature, asking for an indication of direction of development: improve, worsening or remain unchanged.

4.12 Business situation evaluation, demand-turnover expectation and sale price expectation are typical examples for economic sentiment indicators based on business tendency surveys. Consumer tendency surveys cover items such as the current financial situation of households, attitudes to spending money on durable or semi-durable goods, and the probability of buying a car.

4.13 Economic tendency surveys have a long history. In the 1920s, trade associations in Britain and Germany started conducting them and in the 1950s, NSOs, research institutions and central banks of countries like France, Germany, Italy, etc. followed. The Centre for International Research on Economic Tendency Surveys (CIRET) was also founded in this decade. CIRET is a forum for leading economists and institutions concerned with analysing and predicting the development of the business cycle and the economic and socio-political consequences. In the 1960s, the European Commission's predecessor launched what is now known as the Joint Harmonised EU Programme of Business and Consumer Surveys. In the 1990s, the OECD started a programme on business tendency surveys and lastly, in the aftermath of the last financial crisis in 2008/2009, the importance of economic tendency surveys was acknowledged at an international level. This is reflected in the data template for short term statistics established as part of the international programme on short-term economic statistics endorsed by the United Nations Statistical Commission in 2011, which includes economic sentiment indicators from both business and consumer tendency surveys. See the *Data template and Metadata for Short-term Statistic*s (UN, 2018). The data template includes a set of indicators that are internationally recognized as being important for macroeconomic surveillance, early warning of economic and financial vulnerabilities and the detection of turning points in business cycles.

4.14 Timeliness is a key advantage of economic sentiment indicators. This stems from the use of simple survey questionnaires and a short production process. Their main risk is related to their subjective nature being based on respondents' perceptions or expectations. They may show poor performance compared to the reference series that they aim to track[1]. Economic sentiment indicators therefore must be carefully documented and explained to users.

4.2.1 Methodological material

4.15 Several methodological guidelines and handbooks are available that producers of sentiment indicators may refer to. The European Commission's Directorate General for Economic and Financial Affairs (DG ECFIN) conducts business and consumer tendency surveys in collaboration with NSO's, research institutions, central banks and private statistical institutes. At the DG ECFIN homepage, the *Methodological guidelines and other documents* provides recommendations for conducting such surveys. The *Methodological User Guide* (DG ECFIN, 2017) provides the basics of the surveys including sampling, aggregation and weighting, seasonal adjustment and calculation of balances. In the guidelines are also listed the questions asked within the monthly/quarterly Industry survey, construction survey, services survey and retail trade survey, as well as within the monthly/quarterly consumer survey and the biannual Industry Investment survey.

4.16 The publication *List of 'best practice' for the conduct of business and consumer surveys* (DG ECFIN, 2014) complements the above guideline with recommendations for best practices. Sampling frame, sampling size, sampling methods, weighting procedures, seasonal adjustments and measures to increase response rates are reviewed.

4.17 Also, to be mentioned is the Special report No 5/2006. European Economy: *The Joint Harmonised EU Programme of Business and Consumer Surveys* (DG ECFIN, 2006) which provides a) A user manual to the Joint Harmonised EU Programme of Business and Consumer Surveys b) International guidelines and recommendations on the conduct of business and consumer surveys and c) Studies related to the EU BCS programme.

4.18 The United Nations publication *Handbook on Economic Tendency Surveys* (UN, 2015) aims to provide best practices and harmonized principles on sample selection, questionnaire design, survey questions, survey execution, data processing and the use of composite tendency indicators. Finally, *Business Tendency Surveys: A Handbook* (OECD, 2003) also has recommendations on questionnaire design, sample selection, uncertainties, and result processing.

4.2.2 Compiling business tendency surveys (BTS)

4.19 Business tendency surveys (BTS) are conducted in many countries around the world in various forms and under different labels by NSOs, central banks, universities or private agencies. The Purchasing Managers Index (PMI) from the Institute for Supply Management is an example from USA, while the central bank of India carries out the BTS in India.

4.20 Another example is the European Commission Business Tendency Surveys, which are part of the Joint Harmonized EU Programme of Business and Consumer Surveys. The programme includes monthly surveys of industry (manufacturing), construction (building), retail trade and services. In addition, a half-yearly investment survey within manufacturing industry is carried out. Often, the monthly questionnaire is expanded with additional questions each quarter. Participation in BTS is mostly voluntary but compulsory in some countries, and the quality of the results depends on the willingness of enterprises to participate. To what extent the compulsive surveys are enforced is probably limited. Hesitations

[1] For instance, the research paper *The usefulness of Consumer Sentiment: Assessing Construct and Measurement* (Kellstedt, Linn, & Hannah, 2015) investigates the reliability of the Consumer Sentiment indicator, and concludes it falls short in some aspects of predictive validity.

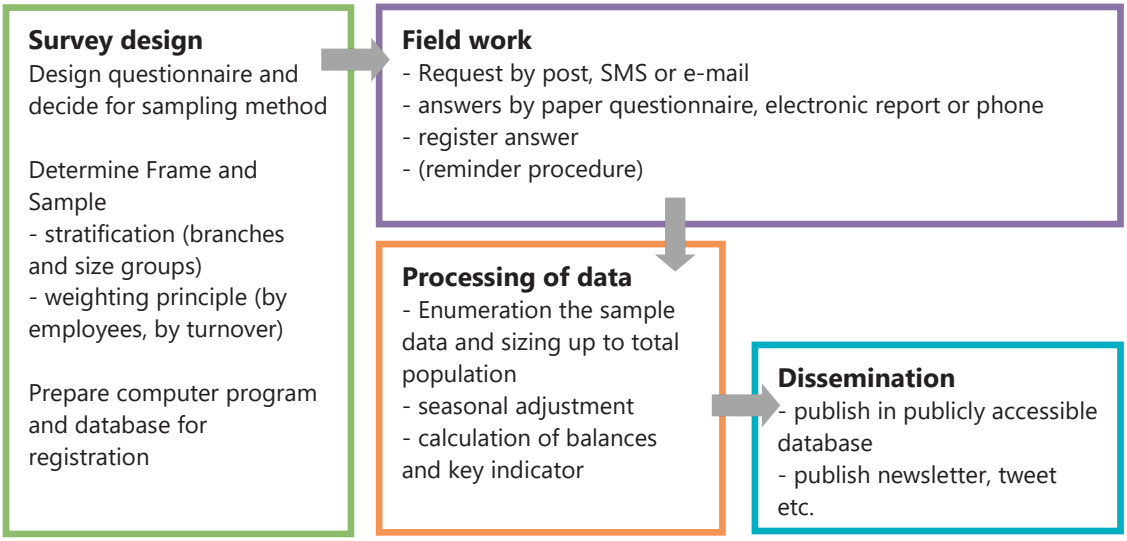
towards compulsory surveys especially regarding tendency surveys are based on the risk that it could reduce the quality of the answers and slow down the field work because of reminding procedures.

4.21 For BTS, the responding unit should be the manager of the enterprise while accountants are generally responsible for filling in quantitative surveys. This is related to the qualitative nature of the survey since the managers are more likely to have overall information on the current situation of the company and the sector.

4.22 The enterprises included in the survey should be convinced that the information they provide is not only an important input for macro-economic analysis (policy making) by trade associations, the financial sector and the governmental administration, but also valuable information that can be used by the enterprises more directly e.g. in market research.

4.23 The main steps of the BTS production process, survey design, field work, data processing and dissemination, are shown in Figure 4.2 and discussed in the following paragraphs, except dissemination, which is discussed in more detail in Chapter 7.

Figure 4.2 **Production process for business tendency surveys**



4.24 The business tendency survey in services in France, the European Commission harmonized Business Tendency Survey and the business tendency survey in manufacturing in Israel are presented in Box 4.1, Box 4.2 and Box 4.3, respectively.

Survey Design

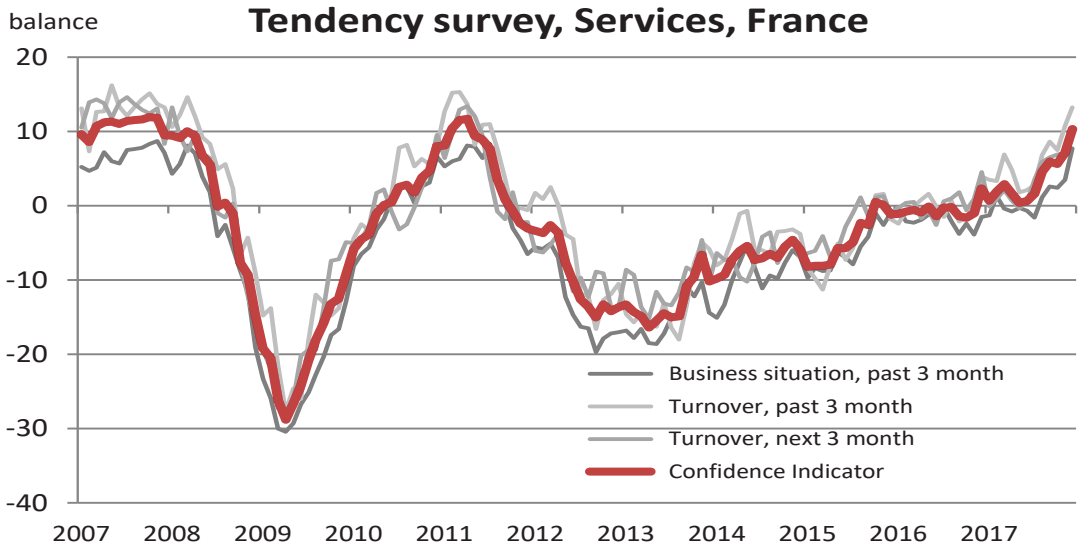
4.25 The survey can either be conducted as a random sample or as a panel sample. In the latter case, the same companies receive recurrent requests for participation. This may lead to significant drop out, so the panel sample must be supplemented at frequent intervals.

4.26 For the sample design, breaking down according to economic activity is a useful stratification. Stratification into groups of company size is also common. Often, establishments or enterprises below a certain minimum threshold size in terms of number of employees or turnover, are not covered. The DG ECFIN (2017) *Methodological User Guide* gives additional guidance on sample design.

4.27 Furthermore, the survey sample may be divided by region; this is especially of importance for larger countries and for countries with large regional differences.

Box 4.1 **EU harmonized Business Tendency Survey, Services - France**

The French services tendency survey is part of the EU harmonized programme. The survey sample is stratified using two criteria: principal economic activity at NACE sub-class level and turnover (as an indicator of enterprise size) with four turnover brackets. The survey is monthly, and requests are sent by e-mail or post. Most of the respondents answer online on a dedicated and secure website, the rest fill in a paper questionnaire. A reminder procedure is activated about the 7th in the month. By the 21th in the survey month, the data are compiled, all questions are processed and the *balances* for each indicator are calculated.



Confidence indicator and components; seasonally adjusted. Source: DG ECFIN based on INSEE data.

The monthly survey includes the six harmonised questions of the EU Joint Programme, about the business situation development over the past three months, the change in turnover and employment over the past three months and over the next three months, and the expected trend of sales prices for the next three months. The respondent answers by selecting an up, stable or down arrow. Additional quarterly questions are asked about factors limiting production: insufficient demand; shortage of labour force; shortage of space/equipment; financial constraints; other factors; none. Also, the company is asked if its volume of activity could be raised with present resources if demand increased; and if so, by what percentage.

Besides the EU harmonized questions, complementary questions are asked, for instance about hiring problems; the trend of export turnover and operating balance result; opinion about the general outlook for the whole sector; the recent change in sales prices, and the development of the company's investments.

The balances summarising the qualitative information provided by the business tendency surveys play an important role in the forecasting process carried out by INSEE, as these balances in general are closely correlated with corresponding macro-economic variables. Further, a specific composite Business Climate Indicator is calculated from eight of the *balances*, by factor analysis, for the whole services sector and at sub-sector level, to better track the economic outlook in these activities.

4.28 The coverage of economic activities within each sector (services, manufacturing etc.) is determined by considering the economic activity. Most market oriented economic activities which are sensitive to cyclical movements of the economy should be covered in the survey. The coverage of the services sector raises particular challenges, since public and semi-public institutions may have commercial activities and for this reason should be included in the sample.

4.29 As for other survey-based statistics, where possible the response burden should be minimized by applying suitable sampling frames and techniques, including e.g. use of electronic reporting systems.

4.30 In general, economic activities should be classified according to the Standard Industrial Classification of All Economic Activities (ISIC) (UN, 2008) or the EU classification system NACE (Eurostat, 2008), to ensure international comparability. Also, when selecting the economic activities within a survey

there would be advantages in ensuring the indicator has the same coverage as a possible reference series. Within the EU Business and Consumer Surveys, the exact economic activity coverage is defined according to DG ECFIN (2017).

Formulation of survey questions

4.31 Questions in business survey are usually asked about the business situation, turnover, sales, employment, sales prices, stocks and orders. Questions about the actual development target a previous time period up until the present, and questions about expected development target a future time period from the present onwards. Questions about the present/current situation are also asked.

4.32 Typically, three answering options (a negative, neutral and positive value) are provided. For questions about current stocks, answers can be of the type: too large, adequate or too small. For questions about the current situation, answers can be of the type: decrease, unchanged or increase. This follows an ordinal Likert scale. If finer nuance is needed, answering options can be expanded to five: strong increase, increase, unchanged, decrease or strong decrease.

4.33 Questions may be value-laden. For example, a question on the current overall order books can be assessed to be *more than sufficient, sufficient,* or *not sufficient*. A more neutral phrasing of the answering options is also possible*: above normal, normal for the season,* or *below normal*. The latter is not as value-laden as the first, but the first may be easier for the respondent to understand. In all cases, it is important to maintain the same formulation of the questions. Changes may lead to level shifts and thus breaks in time series.

4.34 Respondents may be asked to disregard seasonal effects when assessing the changes. However, in practice survey results may nevertheless display a seasonal pattern and therefore need to be adjusted (see paragraph 4.51 on seasonal adjustment).

4.35 The time period which respondents are asked to consider may differ from one country to another. In the European Harmonized Program of Business Tendency Surveys, businesses are asked to consider the previous three months and the next three months, including the survey month. According to the guidelines (DG ECFIN, 2017) for each of the three months periods, the respondents should evaluate the changes *over* the period, from the beginning to the end.

4.36 In summary, qualitative survey questionnaires should be easy and quick to complete. In many cases the respondent may have the information asked for at hand and does not need to look it up. The use of few and clearly formulated questions and predetermined reply options makes it easier to reply, which helps with the willingness to respond and reduces the time used for data collection.

Field work of the survey

4.37 Generally, BTS are conducted via web-forms or paper questionnaires send by post. However, in some countries reporting by fax, telephone interviewing or computer assisted face-to-face interviewing is also used for data collection. For monthly surveys the field work period is usually the first two or three weeks of the month. Data and possible newsletters should be published by the end of the survey month, if possible, or at the beginning of the following month.

4.38 Participation in business tendency surveys is usually voluntary. Since these surveys include questions about the respondents' assessment of past or current developments or their expectations about the future, mandatory participation may harm the reliability of the answers to survey questions.

4.39 For the field work, it is recommended to draw on the experiences of other voluntarily surveys and from expertise knowledge about the expected willingness to participate in the survey. What will it take to get enough responses? How should the survey be promoted? What hurdles need to be overcome? Should the respondents receive a thank-you-letter with a summary or graphs of the main results included?

Box 4.2 **The European Commission harmonized Business Tendency Survey**

The European Commission (EC) harmonized Business Tendency Survey targets the development over the past 3 months and the next 3 months along with questions on the current situation. Four surveys are carried out, namely the Manufacturing, Services, Retail trade and Construction sectors.

In the questionnaire of the EC Business Tendency Surveys, the main section of questions typically covers production/turnover, employment, order books, stocks, prices. They are answered by ticking one of three options, namely negative, positive or neutral, e.g. decrease, increase or unchanged. The actual questions are adapted to each survey.

Additional questions are to be answered in different ways. Some need to be answered in the same way than above. Others are answered by tick marks if positive. For example, the various listed factors (like insufficient demand, shortage of labour force or financial constraints) for questions about certain factors limiting the company's production. There are also questions that require numbers, such as the percentage capacity utilisation and how many months' production is secured in the order books.

While the Retail trade survey within the EC Business Tendency Surveys has identical questionnaires from month to month, the three others expand their questionnaires in the first month of a quarter (January, April, July, and October) with additional questions. For more information about the EC Business and Consumer Surveys, refer to DG ECFIN (2017).

4.40 It has become more common to conduct the surveys over the internet or by smart phone apps. Establishing an online web-form is appealing because it saves paper, printing costs, postage and the many hours needed to capture responses into databases. In practice, the newly selected respondents would receive an introduction letter by post, which then guides them to the web form. When completing the web form, the respondent is asked to provide an email-address for further contact. When the next survey becomes due, the respondent receives an invite per email to complete the web form.

4.41 Many respondents welcome online questionnaires or smart phone apps. However, some will prefer paper questionnaires. Among the latter may be large companies whose responses are important for the overall quality of the survey. A mixed mode of responding options (paper and web) can be considered.

4.42 One of the factors impeding the ease of web forms is security. Often access to an online form demands that the respondent be identified with a login name and password, which then provides the respondent with access to other information about the company. This can be perceived as an obstacle. However, this could be overcome by the development of a one-directional system that generates a hyperlink in the invitation email and provides respondents with access to their specific surveys when they click on it.

Data processing

4.43 Once the data collected via the online forms, telephone surveys and paper questionnaires is captured, it can be processed. Important steps in the processing of the results are elaborated below. After the processing of the results, it can be made public, a process which is dealt with in Chapter 7.

4.44 There are common methodologies to process the data. They include the calculation of net balances and confidence indicators. Automated computing and systems must be adopted for each survey, indicator and data base.

4.45 Basically, data processing entails the enumeration of the individual businesses' answers to the survey questions in such a manner that the results cover the entire population of that sector. Thereafter the percentage shares per answering option can be calculated for each question. For instance, the percentage of respondents' selecting an increase, decrease or no change in turnover is calculated. The calculations become more complicated, because of stratifications, as well as size and sample weights.

Size and sample weights

4.46 In a BST, companies in the sample are typical *weighted according to size,* as measured by the number of employees or turnover. Weighting is necessary because the responses do not automatically distinguish between small and large firms as in the case of a quantitative survey. The weighting of qualitative responses ensures that more importance is attached to the responses of large firms relative to those of small firms.

4.47 It is also typical to stratify into size groups, where the probability of being chosen is much higher for big companies than for small companies. This helps to minimize the size of the sample, since the sample coverage measured by the number of employees, for instance, becomes bigger when compared to the entire population.

4.48 The enumeration process is the transformation of the sample results to cover the entire population within the same economic activity/activities. In the enumeration process, strata with small companies will have a higher weight (*sample weight*) than big companies, since their weight is determined by the inverse of the probability of being chosen. In other words, a small company represents many other small companies that are not in the sample, while a big company only represents itself, since all other big companies (in principle) are usually selected for the sample.

4.49 In general, the number of employees is a good proxy for company size. However, turnover, production or income may be more accurate, especially considering that in the post-industrial era there may be larger and larger differences on turnover per employee between companies, leading to biases within and among branches. Whichever method is agreed upon, it is recommended that the same method be used throughout for all indicators in the survey to maintain comparability.

Imputation of missing replies

4.50 There are different practices in handling missing replies. One method is to use indirect imputation where it is assumed that the non-responding companies would have answered the same as the responding companies within the stratum. However, this method implies that changes from one month to another to some extent will reflect non-responding companies, rather than actual responding companies. This is especially the case when large companies are missing, such as when a large company replied to the previous survey but not to the current one. In such cases, a pragmatic solution would be to impute the previous month's answer. Imputing over longer periods is not a suitable method for surveys that aim to measure developments over time and should therefore be avoided.

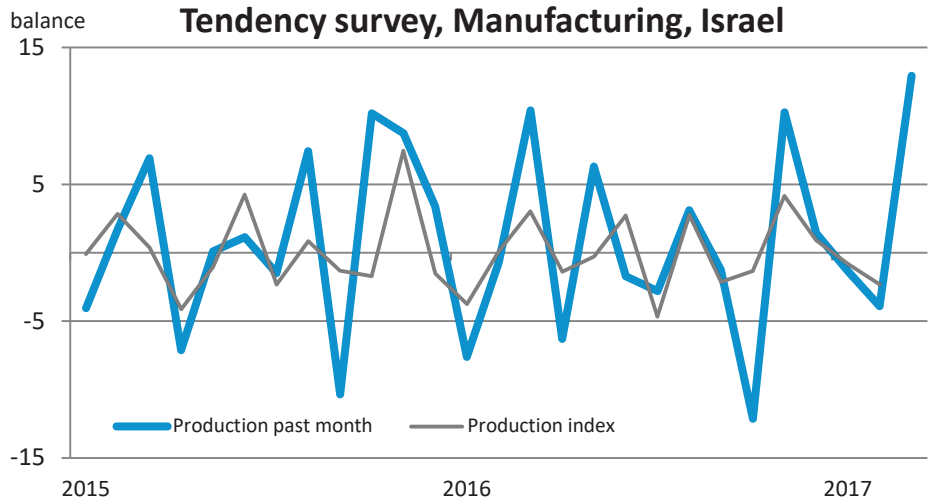
Seasonal adjustment

4.51 In some surveys, the respondent is asked to ignore seasonal effects when evaluating the past, present and future. This may be difficult, and results may still show seasonal patterns. It is, therefore, recommended to seasonally adjust the results to evaluate the development from period to period. For further methodological guidance on the treatment of seasonality, readers are referred to the already mentioned handbooks from the OECD, UN and DG ECFIN. Eurostat has also developed the JDEMETRA+ application[1], which is able to establish advanced correction models, taking specific national holidays and national trading days into account.

[1] https://ec.europa.eu/eurostat/cros/content/download_en

Box 4.3 **Business tendency survey, Manufacturing, Statistics Israel (2017)**

The Israeli business tendency survey covers a population of 14.000 manufacturing companies in Israel within ISIC groups 6-33. There are 7.500 companies after cutting off companies with less than five employees. For the panel sample frame, 400 companies are selected. The sample is stratified into the above-mentioned ISIC groups for economic activities, and further stratified into five size groups: 5-10; 10-49; 50-100; 100-250 and above 250 employees.



Source: Central Bureau of Statistics, Israel

The survey questions cover the current business situation, the past development and expected development regarding order books, output, sales, finished goods inventories and employment. Furthermore, respondents are quizzed about the expected inflation rate and about the expected foreign exchange rate over the next 3 months and the next year. Owing to the high correlation with the production index, the release of the manufacturing tendency survey results focuses on the production indicator in the past month.

The monthly survey questionnaire is sent at the beginning of the month by email or fax. The fieldwork methodology in Israel differs from the EU harmonized methodology to provide for the effects of possible sudden political and other external events. The sample is randomly divided into 4 weeks of collection and respondents are instructed to report in that specific week of the month. Also, different to the harmonized EU-methodology, the Israeli business tendency survey asks only about developments in the last month as compared to the previous month, and likewise asks only about expected development in the next month compared with the current month.

Balances

4.52 Increasing, decreasing or unchanged? Below normal, normal or above normal? Those are some of the responses businesses or households are expected to provide each month or quarter to questions on their past, present or expected situation. To compile the results, for each indicator the weighted number of answers distributed across all three answering options are expressed as percentages. The balance or *net value,* (B), is the difference between the positive (P) and negative (N) assessments:

$$B = P - N$$

4.53 For instance, if 15% indicated an increase, 48% no change and 37% a decrease, the net value is minus 22, which is the 15% increase less the 37% decrease. When communicating the results, it is better to indicate it without the percentage to prevent confusion. However, the balance can, for instance, be worded as follows: "22 per cent more of companies, weighted by size, within the sector expects the production to decrease over the next three months than expect it to rise". Neutral answers (unchanged, normal, sufficient etc.) are excluded from the balance calculation.

4.54 Some NSOs, like the Israeli Central Bureau of Statistics, have chosen to expand the set of answering options to the following five: *strong increase, increase, unchanged, decrease or strong decrease*.

When calculating the balance, *strong* increase/decrease counts with full weight, while increase/decrease only counts with half weight. A concrete example of calculating balances is provided in Section 4.2.3, under Processing of data.

Averaging of questions

4.55 Single economic sentiment indicators may be based on one or more questions within the same dimension, which can be easily averaged or aggregated into one single measure. Typically, such an indicator will summarise the results of a limited number of survey questions by averaging the balances into one measure. For example, the so-called confidence indicator within the EC Services Tendency Survey is calculated as the simple average of the following balances:

- business situation (over the past 3 months)
- demand / turnover (over the past 3 months)
- demand / turnover (next 3 months)

4.56 The selection of those three indicators was guided by the aim of maximizing the correlation to the reference series, such as output or gross value added, for example. When communicating the results, the average indicator would provide the overall result of the survey in one figure.

4.2.3 Compiling consumer tendency surveys (CTS)

4.57 Consumer tendency surveys (CTS) aim to measure consumers' or households' assessment of their current economic situation or their expectations of future economic prospects. Data are usually collected in household surveys through questions about the current economic situation in general, the economic situation of the households or the future. In the last case, the questions may be about planned consumption expenditures (including plans to purchase major consumer durables) and savings, or expectations about inflation or employment. Outcomes of consumer surveys often have high media profile and are widely used in economic analysis by researchers and policy makers.

4.58 In the following, the compilation of CTS is briefly discussed. More detailed descriptions and considerations can be found in Eurostat (2014, 2017a), UN (2015) and OECD (2003) and in previous sections about BTS.

4.59 CTSs are mostly monthly surveys conducted by NSOs, central banks, universities or private agencies. The Conference Board's consumer confidence index or the consumer sentiment indicator of the University of Michigan are examples from USA, while the central bank of India conducts the CTS there. DG ECFIN coordinates business and consumer tendency surveys for EU member and candidate countries. DG ECFIN also collects and publishes data through joint projects with the institutions conducting the survey in the country. The *Methodological User Guide* (DG ECFIN, 2017) to the Joint Harmonised European Union Programme of Business and Consumer Surveys provides a theoretical framework covering all aspects and methodologies of consumer surveys.

Survey design

4.60 The CTS would usually target the whole adult population of a country. The representative individuals are selected directly or from a selected household based on socio-economic and demographic characteristics. The sampling method, categories of weighting for sampling and survey method are determined by a trade-off between the financial restrictions the organization faces and quality requirements. Every month or quarter, a nationally representative sample of households is selected by using an appropriate sampling framework and then interviewed.

4.61 Depending on the mode of the survey, sampling frames could be census frames or population registers (a register of all the residents of a country), telephone registers (fix telephone directory, official telephone directory, database of households' phone numbers, public telephone registers, private database of randomly generated mobile and landline telephone numbers), address etc.

4.62 Categories of weighting or strata for sampling can be age, age group, gender, education, occupation, work regime, size of household, size of municipality, income of household (income classes or quartiles), region, geographical partitions or all categories of population etc.

4.63 The questionnaire of the survey should consist of two main parts: one for collecting information on household features and another one covering the responses to the questions of the selected individual. The tendency part contains pre-coded questions, generally using a five level Likert scale. The reference period of the questions usually varies between the "last 12 months" and the "next 12 months". DG ECFIN's harmonized questionnaire can be used as a basis and – if necessary – some questions could be added to the questionnaire to cover country specific cases.

Field work

4.64 Consumer tendency surveys are generally conducted by telephone (CATI - computer-assisted telephone interview). Other modes could also be used in accordance with the conditions of the respective country like CAPI (computer-assisted personal interview), CAWI (computer-assisted web interview), PAPI (paper and pencil interview) or mix mode.

4.65 CTS results are generally published and used within the data collection month. Hence, the field work should be organised so that it is possible to collect a sufficient number of replies to allow early publication of the results of the survey.

4.66 The fieldwork period of the consumer survey is generally the first two weeks of each month. The survey results of the reference month are expected to be published at the end of the fieldwork month or just thereafter.

Processing of data

4.67 For categorical data such as respondents' replies on whether they agree or disagree with statements, an average value needs to be compiled. This average is usually referred to as the *balance*. A balance value is calculated by using the weighted responses to the Likert scale questions. In the case of five levels, the answers range from "extremely positive" to "extremely negative". The balance (B) is calculated as the difference between the percentages of positive and negative responses after the formula:

$$B = (PP + ½P) - (½N + NN).$$

4.68 The most positive (PP) and the most negative (NN) replies count with their full weight, while the moderate positive (P) and the moderate negative (N) replies count with half their weight. Thus, if the percentage distribution between five answers on this question "How has the financial situation of your household changed over the last 12 months" is, for example, distributed as follows: got a lot better (4%), a little better (11%), stayed the same (63%), a little worse (15%), a lot worse (7%), the balance is (4+ ½*11) – (½*15 + 7) = minus 5. As mentioned before in the section about business tendency surveys, this balance figure, or net value, is better communicated without referring to the percentage unit. The single figure gains more meaning when presented in a time series for comparison to the previous months. However, the stand-alone figure can also be communicated in the following manner: An overweight of 5 % of participants stated that their financial situation has worsened over the past 12 months.

4.69 As of January 2019, the European Commission's consumer confidence indicator (CCI) is compiled as the arithmetic mean of the following four indicators:

- Financial situation of households, change over the past 12 months
- Financial situation of households, expected development over the next 12 months
- General economic situation in your country, expected development over the next 12 months
- Major purchases in your household, spending more or less money over the next 12 months

4.70 Individual countries may choose different indicators from the CTS for their national publication purpose.

4.71 The confidence indicator as well as its components are easily presented on a scale ranging from minus 100 (pct.) to plus 100 (pct.), where at balance value of zero indicates no change. This is the practice in the EU countries. Some institutes, including e.g. The Turkish Statistical Institute and the Central Bank of Japan[1], disseminate the consumer survey results by converting the balance values to a so-called *diffusion index*. This is done by adding 100 to the balance values. The shifting of the above-mentioned scale (from -100 to 100, to 0 to 200) means that the balance at minus 5 calculated above turns into 95. Thus, the index value of 100 indicates a neutral balance.

4.2.4 Reference series analysis: leading, coincident or lagging

4.72 It is important to validate the sentiment indicator against the reference series to assess if the indicator has lagging, coincident or leading properties relative to the reference series and evaluate the performance of the indicator and its possible usage in various forecast models.

4.73 One of the virtues of sentiment indicators is their timeliness. A leading economic sentiment indicator, which is the first indicator to give notice about turning points in the economy, has a great value, especially for business and financial sector analysts. Some economic statistics based on quantitative data are published with such delay that even sentiment indicators with coincident or lagging properties may still be the first to indicate significant developments.

4.74 The ability to track the development of the reference series is a key feature of economic sentiment indicators. However, as mentioned earlier, economic sentiment indicators may not necessarily co-move perfectly with their reference series because they are based on the perception or expectations of individuals.

4.75 Leading, coincident and lagging indicators are defined in Chapter 2. The determination whether an economic tendency indicator has leading, coincident or lagging properties should be based on a thorough analysis considerations. As previously mentioned, sentiment indicators may be composed of individual indicators of different nature. Some may reflect the previous month, some the next month and others the current situation. Furthermore, some individual indicators are leading although they refer to the present situation, for example a current stock of orders indicator inherently points towards future production based on the current order book.

4.76 Annex A provides a more detailed description of the two main methods to describe business cycles, the *growth cycle* approach and the *growth rate* approach. The annex discuss how business tendency indicators may be compared to their reference series, using either of these approaches. In the growth cycle approach, the indicator is compared with the cyclical component of the reference series. The cyclical component is estimated by removing the trend component from the reference series. In the growth rate approach, the indicator is compared to the growth rate of the reference series.

4.77 Another method to determine if the business tendency series is leading, lagging or coincident is *turning point detection*. Various methods, such as the Bry-Boschan algorithm, are mentioned in the OECD system of composite Leading Indicators (OECD, 2012) to detect peaks and troughs in time series, and thus turning points. A comparison of the turning points of the business tendency series to that of the reference series indicates if the business tendency indicator is lagging, coincident or leading. Section 5.4 discusses these issues further.

4.78 The OECD Composite Leading Indicator (CLI) is "designed to provide early signals of turning points in business cycles showing fluctuation of the economic activity around its long-term potential level."[2] The CLI is developed both for individual countries and for country aggregations such as G7-

[1] E.g. the Short-Term Economic Survey of Enterprises in Japan (Tankan) of Central Bank of Japan. http://www.boj.or.jp/en/statistics/outline/exp/tk/extk03.htm/

[2] https://data.oecd.org/leadind/composite-leading-indicator-cli.htm

countries, EURO-area or OECD total. It is based on various compositions of individual short-term economic indicators with optimal associations with GDP, and because of its leading property provides early signals about possible turning points.

4.79 The OECD (2012) document is recommended as a good entry guide to the methodology of constructing business cycle indicators with coincident or leading properties relative to a reference series. The Paper "Detecting Cyclical Turning Points: The ABCD Approach and Two Probabilistic Indicators" (Anas & Ferrara, 2004) deepens various concepts and methodologies in turning point detection. Other research includes, e.g., Howrey (2001) and Ludvigson (2004).

Consumer survey and reference series

4.80 Consumers' perceptions and expectations influence their *ex ante* consumption plans. The *ex post* realization of consumption plans is covered by traditional quantitative surveys. However, information about consumers' expenditure plans provides early information about possible developments in actual consumption. The theory on the link between consumers' attitudes and consumption pattern was first studied by George Katona (1951) and today there is ample literature on this area.

4.81 The final consumption expenditure of households is an obvious reference series for consumer confidence indicators. Therefore, a close relation between the consumer confidence indicator and the monthly, quarterly or annual growth rate of household consumption may be expected and would reflect the quality of the indicator. The example in Box 4.4 shows that the indicator does not necessarily maintain its leading property over time. Since the consumer confidence indicator reflects subjective perceptions that vary with changes in circumstances and consumers' expectations, it may not track the development of the reference series consistently over time. In addition, other factors, e.g. unexpected changes in disposable income, may have an impact on the reference series not fully reflected in the confidence indicator.

4.82 Consistency in timing is a key property of a leading indicator. An indicator which changes from leading to coincident or vice versa unpredictably must be analysed and used more carefully than one that remains leading or coincident.

4.3 Socio-economic sentiment indicator

4.83 Socio-economic sentiment indicators are quite different to economic sentiment indicators. Where the primary aim of economic sentiment indicators is to deliver information on the present or future state of the economy, the socio-economic sentiment indicators are targeting a range of aspects for which there may be no monetary measures.

4.84 There is a growing interest in measuring subjective well-being. OECD, as a leading international institution in this area has been working on encouraging countries to produce subjective well-being indicators and use them in political decision-making.

4.85 Single socio-economic sentiment indicators could be simply defined as perception of individuals on different aspects of their life such as their health, financial situation and life satisfaction, but also on their environment. These indicators aim to measure the phenomenon of subjective well-being directly, Hence, they usually do not have directly comparable reference series.

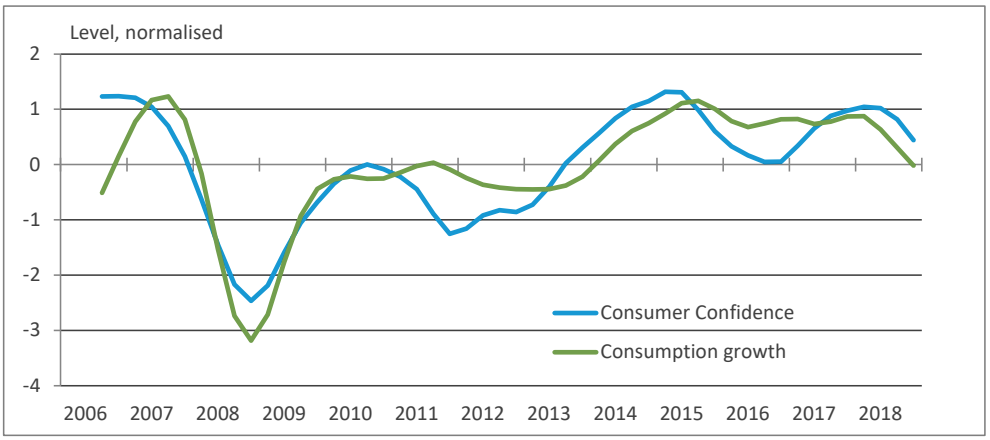
Background

4.86 Measuring social progress brings individual citizens and their perceptions into focus in every life dimension besides the economic dimension. These measures track social progress and portray the state of *well-being* or *quality of life* of people.

Box 4.4 **Consumer Confidence vs Household consumption growth**

The graph shows the Danish Consumer Confidence Indicator and the quarterly growth rate of household consumption expenditure. The two series are standardized and smoothed for visualization purposes.

Consumer Confidence vs Consumption growth. Standardized, Denmark



Source: Statistics Denmark

The Danish Consumer Confidence Indicator is an unweighted arithmetic average of five individual indicators from the consumer tendency survey. The correlation coefficient with the consumption growth rate for the period 2007 to 2018 is 0,85. Smoothing of both series eliminates erratic fluctuations and improves the correlation. When comparing to reference series, a perfect fit is not what is aimed for. Reference series typically are narrow measures build on "hard data", while the confidence indicator gives a broader picture based on several individual indicators.

Measured over only the period 2010-2018, the correlation coefficient is 0,77. If the confidence indicator is moved two quarter forward, the correlation coefficient increases to 0,84. In other words, the confidence indicator have leading properties and indicates consumption growth rate two quarters ahead. As evident from the graph, the leading property is not consistent; sometimes the property becomes more coincident. However, a coincident signal from an early indicator such as the consumer confidence indicator provides leading information compared to consumption growth for which statistics are published later. The indicator and the reference series are analysed using the growth rate cycle approach, which is explained in more detail in Annex A.

4.87 Based on earlier work, Diener and Seligman (2004), Kahneman et al. (2006) and various other researchers formulated a general understanding of different properties of subjective well-being. These studies formed the background for the jointly organised conference "Beyond GDP" in 2007[1], the constitution of the Stiglitz-Sen-Fitoussi Commission in 2008 and the publication of the *Report by the Commission on the Measurement of Economic Performance and Social Progress* (Stiglitz, Sen, & Fitoussi, 2009).

4.88 As mentioned in the report of the Commission, the concept of well-being is accepted as not directly measurable, but as a structured concept of many different dimensions. This includes *subjective well-being* as a separate indicator, which is regarded as a complementary but not a substitute measure, to other well-being indicators. Indeed, according to OECD (2013, p.185) the general level of *life satisfaction* was evaluated as one of the most important domains for the public opinion assessments in enquiries conducted by UK Office for National Statistics and by the OECD in 2012.

4.89 In the Report of the Stiglitz-Sen-Fitoussi Commission, NSOs are invited to broaden their working areas to collect and publish measures of *subjective well-being*. The Commission notes that the determinants of subjective well-being go well beyond people's income and material condition and NSOs

[1] http://ec.europa.eu/environment/beyond_gdp/2007_conference_en.html

should incorporate questions on subjective well-being in their standard surveys to capture people's life evaluations, hedonic experiences and life priorities.

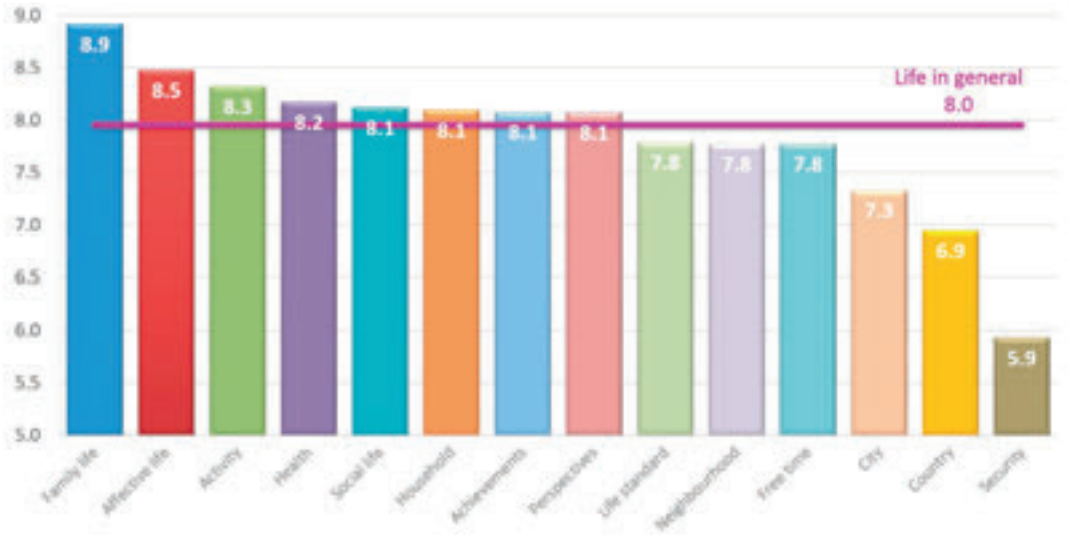
4.90 Subjective well-being includes a range of dimensions, including respondents' satisfaction or expectations about their economic situation, employment, housing conditions, safety, health and social relations. Therefore, a comprehensive measure of well-being must be based on a number of single sentiment indicators, which, taken together, covers the different aspects or dimensions of subjective well-being. The example of a subjective well-being indicator from Mexico is presented in Box 4.5.

4.91 The data sources of socio-economic sentiment indicators are social surveys, which collect data on respondents' evaluations, expectations and perceptions. The frequency of these surveys is generally annually or rarer, for two main reasons. First, the well-being of people usually does not change from month to month; therefore, a monthly survey is not necessary in this area. Second, these kinds of social surveys are large-scale surveys, thus costly for the survey institution to implement and causing heavy response burden on the respondent. Some well-known studies covering socio-economic sentiment indicators are mentioned in the following part, including brief information about their data sources.

Box 4.5 **Subjective well-being index in Mexico**

The Instituto Nacional de Estadística y Geografía of Mexico (INEGI) conducts an extensive survey on subjective well-being both in terms of detail of questions and geographical coverage. The survey provides data both at national and state level through various modules under the label BIARE (Bienestar Autorreportado (INEGI, 2015) which is a self-reporting well-being module system that accompany the household surveys of INEGI. The Amplified BIARE (2014) surveyed about 40.000 households, which allow for indices both at federal and national level.

The indicators are among others: life satisfaction, self-reported health, social connections, civic engagement, satisfaction with time available for leisure, neighbourhood etc. The graph shows the national outcome. On a scale from 0 to 10 the general well-being is at 8.0, which is broken down according to the dimensions recommended by the OECD.



Source: INEGI's press release 412/15 Oct. 20th, 2015

Some well-known socio-economic sentiment indicators studies

4.92 The "OECD Better Life Index"[1] makes it possible to compare well-being across countries based on topics identified as essential in the areas of material living conditions and quality of life in OECD countries and a few non-OECD countries, such as Brazil, Russia and South Africa. The Index covers four

[1] http://www.oecdbetterlifeindex.org/

socio-economic sentiment indicators: self-reported health, quality of support network, satisfaction with water quality and feeling safe walking alone at night.

4.93 Eurostat has a section on the topic of Quality of Life on the Eurostat website[1]. The data presented in this dedicated section come from several sources from within the European Statistical System (ESS), in particular SILC[2] (statistics on income and living conditions), LFS (labour force survey), EHIS (European Health Interview Survey) and administrative sources. In cases where no data are available from within the ESS, external links to non-ESS sources, such as the EQLS (European Quality of Life Survey), are provided.

4.94 The European Commission has conducted other studies such as *Qualitative survey about Well-being* (European Commission, 2011a) and *Qualitative study about Well-being in 2030* (European Commission, 2011b). The Eurobarometer[3] analyses how Europeans perceive their political institutions, the current economic situation, European citizenship etc. The Qualitative survey about Well-being was conducted in 15 member states providing insights into the notion of personal well-being.

4.95 The United Nations Sustainable Development Solutions Network (UN SDSN) publishes the World Happiness Report (UN SDSN, 2018) (see Box 4.9) which includes the self-assessed level of happiness and a decomposition into various economic and socioeconomic factors.

4.96 The World Values Survey[4] is also a source for socio-economic sentiment indicators. It is a global network of social scientists studying changing values and their impact on social and political life. Among other topics like economic development, democratization, religion, gender equality and social capital, subjective well-being assessment is also covered.

4.97 World Database of Happiness[5] is an archive of research findings on subjective enjoyment of life, run by the Happiness Economics Research Organization at the Erasmus University Rotterdam, which states that it brings together findings that are scattered throughout many studies and provides a basis for synthetic work. The database includes research findings on subjective enjoyment of life. The findings on happiness stored in this database are largely based on responses to survey questions on happiness using verbal response options, such as "very happy" and "fairly happy". The aim is to estimate what degrees of happiness are denoted by such terms in different questions and languages. These degrees are expressed in numerical values on a 0 to 10 scale, which are then used to compute 'transformed' means and standard deviations.

4.3.1 Compiling socio-economic indicators

4.98 The subjective well-being measures might be integrated into existing household surveys. Time use surveys, living conditions surveys or health surveys might be good examples of where subjective well-being questions could be included. To monitor changes in well-being over time, annual surveys might be preferable. Including measures of subjective well-being in panel surveys might be preferable for researching causality and the drivers of subjective well-being. The methodology of conducting and compiling socio-economic surveys (time use, living conditions etc.) within the broad range of socio-economic indicators may differ, according to the specific setups, and is not dealt with in detail here.

4.99 Another option is to conduct an independent survey aiming to measure well-being of people in the country. Individual quality of life surveys are carried out in various countries bringing about more detailed information on quality of life illustrated by various socioeconomic and geographical characteristics. Data may be collected by telephone interviewing, by questionnaires send by postal mail or by web form questionnaire. Training of interviewers will be required to ensure they have the necessary understanding of how to conduct interviews.

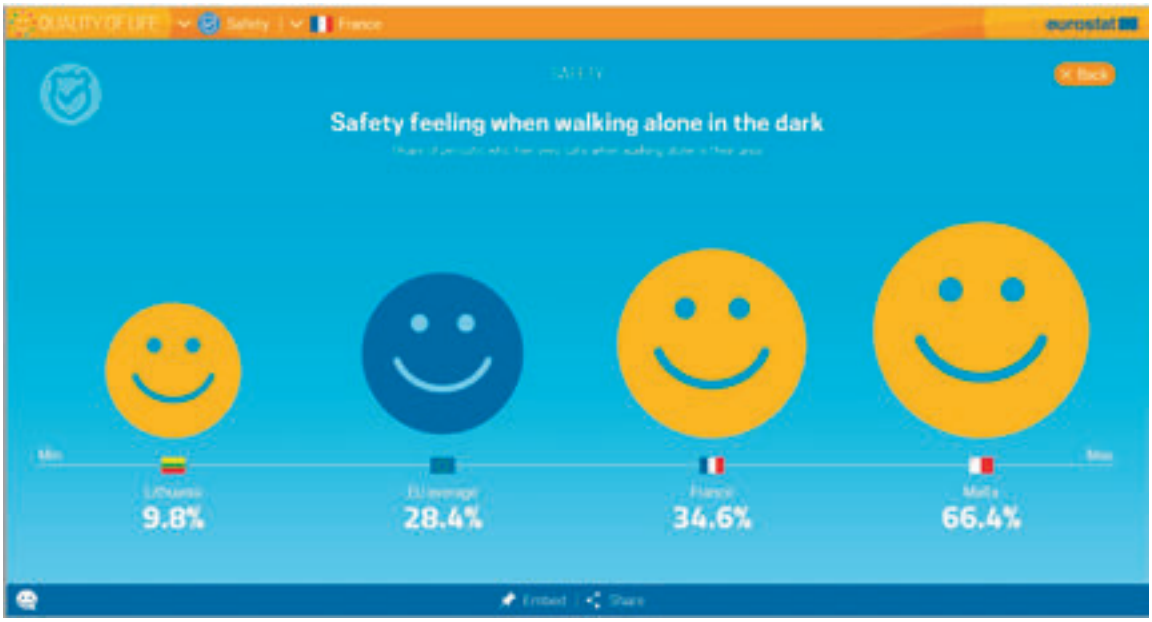
[1] http://ec.europa.eu/eurostat/web/gdp-and-beyond/quality-of-life
[2] http://ec.europa.eu/eurostat/web/microdata/european-union-statistics-on-income-and-living-conditions
[3] http://ec.europa.eu/commfrontoffice/publicopinion/index.cfm/General/index
[4] http://www.worldvaluessurvey.org/wvs.jsp
[5] https://worlddatabaseofhappiness.eur.nl/

Box 4.6 **Quality of Life - Well-being of Europeans**

Eurostat presents in the Quality of Life study the well-being of Europeans. Within 11 life dimensions, subjective sentiment indicators are selected to illustrate and indicate the topic:

Dimension	Subjective sentiment indicator
Overall life satisfaction	Overall life satisfaction
Material living conditions	Satisfaction with finances
Housing conditions	Housing satisfaction
Employment	Job satisfaction
Time use	Satisfaction with time use
Education	life satisfaction gap: high and low education level
Health	Self-perceived health
Social relations	Satisfaction with personal relationships
Safety	Safety feeling when walking alone in the dark
Governance	Trust in the legal system
Environment	Satisfaction with living environment

The well-being interactive infographic allows for comparing subjective sentiment indicators across countries; e.g. *Safety feeling when walking alone in the dark*.



Source: http://ec.europa.eu/eurostat/cache/infographs/qol/index_en.html

4.100 Questions asked may include enquiries about people's satisfaction with life, their economic situation, social relationships, work, health, sense of security, confidence in politicians etc.

4.101 In the design of the survey, the following should be taken into consideration:

- The wording of the questions should not be complex or ambiguous, instead they should be easily translatable across languages and cultures.
- The tone of the question should be neutral so that it does not favour particular answers.
- The response options should be easy to understand and mutually exclusive. There must be enough response categories to enable views to be expressed fully.
- Field application time influence on responses should be taken into consideration, e.g. day of the week, the time of year, effect of day-to-day events or the weather.
- Question order should be considered if preceding questions influence how an item is interpreted and/or prime the use of certain information.

4.102 The *OECD Guidelines on Measuring Subjective Well-being* (OECD, 2013) are the main source on compiling socio-economic surveys. The Guidelines give methodological considerations for the measurement of subjective well-being and give recommendations on question wording, response formats, question order, context effects, survey mode, timing, response styles and international comparability. The example "OECD Life evaluation questions" in Box 4.7 illustrates how questions can be posed well.

Box 4.7 **OECD Life evaluation questions**

Please imagine a ladder with steps numbered from 0 at the bottom to 10 at the top. The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you.
B1. On which step of the ladder would you say you personally feel you stand at this time? [0-10]
The following question asks how happy you feel, on a scale from 0 to 10. Zero means you feel "not at all happy" and 10 means "completely happy".
B2. Taking all things together, how happy would you say you are? [0-10]
The following questions ask how satisfied you feel, on a scale from 0 to 10. Zero means you feel "not at all satisfied" and 10 means "completely satisfied".
B3. Overall, how satisfied with your life were you 5 years ago? [0-10]
B4. As your best guess, overall how satisfied with your life do you expect to feel in 5 years' time? [0-10]
Below are five statements with which you may agree or disagree. Using the 1-7 scale below, indicate your agreement with each item. Please be open and honest in your responding. The 7 point scale is as follows:

1. Strongly disagree.
2. Disagree.
3. Slightly agree.
4. Neither agree nor disagree.
5. Slightly agree.
6. Agree.
7. Strongly agree.

B5. In most ways my life is close to my ideal [1-7]
B6. The conditions of my life are excellent [1-7]
B7. I am satisfied with my life [1-7]
B8. So far I have gotten the important things I want in life [1-7]
B9. If I could live my life over, I would change almost nothing [1-7]

4.103 The OECD Guidelines also give advice on sample and survey design, data processing, coding and questionnaire design. For instance, computer assisted personal interviewing (CAPI) is recommended to improve data quality, although NSOs are advised to test experimentally the impact of different survey modes on responses to the core measures of subjective well-being and publish the results of the different modes. Lastly, the Guidelines advise on output and analysis of subjective well-being measures.

4.104 In designing and conducting socio-economic sentiment surveys, it is important to be aware of various measurement errors that may bias the result. The OECD Guidelines and other literature on survey methodology[1] treat the subject at various levels. Numerous response biases can be established. Along with biases caused by the questionnaire's design and phrasing of the questions, biases may also be socio-psychological, rooted in the momentary mood of the respondent, the respondents' surrounding environment etc. Questions on some issues may be sensitive, for instance in relation to gender, ethnicity or political views, and respondents may be hesitant to disclose their views. It is of crucial importance for the validity of the results that the NSOs ensures trust in data being kept confidential.

4.3.2 Comparison to reference series

4.105 Usually there will not be a reference series to compare the socio-economic indicators directly to, as is the case with economic indicators. However, it is possible to evaluate the indicator's

[1] Examples are: A Catalog of Biases in Questionnaires (Choi & Pak, 2005); Survey Methodology (Groves, et al., 2009); Methods of coping with social desirability bias: A review (Nederhof, 1985)

development over time: how is the trend moving and how the quarterly level compares to the same quarter a year ago. In addition, while there may be no reference series, it may still be useful to compare the indicator with available statistics that describe the same area. For instance, households' satisfaction with public transport may be compared with transport statistics, perception of health may be compared with statistics on health or households' satisfaction with their housing situation may be compared with available dwelling statistics (as in the example by Statistics Denmark in Box 4.8). It might be useful to compare the same indicator among regions within the country, taking possible different socio-economic structures into account. Similarly, to compare indicators to those in countries with comparable socio-economic structures and performance could also add value.

4.106 Often life quality indicators are weighted according to the individual's belonging to a specific income group and various demographic features, which ensure the quality of the statistics remains stable over time and continues to mirror the actual population.

Box 4.8 **Example: Life quality indicator compared to dwelling size**

In the Quality of Life survey conducted by Statistics Denmark, 2015-16, results from the various dimensions, divided into municipalities, are compared to a relevant quantitative indicator. As pictured below, the life quality indicator "Satisfaction with (own) housing situation" is visualized along with data on average dwelling size, for selected municipalities. Though not an all-embracing link, it is clear that the satisfaction level relates to the square metres that the respondent lives in.

Source: http://dst.dk/extranet/livskvalitet/livskvalitet.html?lang=en

4.4 International comparability of sentiment indicators

4.107 Surveys measuring the perceptions of individuals, either economic or socio-economic, are conducted somewhat differently across countries. However, as mentioned in Section 4.2.1 internationally harmonized principles for the conduct of tendency surveys covering the questionnaire design, survey frame and sample design, estimation procedures, data collection, dissemination and use are provided in UN (2015), Eurostat (2017a) and OECD (2003).

4.108 Data collection and reference periods may differ among countries. Different questions may be used and questions which are intended to measure the same phenomenon may be formulated in different ways. The perception of a phenomenon and questions related to this may also vary because of cultural and other differences and may influence the comparability across countries. In addition, different scales are used when evaluating qualitative survey replies, balances may be calculated in different ways and different weights may be assigned to the individual questions when their balances are aggregated into one measure. Such differences will, eventually, affect the comparability across countries. While there are no globally agreed guidelines or best practices, it is recommended to follow existing handbooks and manuals on tendency surveys, e.g. Eurostat (2017a) and UN (2015).

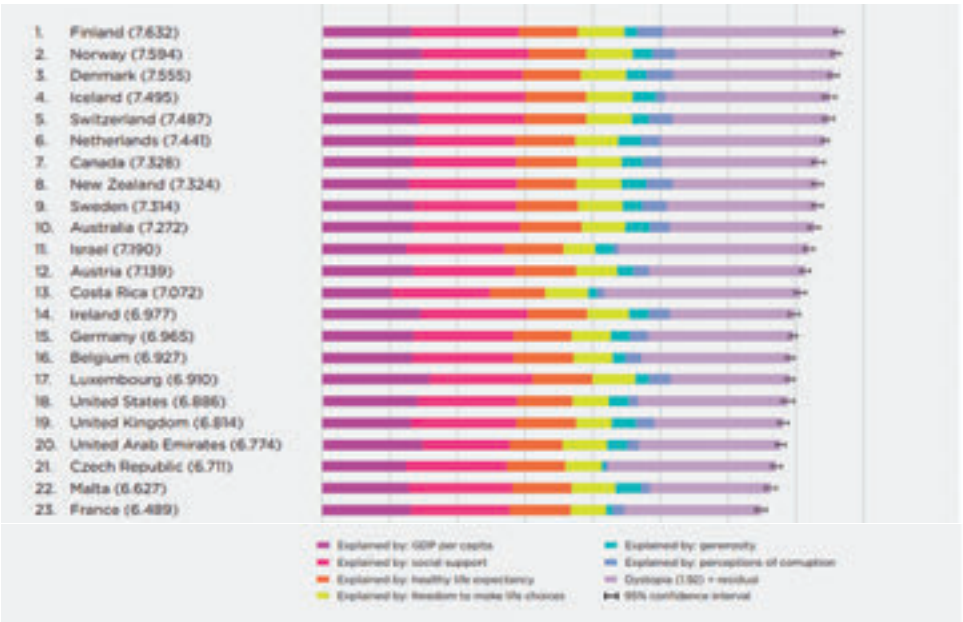
4.109 However, it should also be noted that even if individual questions differ, if the sentiment indicator is composed from a set of many questions, these differences may tend to cancel out so that the resulting indicator nevertheless may be used for international comparisons.

4.110 The example in Box 4.9 describes the World Happiness indicator, which compares the self-assessed level of happiness among countries of the world. For NSOs, such an index may serve as inspiration for more comprehensive national surveys to benchmark against other countries.

Box 4.9 **The World Happiness Report**

The annual World Happiness Report ranks the world's countries according to the label happiness. The country ranking reflects the average score among individuals who are asked in one single question to evaluate the quality of their current life on a scale from 0 to 10.

The graph shows an excerpt, no. 1 to 23, of the total ranking covering 156 countries. The hightest performing country in 2017 is Finland with the value 7.6. When compared to the Eurostat life well-being indicator from the SILC project (2013), the rankings of the individual European countries are quite similar.



In order to explain this single figure ranking of happiness perception, in a next step the country bars are decomposed into six segments covering the variables GDP per capita, Social support, Healthy life expectancy, Freedom to make life choices, Generosity and Perception of corruption. These variables are depicted with their relative contribution compared to a hypothetical country, Dystopia, that have values equal to the lowest average ranking over the time period 2015-2017. Data is based on the Gallup World Poll.

Besides the main happiness indicator, each annual report focuses on a special topic. In the 2018 report, the focus is on migration between countries.

Sources: UN SDSN (2018), Eurostat (2013)

4.111 Within the EU, the Commission organizes the Harmonized Programme on Business and Tendency indicators. In various publications, the EU analyses and communicates basic results and composite indicators such as the Economic Sentiment Indicator, which allows for direct comparisons among EU countries (see Section 5.6).

4.112 The results of the Business Tendency and Consumer Opinion Surveys are available in the OECD.stat databank[1] under the theme Monthly Economic Indicators. The database targets users of statistics but is also helpful for data producers to get an overview of results and practices among OECD countries. Depending on what is provided by the individual countries, the database also includes information on the data producer and methodology.

4.5 Summary of recommendations

4.113 The following recommendations for the production of sentiment indicators can be made:

- Allocate the necessary resources for the development of the indicator and its future production. To this end, it may be useful to engage possible stakeholders, user groups and experts.
- In developing a sentiment indicator, references should be made to available international guidelines and handbooks on sentiment indicators and survey design. To the extent possible, the indicator should be designed to meet national needs and facilitate international comparability.
- Ensure that the indicators can be produced in line with the quality criteria of official statistics concerning accuracy, reliability, accessibility, clarity and timeliness. The production of the sentiment indicators, including methods used and questions asked in surveys, should be fully documented and made available to the public.
- Experiences from other surveys will be useful to take into account, concerning e.g. sample size, response rates and communication with the respondents. The use of electronic, on-line questionnaires may substantially reduce running costs and be helpful in improving timeliness.
- Because of the importance of timeliness of economic sentiment indicators, data collection periods should be short and the data processing steps should be automated to the extent possible to facilitate timely production.
- Sentiment indicators should be published with sufficient documentation and explanation to facilitate correct use of the indicators and avoid misunderstandings. It is useful to design the communication according to possible target groups. Sentiment indicators differ from established quantitative statistics and may need additional explanations.

[1] http://stats.oecd.org/

5 Composite economic indicators

5.1 Introduction

5.1 This chapter presents the methodology to produce composite economic indicators, to discuss their use, and give guidance to NSOs on their construction. The chapter highlights issues and pitfalls that the NSOs should be aware of when constructing these indicators and give examples of their construction. The content of this chapter may also be useful when reading Chapter 6 on composite socio-economic indicators, to better understand the similarities and differences between these two types of indicators.

5.2 The chapter focuses on cyclical composite economic indicators, which are the most common in use. Cyclical indicators aim to measure the development in economic activity as measured by the evolution in GDP or other economic aggregates. They are usually constructed to measure business cycle development, including turning points, but may also be compiled as an early indicator of economic aggregates, such as GDP. Cyclical indicators are constructed by aggregating individual indicators into one measure, the composite indicator. The component series may include sentiment as well as non-sentiment indicators. Some cyclical indicators are constructed purely based on sentiment indicators, typically derived by aggregation of survey results. These are often referred to as sentiment indicators or confidence indicators. This chapter also briefly presents structural composite economic indicators, which aim to describe structural aspects of the economy that are not related to the short-term development of the economy.

5.3 Section 5.2 gives an overview of composite economic indicators. Cyclical composite economic indicators are presented in Section 5.3, while recommended steps and methods to produce these are presented in Section 5.4. An example of an alternative approach, where the leading composite indicator is constructed based on a very large set of input variables, is provided in Section 5.5. The special case of composite economic sentiment indicators, based solely on sentiment component indicators, is presented in Section 5.6. Section 5.7 briefly presents structural composite indicators. Section 5.8 addresses issues in relation to international comparability of the indicators. Finally, Section 5.9 summarises recommendations for compiling composite economic indicators.

5.4 The chapter draws upon the Handbook on Cyclical Composite Indicators (EU & UNSD, 2017a), the Handbook on constructing composite indicators (OECD, 2008), the OECD system of Composite leading indicators (OECD, 2012) and the 10 step Guide for composite indicators from EU/OECD[1].

5.2 Overview of composite economic indicators

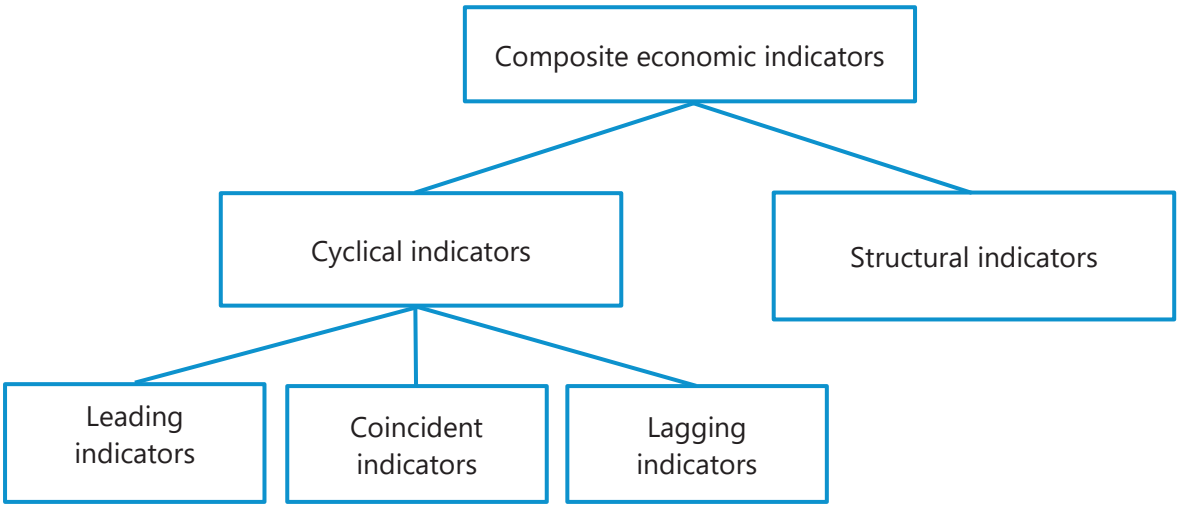
5.5 In comparison to individual indicators, composite indicators can provide a measure that balances responsiveness and stability, showing the underlying development and only allowing the individual indicators limited impact on the composite indicator. Composite indicators can also be used to identify various sources of economic development or fluctuations by analysing the individual components' behaviour in comparison to each other and to the composite indicator.

5.6 While composite indicators provide a signal associated with a given phenomenon, dashboards and scoreboards provide a detailed picture of the same phenomenon by listing a set of selected individual indicators (Mazzi, 2015). Composite indicators and dashboards/scoreboards can be complementary tools and the ultimate choice between them depends on user's needs. The main pros and cons of composite indicators that NSOs should consider when deciding whether to engage in their production are listed in Table 3.2 in Chapter 3.

[1] https://ec.europa.eu/jrc/en/coin/10-step-guide/overview

5.7 Composite economic indicators can be divided into two main categories: cyclical and structural, as illustrated in Figure 5.1. Cyclical indicators aim to measure short-term economic developments; structural indicators aim to describe structural aspects of the economy which tend to change only over the longer term.

Figure 5.1 **Types of composite economic indicators**



Cyclical composite economic indicators

5.8 Cyclical composite economic indicators aim to measure short-term economic developments. Usually, they will have a reference series which movement they aim to track. Cyclical indicators with reference series can be leading, coincident or lagging indicators, depending on their timing with respect to the reference series (see Chapter 2).

5.9 Cyclical composite economic indicators have been in use for many years. In the first attempts to derive an economic indicator for a target variable, a single indicator was used, for example industrial production as a proxy for GDP. The further development of this approach led to the construction of so-called synthetic indicators or barometers. These combine a homogenous set of single indicators representing a specific economic sector or a particular aspect of economic fluctuations into one measure (EU & UNSD, 2017a). The synthetic indicator is obtained by means of an average of the selected indicators that are assumed to be most related to the cyclical movements of the target variable.

5.10 Cyclical composite economic indicators represent the next step in which the composite indicator can be based on a broad set of individual indicators which may cover different sectors of the economy and include both quantitative and sentiment single indicators. The main reason for developing them is either to anticipate movements or simply to track the reference series that the indicator aims to measure: usually GDP, industrial production or unemployment rate. Cyclical composite economic indicators have also been used for monitoring cyclical movements and signalling peaks and troughs in business cycles.

5.11 One of the first and best known cyclical composite indicators is the Conference Board's Leading Economic Index[1]. Until 1995, this indicator was compiled by the US Bureau of Economic Analysis (BEA)[2]. It is now produced by the Conference Board, based on ten component series:

- Average weekly hours, manufacturing
- Average weekly initial claims for unemployment insurance
- Manufacturers' new orders, consumer goods and materials
- Institute for Supply Management (ISM) Index of New Orders

[1] https://www.conference-board.org/data/bci/index.cfm?id=2154
[2] https://www.conference-board.org/data/bci/index.cfm?id=2157

- Manufacturers' new orders, nondefense capital goods excluding aircraft orders
- Building permits, new private housing units
- Stock prices, 500 common stocks
- Leading Credit Index
- Interest rate spread, 10-year Treasury bonds less federal funds
- Average consumer expectations for business conditions

5.12 The economic recession in 2008-2009 reinforced users' demand for a more coherent, timely and comparable set of macroeconomic indicators, allowing for real-time monitoring of the economic development and cross-country comparisons. Composite economic indicators appear relevant in this respect because they "are valued for their ability to integrate large amounts of information into easily understood formats for a general audience" (OECD, 2008, p. 3).

5.13 The method used for constructing cyclical composite indicators has varied over time and between producers. A composite indicator is constructed by compiling individual indicators into a single index, based on an underlying model of the multi-dimensional concept that is being measured, as defined in Chapter 3. As pointed out by Zarnowitz (1992), in the case of leading composite economic indicators, "to increase the chances of getting true signals and reduce those of getting false ones, it is therefore advisable to rely on a reasonably diversified group of leading series with demonstrated predictive potential. This suggests combining selected leaders into an appropriately constructed index and monitoring changes in that index as well as in its components on a regular basis". Cyclical indicators are the most commonly used composite indicators and the components of the cyclical indicators are often official statistics.

Structural composite economic indicators

5.14 Structural composite economic indicators aim to measure phenomena that usually do not change in the short-term but are associated with longer-term changes in the economy. This includes indicators that describe phenomena such as competition, technological development and globalisation. Structural indicators are rarer in practice than cyclical indicators. Usually, they will not have a reference series, so it is not possible, or not relevant, to group these indicators according to their leading or lagging properties. Structural composite indicators are dealt with in Section 5.7 of this chapter.

5.3 Cyclical composite economic indicators

5.15 Cyclical composite economic indicators aim to estimate developments in real time or to forecast the cyclical component of the reference variable or detect its peaks and troughs (turning points). They may also aim to estimate in real time or forecast the short-term pattern (period-on-period or year-on-year grow rates) of the reference variable. In practice, most composite indicators having a reference series are cyclical economic indicators, and the reference series are usually various transformations of GDP or other economic aggregates.

5.16 Cyclical composite economic indicators extract a common signal from the component series. This signal is generally more stable over time than signals returned by individual component series. According to the typology proposed in Chapter 3 of the Eurostat and UNSD Handbook on cyclical composite indicators, cyclical composite economic indicators are constructed with the three following objectives in mind (Mazzi, 2015, p. 75):

1) Provide an estimate of the current state of the reference series, which is also useful for forecasting purposes.
2) Estimate unobserved components of the reference variable such as its trend or its cycle.
3) Identify turning points in economic activity.

5.17 The main desirable properties of cyclical composite indicators are (EU & UNSD, 2017a):

- Consistent timing
- Reduction of volatility of month-on-month changes
- Data quality

5.18 Consistent timing is a main property of a cyclical indicator, meaning that the indicator should identify turning points without major delays. The indicator should also reduce month-on-month changes to ease interpretation, though, of course, this should not be purchased at the risk of obscuring genuinely new information. Most NSOs conducting business tendency surveys select a set of survey series and combine them into a composite indicator. This is done to summarise the information, reduce the risk of false signals, and arrive at better nowcasting/forecasting results. This is described in Section 5.6.

5.19 The quality of the data series that are used for the construction of the composite indicator is crucial. This implies that component series should have an economic rationale (components should not be selected by chance or based on spurious correlations). The quality of the component series should be ensured and they should be expected to be available in the future. Further, the component indicators should be as timely as possible and not be subject to big revisions. Hence, the choice of the components in the construction of composite indicators is essential for multiple reasons.

Leading, coincident and lagging indicators

5.20 Cyclical composite economic indicators are usually classified into leading, coincident and lagging indicators according to whether their turning points occur before, at the same time or after those of the reference series.

5.21 The leading and coincident indicators are used for business cycle analysis while lagging indicators are less frequent and mostly used as a validation tool for leading and coincident indicators. A lagging composite indicator should be able to track the leading and the coincident with different lags but with the same cyclical characteristics. Leading indicators are based on components that have shown leading abilities, such as data on orders or expectations, while coincident indicators are based on components within the same "time frame", such as monthly production data within a quarter.

5.22 Leading indicators can be represented by single statistical indicators such as a specific sentiment indicator or quantitative indicators such as new orders or new passenger car registrations. Furthermore, some financial variables like the interest rate can have some leading properties as well as certain indicators available on the market such as the Purchase Managers Index (PMI).

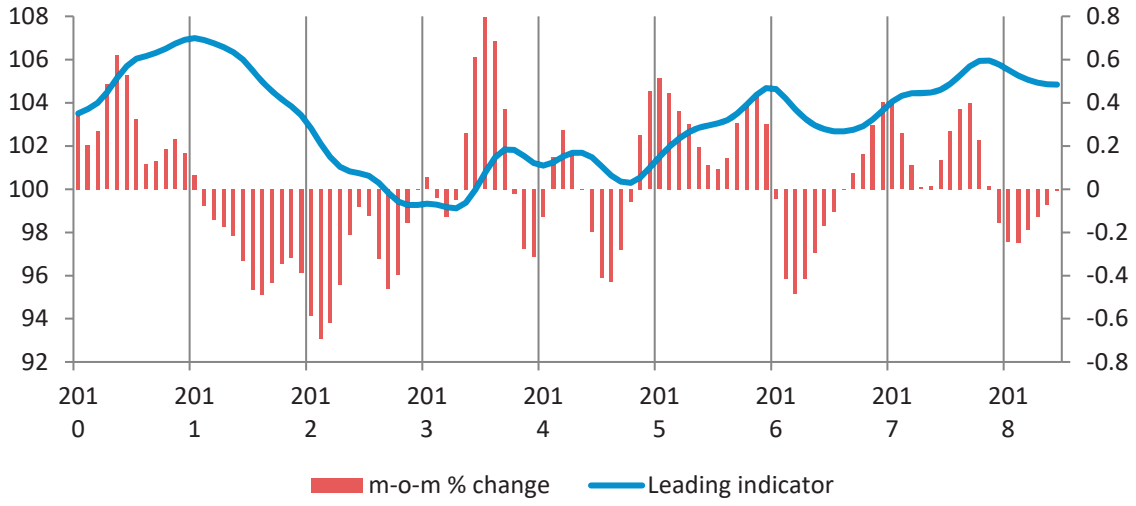
5.23 Leading composite indicators are produced by many institutions. The best known might be the OECD Composite Leading Indicator (CLI) and the Conference Board Leading Economic Indicator (LEI). Several NSOs and central banks also produce leading indicators on a regular basis. One example is provided by Italy is shown in Box 5.1. The composite economic indicator compiled by Mexico is presented in Annex B. The EU Economic Sentiment Indicator (ESI) is an example of a coincident composite indicator. However, owing to its early publication compared to its reference series GDP, it is often seen as providing leading information on the development of GDP (see Chapter 2).

Box 5.1 **The Italian Leading composite economic Indicator**

First week each month, ISTAT releases the *Monthly report on the Italian Economy* which provides a broad picture of the current state of the economy and the expected development over the next quarter. The release includes the leading composite indicator of the Italian economy together with the results of consumer and business tendency surveys and other key short-term statistics.

The leading indicator is constructed in two steps. In the first step, a coincident composite economic indicator is formed based on the classical business cycle approach. Through analysis of a large set of individual data series those with the highest correlation with the turning points of the GDP are selected for the compilation of the coincident composite indicator. In the second step, a leading indicator is constructed to track the development in the coincident indicator, which forms the reference series of the leading indicator. To this end, ten individual series are selected according to their correlation with the coincident indicator with a lead of at least three months to build the leading indicator. The individual series are selected to represent different sectors of the economy including the foreign sector.

The Italian Leading indicator (index and % change)



Source: Italian National Statistical Institute (ISTAT).

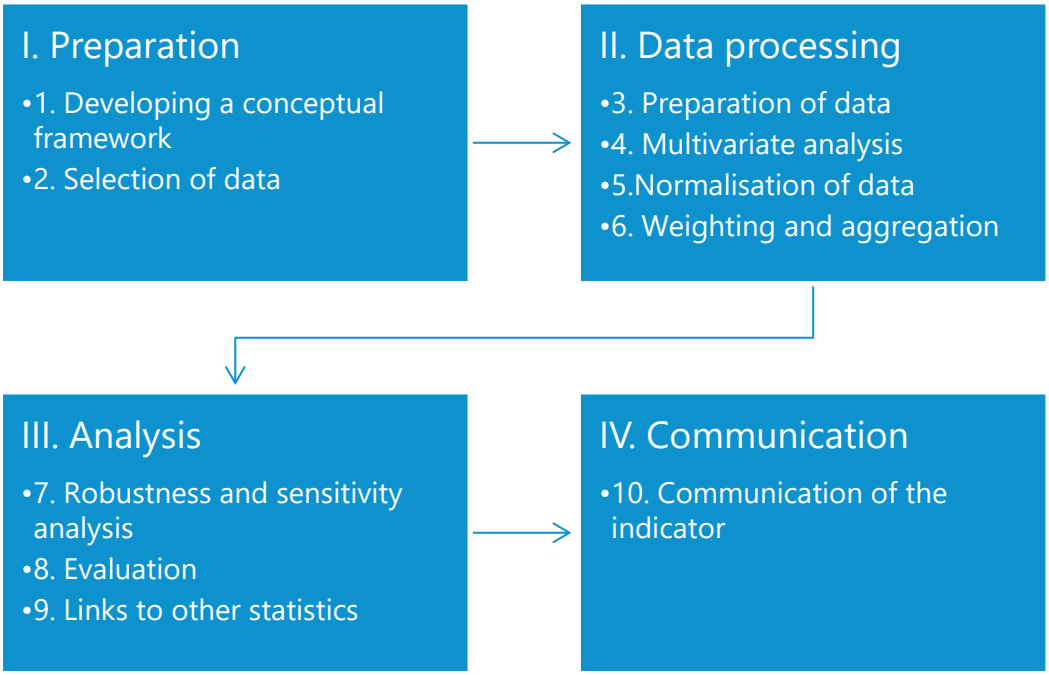
5.4 Steps for constructing cyclical economic composite indicators

5.24 The construction of cyclical composite indicators can be divided into four main processes, which include ten steps to be undertaken. The processes and the steps are shown in Figure 5.2.

5.25 The steps are based on and follow the Handbook on Constructing Composite Indicators (OECD, 2008). The steps are presented below with a focus on the construction of cyclical composite economic indicators. However, the steps also apply to the construction of structural composite indicators and socio-economic composite indicators discussed in Chapter 6.

5.26 The steps of constructing cyclical composite indicators are described in more detail in OECD (2008) and OECD (2012). EU and UNSD (2017a) also provides detailed guidance for the construction of cyclical composite.

Figure 5.2 **Production process for composite indicators**



5.4.1 Developing a conceptual framework

5.27 To construct a composite indicator, a conceptual framework must be developed. The framework should:

- Define and describe the phenomenon (the reference series) the indicator aims to measure.
- Specify a cyclical model and whether the indicator aims to estimate the entire cycle, turning points or short-term developments.
- Define the timing of the indicator, i.e. whether it should be leading, coincident or lagging.

5.28 The cyclical movements of the reference series can be described using different models. Three such models are available: the classical business cycle model, the growth cycle model and the growth rate cycle model. These three approaches are described in more details in Annex A.

5.29 The statistical office will need choose which business cycle model to apply, based on the purpose of the indicator, i.e. whether to estimate the cyclical component of the reference series or only its turning points, and weighting the advantages and disadvantages of the different models. The Conference Board's Leading Economic Indicator and OECD's Composite Leading indicator are based on the classical business cycle model while Eurostat's cyclical composite indicators refer to the growth cycle. The growth rate cycle model is generally not considered suitable due to its volatility (see, for example, Anas and Ferrara (2004)), although problems with volatility can be reduced by smoothening of time series or applying year-on-year growth rates rather than monthly or quarterly growth rates.

5.30 The choice of business cycle model is crucial since it will influence which statistical methods should be applied to analyse data series and build the indicator. More details concerning the different cyclical models are provided in Handbook on Cyclical Indicators, Chapters 7, 12 and 14 (EU & UNSD, 2017a). The relevance of the indicator, including the choice of cyclical model, should be carefully evaluated and discussed with users.

5.4.2 Selection of data

5.31 For most cyclical composite indicators aiming at describing overall economic developments, the ideal reference series is GDP. Nevertheless, since GDP is available only on a quarterly basis and cyclical

composite indicators are usually requested on a monthly basis, either a monthly estimate of GDP is needed, or another reference variable is used. In the second case, one candidate is the industrial production index.

5.32 Concerning the selection of component series, it is important to look at the quality (especially reliability and timeliness), and at the leading properties of candidate series. It is recommended that candidate series include as much as possible official statistics and sentiment variables which could be complemented, whenever needed, by non-official source. Component series could be either accepted or rejected starting from large information sets, or large information sets could be summarized using factor analysis models (see, for example, OECD (2008) for more details on factor analysis).

5.33 The timeliness of the composite cyclical economic indicator is crucial for its purpose. Hence, when selecting individual indicators their timeliness needs to carry a high weight in the decision.

5.34 As already mentioned, the quality of component series is essential in constructing cyclical composite indicators. In this context, the availability of exhaustive and updated metadata can be used to assess the quality of the series and identify shortcomings.

5.4.3 Preparation of data

5.35 Usually, both the individual indicator time series and the reference time series need various data transformations. This may include, e.g., first-differencing, imputation of missing observations, and detection of outliers. The data transformations must be chosen in relation to the phenomenon that is being measured. For example, if the aim is to estimate economic fluctuations around a trend, the reference series needs to be filtered to remove the trend and the irregular component.

5.36 Data transformations may apply well-known filtering techniques, such as those described in Baxter and King (1999) or Hodrick and Prescott (1997). Traditional seasonal adjustment procedures, either TRAMO-SEATS (Gómez & Maravall, 1998) or X-13-ARIMA[1] can also be used at this stage of the process. The outlier identification should also be taken into consideration as these can disturb the picture. The treatment of outliers should be fully transparent and well documented for users and analysts. Seasonal adjustment of time series can be carried out through use of available software packages (e.g. JDemetra+).

5.4.4 Multivariate analysis

5.37 In this step, an analysis of the suitability of the dataset is performed to yield a better understanding of the data structure. There are several methods to perform a multivariate analysis, which are recommended in the OECD Handbook on Constructing Composite Indicators (OECD, 2008), such as, for example, Principal Component Analysis, Factor Analysis and Cluster Analysis. In brief, these analyses can be used to group the individual indicators according to their statistical correlation and to derive their impact, or weight, on the composite indicator. To each group, the analysis associates a score, the so-called loading, which indicates how much of the information of each group is included in the composite indicator, which is an indication of the statistical quality of the groupings of the individual indicators. Principal component and factor analyses are suitable for business cycle indicators and other macroeconomic Indicators, while the cluster analysis is more suitable for structural indicators. Emerging is also the Partial Least Square (PLS) technique, see for example DG ECFIN (2018; pp.18). It may be necessary to normalise data series, as mentioned below, to perform multivariate analysis.

5.38 It should be recalled that these analytical models are based purely on the statistical correlations between the indicators and does not necessarily imply presence or absence of causality. Hence, expected causalities must be considered in the selection of individual indicators and concerning how they are

[1] https://www.census.gov/srd/www/x13as/

grouped as a result of the statistical analysis. The statistical based analysis is more suited for sets of indicators that are related and within the same dimension.

5.4.5 Normalisation of data

5.39 Normalisation is required prior to any data aggregation when the indicators in the dataset are nominated in different units. Normalisation, thus, may also be required for multivariate analyses.

5.40 Several normalisation methods are available (OECD, 2008, p. 83). Among them, the most common is standardisation, which means converting all indicators to a common scale with an average of zero and a standard deviation of one.

5.41 Furthermore, it might prove to be practical to adjust variables that are negatively correlated with the composite indicator by changing their sign (i.e. by multiplication with (-1)). This can ease the interpretation of results and of the effects of the indicators in question. Another way of achieving the same result is by assigning negative weights to indicators with a negative correlation.

5.4.6 Weighting and aggregation

5.42 The choice of the weighting and aggregation method is crucial for composite indicator construction. When used in a benchmarking framework, weights can have a significant effect on the overall composite indicator and the country rankings. The choice of the weighting system should reflect both the closeness to the reference series and need to be transparent.

5.43 While the weights to some extent may follow from the conceptual framework of the indicator, this is not always the case. A number of weighting techniques exist (OECD, 2008, p. 89). Weights may be assigned to component series in order to reflect their economic significance (coverage, reliability causality), statistical correlation, cyclical conformity and timeliness. In practice, costs for data collection will also have to be considered. Further methodological guidance on weighting is available in OECD (2008). The so-called Partial Least Square (PLS) technique, as mentioned earlier, may also be applied.

5.44 Commonly used methods for weighting include equal weighting and weight calculation based on statistical models:

- Principal components analysis or factor analysis
- Data envelopment analysis
- Regression analysis
- Unobserved components models

5.45 Many composite indicators rely on equal weighting, i.e. all variables are given the same weight. Equal weighting may be a suitable method, and in some cases the only option in the absence of statistical or empirical evidence or insufficient knowledge of causal relationships etc. Equal weighting does not imply “no weights” but implies that the weights are equal. When using equal weighting for series some of which are highly correlated with each other, there is a risk of double counting. Weights may also be chosen to reflect the statistical quality of the data. Higher weights are assigned to statistically reliable data with a broad coverage. Other weighting schemes reflecting expert evaluation or appreciation are not considered suitable in this context to reduce as much as possible subjectivity in the production of the statistics.

5.46 The literature of composite indicators offers several examples of aggregation techniques. The most used are additive techniques, which range from summing up ranking for each indicator to aggregating weighted normalized indicators. Yet, additive aggregations imply requirements and properties of the indicators and the associated weights, which are often not desirable and at times difficult to meet or burdensome to verify. To overcome these difficulties the literature proposes other and less widespread, aggregation methods such as multiplicative (e.g. geometric) aggregations or non-compensatory aggregations, such as the multi-criteria analysis (OECD, 2008, p. 102 ff.).

5.47 The additive method is useful when all individual indicators have the same measurement unit and if some statistical conditions are satisfied. Geometric aggregations are better suited if the compiler wants some degree of non-compensability between individual indicators or dimensions.

5.48 The composite indicator may be compiled in one step in which the individual indicators are weighted and aggregated into the composite indicator. The composite indicator may also be compiled in two steps: (1) from individual indicators to dimensions, and (2) from dimensions to a composite index.

5.49 In either case, the compiler will need to carefully consider the different options for weighting, including equal weighting and the use of statistical methods such as factor analysis and principal component analysis.

5.50 Finally, the selection of the appropriate weighting and aggregation procedures with reference to the conceptual framework should be evaluated and considerations should be made regarding the use of alternative methods.

5.51 It should be noted that the absence of an objective way to determine weights and aggregation methods does not necessarily imply that the composite indicator is not valid. However, the entire production process must be transparent. The objectives and the selection of weighting models should be clearly explained in the conceptual framework and in the documentation of the indicator.

5.4.7 Robustness and sensitivity analysis

5.52 The robustness of composite indicators depends on the underlying assumptions and methods chosen. By using a combination of uncertainty and sensitivity analysis, their robustness can be gauged and transparency improved.

5.53 It is sometimes argued that composite indicators are too subjective due to the assumptions and decisions that must be made in the construction of the indicators. The assumptions can heavily influence the message conveyed by a composite indicator in a way that deserves analysis and validation. Sensitivity analysis is the study of how output variation in models such as a composite indicator can be related, qualitatively or quantitatively, to different sources of variation in the assumptions. In addition, it measures how the given composite indicator depends upon the information that comprises it. Sensitivity analysis is closely related to uncertainty analysis, which aims to quantify the overall variation in the final results associated to the uncertainties in the model input. For a presentation of sensitivity analysis, see Saltelli et al. (2004).

5.54 Sensitivity analysis is also useful to measure the influence of each individual indicator on the final composite indicator, together with the associated uncertainty. Examples of a Monte Carlo based robustness analysis can be found in the Handbook on Constructing Composite Indicators (OECD, 2008, pp. 117-131).

5.4.8 Evaluation: indicator performance

5.55 Cyclical conformity of the composite indicator and its reference series can first be assessed by looking at the distance between the turning points of the two series. Cyclical conformity can also be assessed by looking at cross-correlations, which puts less emphasis on turning points than the previous method. Both methods complement each other. Further details about reference series analysis are provided in Section 4.2.4.

5.56 It is important to note that the performance and the accuracy of the composite indicator must be monitored over time. Also, a regular assessment of all components is an essential part of the production of composite economic indicators. Structural changes or changes in source data may reduce the leading properties. It may eventually be necessary to introduce changes in methodology or e.g. in the choice of individual indicators to keep the composite indicator up to date and preserve its accuracy and cyclical properties.

5.57 Overall, the production of composite cyclical indicators should follow the quality standards applied by the statistical offices for its official statistics, or an amended version of the standards to take the specific features of composite indicators into account.

5.4.9 Links to other statistics

5.58 Composite indicators often measure concepts that could be linked to well-known and measurable phenomena, e.g. productivity growth, entry of new firms. These links can be used to test the explanatory power of a composite indicator. Simple cross-plots are often the best way to illustrate such links. An indicator measuring the environment for business start-up, for example, could be linked to entry rates of new firms, where good performance on the composite indicator of business environment would be expected to yield higher entry rates.

5.59 Correlation analysis should not be confused with causality analysis. Correlation simply indicates that the variation in two data sets is similar. A change in one indicator does not necessarily lead to a change in the other composite indicator and vice versa. For instance, countries with higher GDP might invest more in technology or more technology might lead to higher GDP. The causality remains unclear in the correlation analysis. More detailed econometric analyses can be used to determine causality, e.g. the Granger-causality test. However, causality tests require time series for all variables, which are often not available.

5.4.10 Communication

5.60 It is crucial that the indicators are communicated in a clear form that meets users' needs and with sufficient documentation and explanation to facilitate correct interpretation and use of the indicators and avoid misunderstandings. It is also important that changes due to changes in e.g. methods or individual indicators are communicated to users in a timely and clear way. The communication should include a description of the applied methodology and the component series of the composite indicator. Communication of indicators is dealt with in more details in Chapter 7, which also provides examples of visualization techniques. Dialogue with users and stakeholders is also highly desirable to target the communication and avoid misinterpretation.

5.5 An alternative approach

5.61 Often, and as suggested in the steps for constructing a cyclical composite indicator in Section 5.4, the cyclical composite economic indicator will be based on a limited number of individual indicators that are selected from a set of potential indicators because of their expected causality and correlation with the reference series. An alternative to this approach is the KOF Economic Barometer developed by the KOF Swiss Economic Institute. The KOF Economic Barometer is based on a very large number of individual indicators (about 270), which are selected based on their correlation with a reference series reflecting the Swiss growth rate cycle.

5.62 Because of changes in economic relations, availability of data and data revisions, composite indicators need to be updated. In the traditional approach where a number of input variables are selected and kept constant over time there may be a tendency to postpone revisions until after significant deterioration in forecasting performance. In the KOF Economic Barometer the set of individual indicators is updated annually. The annual update of the large number of variables means that structural changes to some extent can be gradually incorporated by omitting or including variables, which helps to preserve the leading properties of the composite indicator, as compared to the same composite indicator without such updates. The KOF Economic Barometer is presented in more detail in Box 5.2.

Box 5.2 **The KOF Economic Barometer**

The Economic Barometer produced by the KOF Swiss Economic Institute is a prominent leading composite economic indicator for Switzerland. The production of the indicator is based on a standardised procedure for selection and updating of input variables, which aims to avoid some of the weaknesses in traditional approaches to constructing leading composite economic indicators.

Standardised variable selection procedure
The input variables are selected from a large number of variables, currently almost 500 series, and all sensible transformations of these, which may potentially have a close correlation with the Swiss growth rate cycle. These are mainly series of the domestic economy but also include variables on the international economy and developments in trading partner countries. Where possible, the theoretical expected sign of the correlation with the reference series is determined. From the pool of potential variables, the input variables are selected based on pre-established rules. Only those variables are selected for which: 1) observations are available throughout a 10-year observation window; 2) the sign of the correlation with the reference series corresponds to the expected sign; 3) the correlation with the reference series meets a predefined level, taking the correlation and the variables' leading properties into account. Approximately 270 series are currently selected as input variables.

Regular and rules-based compilation of the composite indicator
The weights of the input variables are calculated by use of principal components analysis and kept constant for one year. The composite leading indicator is compiled and published monthly based on the weights and the latest observations of the input variables. The indicator is updated annually by moving the observation window forward by one year and calculating a new vintage of the indicator. As part of the update, the list of potential variables is revised; some may have disappeared and new ones may have emerged. The set of input variables is re-selected according to the established rules and a new set of weights is calculated. The regular updating procedure preserves the leading properties of the composite indicator by gradually incorporating structural and other changes. The regular and rule-based procedure also reduces the arbitrariness of the selection and updating of component series and reduces suspicion that revisions are made because the results are not liked.

Source: Abberger et al. (2018)

5.6 Composite economic sentiment indicators

5.63 This section describes the production of composite economic sentiment indicators based solely on the aggregation of individual sentiment indicators into a composite measure.

5.64 Their purpose is usually to produce one single key figure which relate either to the entire economy or of particular sectors. In addition, composite sentiment indicators can be produced timelier than most traditional economic statistics such as GDP or sectoral production data. This is an important advantage.

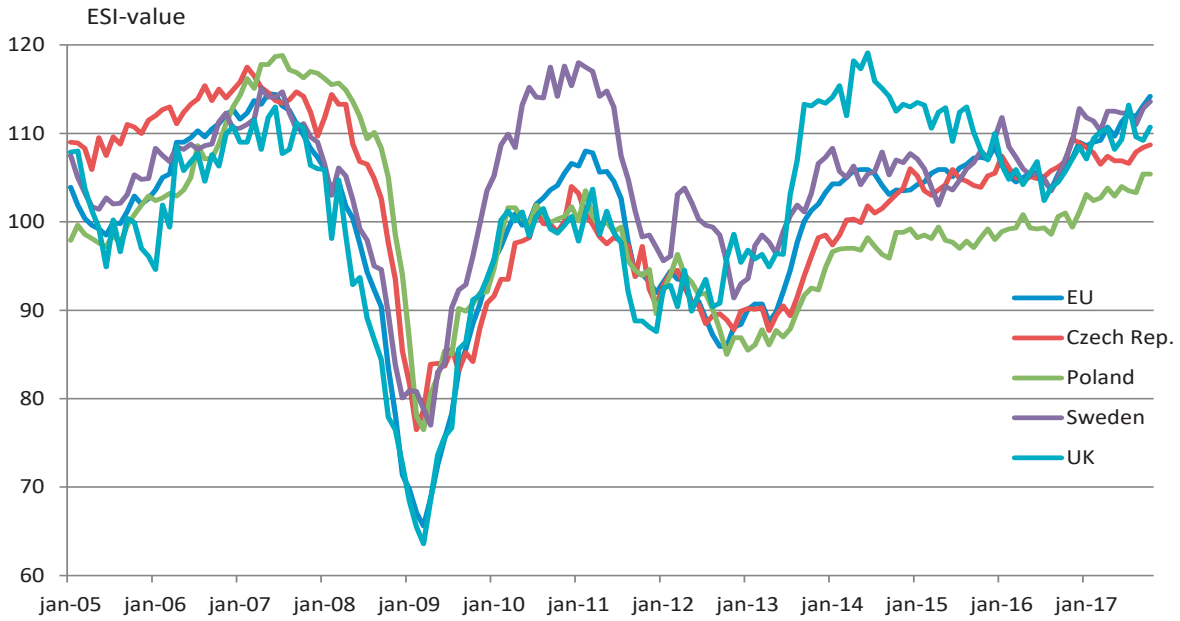
5.65 If based on harmonized or uniform surveys, the indicators can be compared between countries. Prominent international indicators are the Purchasing Managers Index (PMI) produced by several institutes[1] and the EU commissions Economic Sentiment Indicator (ESI).

5.66 The common methodologies for producing composite sentiment indicators are relatively simple since all input components are at same qualitative form, typically expressed in terms of balance values. The following two examples on the Economic Sentiment Indicator and the Economic Climate Tracer illustrate methods to bring economic sentiment indicators at aggregated form.

[1] Various institutes produce PMIs. Internationally renowned is the Markit institute which produces PMI for several countries worldwide, and the Institute for Supply Management (ISM) which produces PMI for the US, but also e.g. China's Bureau of Statistics produces PMI.

5.67 The Economic Sentiment Indicator[1] displayed in Figure 5.3 is produced and published monthly by the European Commission both at country level and EU level. The indicator is coincident with GDP, but since it is released earlier than GDP figures it gives an early signal of the movement in GDP. It is based on the Business and Consumer Survey indicators which constitute the individual sector's confidence indicators (Sections 4.2.2 and 4.2.3). Within each sector, the component's balances are normalized (z-score standardization) and weighted together equally. Thus, having indicators for four business sectors and for consumers, they are again normalized and weighted together with fixed weights across time and countries. The weights of the sectors are: Manufacturing 40%, Services 30%, Consumer 20%, Construction 5% and Retail trade 5%. The size of the weights has been determined by experts out of various considerations, among others, the relative contribution to GDP, the leading characteristics of the sector and the overall resulting ESI-indicators' correlation with the GDP.

Figure 5.3 **Economic Sentiment Indicators**



Source: DG ECFIN database on Economic Sentiment Indicator (ESI) *https://ec.europa.eu/info/business-economy-euro/indicators-statistics/economic-databases/business-and-consumer-surveys/download-business-and-consumer-survey-data/time-series_en*

5.68 The EU Economic Climate Tracer[2] displayed in Figure 5.4 is an example of a more advanced method of aggregating sentiment indicators and visualizing them. These are also called Business cycle clocks or Business Cycle tracers. A set of basic indicators for a given sector, seasonally adjusted, is chosen. By principal component analysis, the indicators are correlated against each other and weighted together according to their correlation significance.

5.69 The time series is transformed into a cyclical anti-clockwise movement. The indicator is plotted along the y-axis against its first deviate (change from month to month) along the x-axis. Each dot marks a month. In a situation with a regular business cycle with constant oscillations of identical length and

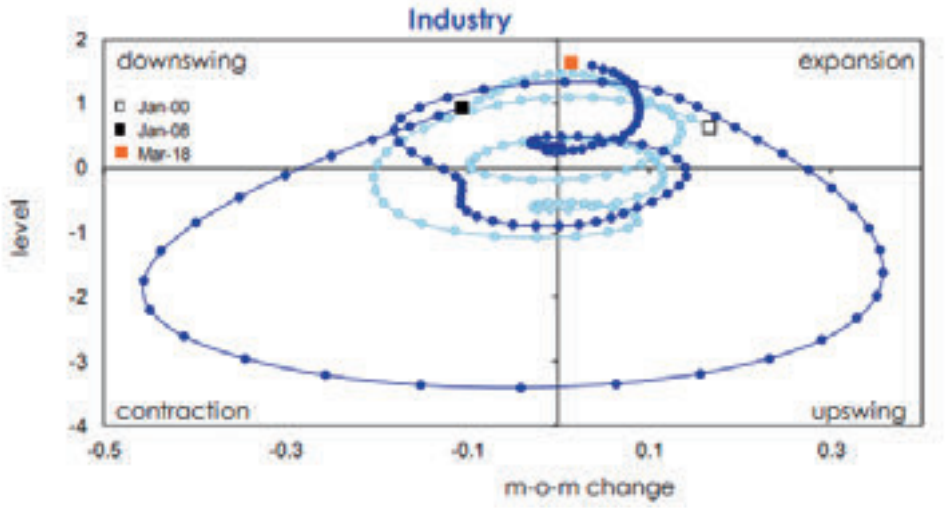
[1] The most recent publication of the ESI can be found on https://ec.europa.eu/info/business-economy-euro/indicators-statistics/economic-databases/business-and-consumer-surveys/latest-business-and-consumer-surveys_en

[2] A detailed description of the methods used in EU's Business Climate Tracer is available in the quarterly publication on European Business Cycle Indicators, e.g. for 4th Quarter 2017. Technical Paper 021; January 2018. https://ec.europa.eu/info/sites/info/files/economy-finance/upd_tp021_en.pdf

amplitude, the graph in Figure 5.4 would show a perfect circular movement. In reality, this rarely happens. Still, the overall movements can be seen to be roughly circular, going through the business cycles' four phases of upswing, expansion, downswing and contraction.

5.70 The indicator is smoothed to eliminate minor fluctuations and show only long-term business cycles movements.[1]

Figure 5.4 **Economic Climate Tracer**



Source: European Business Cycle Indicators, 1st Quarter 2018.

5.71 The tracers can be calculated at sector level or at entire economy level, and at international level, which is the case for the EU Economic Climate Tracer.

5.7 Structural composite economic indicators

5.72 Structural, or non-cyclical, composite economic indicators show trend patterns in economic developments that are non-cyclical in nature. These indicators are found in areas such as measures for competitiveness, globalization, presence of macroeconomic imbalances, etc. Structural economic indicators do not generally have a reference series as they are usually measuring a complex or multidimensional phenomenon, which is not directly observed. They can be useful tools in policy analysis to track structural changes in the economy.

5.73 Often, structural economic composite indicators are used for comparing and benchmarking across sectors or countries. They may also be used in microeconomic studies to show longer-term or permanent structural changes in the economy. Some examples of structural economic composite indicators are worth mentioning:

5.74 The Global Innovation Index has been developed to measure the impact of innovation at sectoral and international level. This index is produced by the World Intellectual Property Organization. An overview of the index is provided in Box 5.3.

[1] The time series in this example is smoothed by use of the Hodrick-Prescott filter. If applying this filter, the user is recommended to consult literature on endpoint problems associated to this and other so-called symmetric filters. By studies it has been generally agreed that filter factor 69 will eliminate fluctuation within 18 months from the indicator. For more information see Gayer, C. (2010): Report: The Economic Climate Tracer - A tool to visualize the cyclical stance of the economy using survey data. http://www.oecd.org/sdd/leading-indicators/39578745.pdf

5.75 The Global Competitiveness Index (GCI) is produced by the World Economic Forum[1]. The index is based on 12 pillars of competitiveness, covering areas such as institutions, infrastructure, macroeconomic environment, health and education, market efficiency, technological readiness and innovation. Each pillar is measured by a number of individual indicators. The individual indicators are, in general, aggregated by the arithmetic mean, while for the higher levels of aggregation weights representing the estimated importance of the pillars are used. The weights of the pillars vary with the development of the countries.

Box 5.3 **The Global Innovation index 2015**

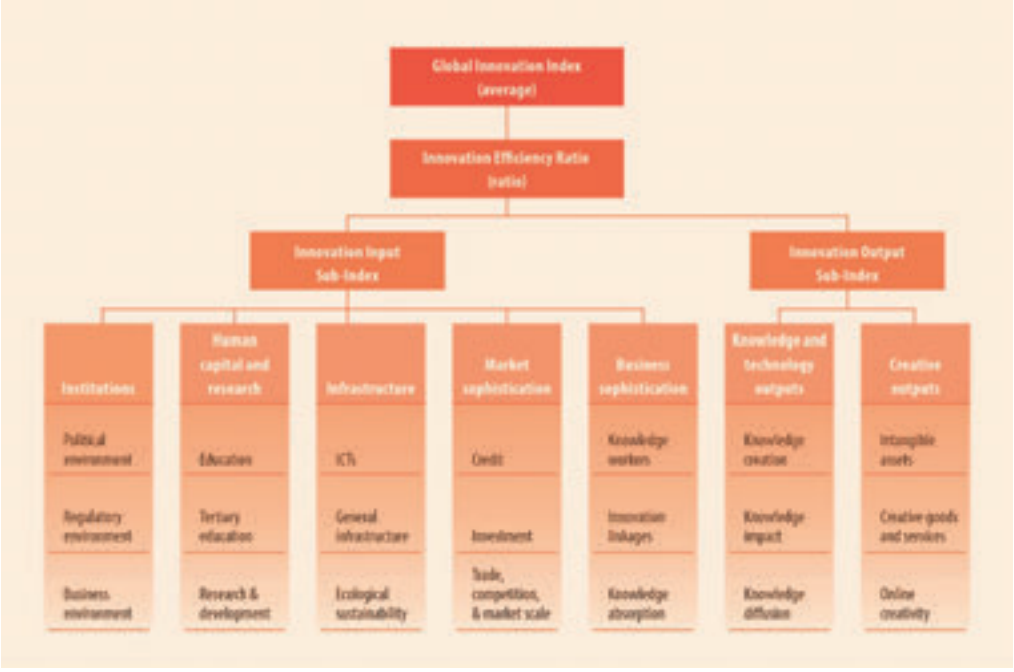
The Global Innovation Index (GII) is an evolving project that builds on its previous versions by incorporating newly available data and the latest research on the measurement of innovation. The GII relies on two sub-indices—the Innovation Input Sub-Index and the Innovation Output Sub-Index—each built around key pillars.

Five input pillars capture elements of the national economy that enable innovative activities: (1) Institutions; (2) Human capital and research; (3) Infrastructure; (4) Market sophistication; and (5) Business sophistication.

Two output pillars capture actual evidence of innovation outputs: (6) Knowledge and technology outputs; and (7) Creative outputs.

Each pillar is divided into sub-pillars and each sub-pillar is composed of individual indicators (81 in total in 2017). Sub-pillar scores are calculated as the weighted average of individual indicators; pillar scores are calculated as the weighted average of sub-pillar scores.

The structure of the Global innovation index



The GII gathers data from more than 30 sources, covering a large spectrum of innovation drivers and results, giving more weight to hard data as compared to qualitative assessments (only five survey questions were included in the GII 2017). The framework is revised every year in a transparent exercise to improve the way innovation is measured. For more on the latest updates to the framework, see Annex 2 of the GII 2016.

Source: World Intellectual Property Organization

[1] For more information about the GCI, see http://reports.weforum.org/global-competitiveness-index-2017-2018/

5.76 Partly using data from the GCI, the European Union has created its own regional competitiveness index (RCI) where regions of the EU member states are compared every three year. The RCI is described in more detail in Chapter 7, Box 7.4.

5.77 The third example is the 2013 study on Composite Indicators of Structural change towards a more Knowledge-intensive Economy by the European Commission Joint Research Centre.[1] This study presents the conceptual framework of a composite indicator that aims to measure innovation and knowledge intensity. The indicator is used to evaluate whether the economic structure of Europe is becoming more knowledge-intensive, in comparison with other European (EU, EFTA) and non-European benchmark countries (US, Japan, China). The composite indicator is constructed at country level. It consists of five dimensions: R&D, skills, sectoral specialization, international specialization and internationalization. Indicators of the dimensions are calculated by taking the arithmetic average of the individual indicators that are selected for each dimension. The overall composite indicator is calculated as the unweighted arithmetic or geometric average of the dimension indicators.

5.78 Structural indicators may aim to measure very different phenomena and be composed to meet specific user needs. It is therefore difficult to recommend more detailed guidance on their production. As for the other types of composite economic indicators, it is advisable to involve user groups and stakeholders in the development of structural composite indicators, which will often require expertise in certain areas, not immediately available within the NSO.

5.79 For the construction of structural composite economic indicators, it is recommended to follow the construction steps presented earlier in this chapter. While those steps focus on the construction of cyclical composite indicators, some of the steps will also apply to structural indicators. This include steps related to the development of a conceptual framework, the selection of individual indicators, data analysis weighting and aggregation, validation and communication. Factor analysis and principal component analysis are generally more suitable for business cycle indicators and other macroeconomic indicators, while cluster analysis is more relevant for structural indicators. More information about cluster analysis can be found in e.g. OECD (2008).

5.80 Careful specification of the quality criteria for the production of structural composite indicators is recommended to ensure as far as possible the overall quality of the indicator. The performance of structural indicators will also need to be monitored over time. If, as will often be the case, the structural indicator does not have a reference series, it may be compared with other relevant statistics that could provide information about the accuracy and usefulness of the composite structural indicator. It may, eventually, be necessary to introduce changes in methodology or in the choice of individual indicators to keep the composite indicator relevant and as accurate as possible.

5.8 International comparability of composite economic indicators

5.81 Composite economic indicators are often used to compare economic development between different countries, either in time series or in a certain point of time. It is therefore desirable that concepts, data sources and methods support the construction of internationally comparable indicators.

5.82 Heterogeneity in the development of composite indicators can be explained by the fact that some countries develop their own methodology, and even if internationally recommended methods are used, they may be applied in different ways. Composite economic indicators produced by international organizations are probably the most internationally comparable. Several such examples are included among the examples in these Guidelines. Differences in available datasets or structural differences

[1] See http://publications.jrc.ec.europa.eu/repository/bitstream/JRC87000/jrc87000_wp3_structural%20change%20report.pdf

between countries are other reasons that can make comparisons difficult. Sharing of experiences and cooperation between countries will be helpful for further harmonisation of methods and practices and improving international comparability.

5.9 Summary of recommendations

5.83 The following recommendations can be made for producing composite economic indicators:

- To produce a composite economic indicator sufficient resources and expertise would need to be allocated to the development of the indicator and its maintenance
- User needs should be critically assessed. Eventually for the development of the composite indicator the right balance needs to be found between simplicity and transparency, on the one hand, and the ability to capture complex phenomena, on the other hand.
- The construction of composite economic indicators should follow a standardized model, e.g. the OECD model or the UN/Eurostat model mentioned in these Guidelines. The theoretical basis should be carefully elaborated to form the most appropriate model for the composite indicator.
- The quality of the composite indicator depends on the methods applied and the Individual indicators that enter the composite indicator. It is therefore important to ensure that the individual indicators are of suitable quality. The timeliness of cyclical composite indicators is crucial for their usefulness. Hence, component series would also need to be timely and the production process should be set-up to facilitate timely production and release of the indicator.
- Weighting and aggregation of individual indicators into the component measure are crucial steps in the construction of a composite economic indicator and require methodological expertise. The weights should be in line with the conceptual framework and the purpose of the indicator.
- Overall, the production steps should be described and documented in detail to facilitate sound and efficient production and transparency. Suitable quality standards in line with those applied for other statistics should be applied.
- Before launching composite indicators, they need to be carefully tested and validated by performing multivariate analyses and sensitivity and robustness checks. The performance of the indicator should be assessed by comparing to the reference series and other relevant statistics.
- A process should be established to ensure that the performance of the composite indicator is critically evaluated over time as e.g. the leading properties of cyclical composite indicators may deteriorate over time. Hence, the indicator needs to be monitored and updated as time progresses to ensure that it maintains its desirable properties.
- Communication and dissemination of the composite economic indicators should include a thorough analysis of the expected audience. Users with little knowledge of statistics need information that is easily understandable, such as pictures or graphs, while more initiated users, such as analysts or researchers, also need explanations on the underlying data and methods.

6 Composite socio-economic indicators

6.1 Introduction

6.1 There is a growing demand for non-economic indicators, whether they be social, socio-economic or environmental. To a large extent, this was catalysed by the report on measuring economic performance and social progress (Stiglitz, Sen, & Fitoussi, 2009), although the tradition of social indicators dates further back (cf. Boelhouwer (2010) & Noll (2011)). In this chapter, the focus is on composite socio-economic indicators.

6.2 As is the case with economic indicators, there is a wide variation in arguments for and against composite indicators and in methods of aggregation. In addition, because of the lack of a common unit for measurement (as provided by monetary units for economic indicators), the way of combining and weighting socio-economic indicators provides an extra point of discussion. These points will be addressed in this chapter.

6.3 Section 6.2 provides a brief overview of composite socio-economic indicators, their construction and main features and the intended use. Section 6.3 presents the successive steps to compile a composite socio-economic indicator. In Section 6.4, issues regarding the international comparability of socio-economic composite indicators are briefly discussed. Section 6.5 summarises the recommendations for the construction of composite socio-economic indicators.

6.4 Various documents and handbooks have been used for this chapter - the most important are compiled by the OECD (2008) and Eurostat (2014).

6.2 Overview of composite socio-economic indicators

Socio-economic concepts

6.5 Various concepts fall under the umbrella of socio-economic indicators. Examples are happiness, quality of life, well-being, living conditions and life situation. But social capital, human capital, generalized and political trust or environmental concepts, for example various ecological footprints, also fall under this heading. Other concepts used to describe this broad kind of indicators are Human Development (UNDP, Human Development Report 2010. The Real Wealth of Nations: Pathways to Human Development, 2010), Beyond GDP[1], and How's Life? (OECD, 2017). In the Conference of European Statisticians Recommendations on Measuring Sustainable Development (UNECE 2013) well-being is considered one dimension of sustainable development. An argument for using composite indicators was given as long ago as the 1970s by Drewnowski (1974) proposing that combining social indicators into a single figure would provide an alternative to set against GDP.

Composite socio-economic indicators

6.6 Typically, composite socio-economic indicators aim to measure complex, multidimensional phenomena, which cannot be measured directly. They are constructed by aggregating a number of individual indicators into one composite measure.

6.7 Most composite socio-economic indicators will be based on so-called formative models. In formative models, the causality is assumed to go from the individual indicators to the composite indicator, which is then seen as a reflection of the developments of the individual indicators. The

[1] *Beyond GDP* was discussed on a conference hosted by the European Commission, European Parliament, Club of Rome, OECD and WWF in 2007. For additional material visit http://ec.europa.eu/environment/beyond_gdp/2007_conference_en.html

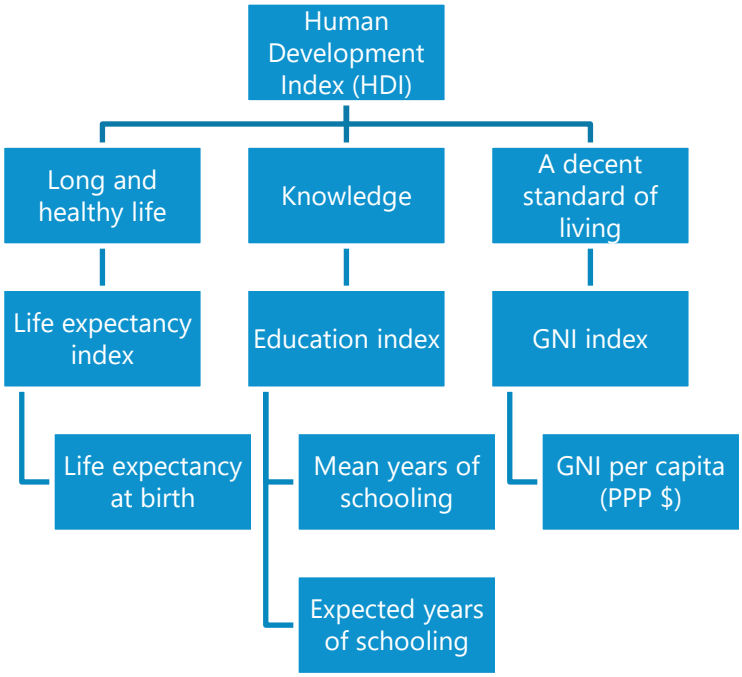
composite is a construct and does not exists as an independent entity or phenomenon in itself. Assume, for example that a composite indicator of socioeconomic status is constructed by use of four indicators covering education, employment, income, and neighbourhood. The indicators are the causes of socioeconomic status, so the causality goes from the indicators to socioeconomic status. If, say, income increases, this will lead to an increase in the composite indicator. There is no causality from socioeconomic status to any of the indicators; an increase in socioeconomic status does not cause an increase in the individual indicators.

6.8 In reflective models, the causality goes from the construct to the individual indicators. The construct is a latent variable that is assumed to be the common cause of the changes in the individual indicators and which exists independently of the individual indicators. One example is intelligence, which may be measured by a number of test scores (indicators). The causality goes from the latent variable, intelligence, to the indicators: if a person is more intelligent, he or she has a higher probability of getting the correct answer to a question in an intelligence test. It is not expected that there is a causality from the indicators to the construct.

6.9 Because most composite socio-economic indicators are formative, the chapter focuses on this type of model.

6.10 A well-known and widely used composite indicator is the Human Development Index, HDI (UNDP, 2010), illustrated in Figure 6.1. The HDI is constructed based on three dimensions of human development: to live a long and healthy life, measured by life expectancy at birth; the ability to acquire knowledge, measured by mean years of schooling and expected years of schooling; and the ability to achieve a decent standard of living, measured by gross national income (GNI) per capita. Minimum and maximum values are set to transform the indicators expressed in different units into indices on a scale of 0 to 1. The geometric mean of the resulting indices is then taken to form the HDI.

Figure 6.1 **The Human Development Index**



Source: UNDP (2015) and UNDP (2016)

6.11 Another example is the composite index for social capital produced and published by Statistics Netherlands since 2009 (Van Beuningen & Schmeets, Developing a Social Capital Index for the Netherlands, 2013). The index is based on a social cohesion framework consisting of two social capital dimensions, Participation and Trust, and 17 individual indicators, and a third dimension, Integration

(Schmeets & Te Riele, 2010). Each of the two social capital dimensions are further broken down into three sub-dimensions covering the social, organisational and political aspects of the dimensions (see Table 6.1). The indicators were incorporated into the new survey on social cohesion and wellbeing (in 2009; redesigned in 2012). The selection and operationalization of the 17 indicators builds partly on Putnam's' social capital index (Putnam, 2000, p. 291).

6.12 The six sub-dimensions, the two dimensions and the overall social capital index consist of weighted averages of the indicators. The weights are estimated in a so-called path regression model, which enables calculation of composite indices for the sub-dimensions, the dimensions and the overall index of social capital. The regression model includes both direct and indirect effects and provides estimates of the direction of the subsequent effects of the indicators, as well as the magnitude of the combined direct and indirect effects of the indicators on the dimensions, and, ultimately, the overall social capital index (Van Beuningen & Schmeets, Developing a Social Capital Index for the Netherlands, 2013, pp. 866-867).

6.13 Differences in social capital between subpopulations, e.g., immigrants and natives are reflected in the third dimension: Integration. A smaller gap in social capital indicates more integration, and wider gaps less integration in society. Overall, higher levels of social capital and integration indicate more social cohesion.

Table 6.1 **Composite index for social capital, the Netherlands**

Participation	Trust
Social	**Social**
1. Contacts: family	10. In other people
2. Contacts: friends	
3. Contacts: neighbours	
4. Informal help	
Organisational	**Organisational**
5. Organisational activities	11. Army
6. Paid work	12. Judges
7. Volunteering	13. Police
	14. Press
	15. Large companies
	16. Civil servants
Political	**Political**
8. Voting	17. Parliament
9. Other political actions	

Key challenges in compiling composite socio-economic indicators

6.14 Table 3.2 lists possible pros and cons of composite indicators that should be considered when deciding whether to engage in the production of such indicators. Two particular challenges in compiling composite socio-economic indicators should be highlighted: the selection of individual indicators and dimensions and the weighting and aggregation of these into a composite measure.

6.15 A composite socio-economic indicator will usually include several dimensions and for each dimension a number of individual indicators. For example, a composite index of well-being may include dimensions such as income, health, employment, housing, personal/family relations etc. It may not be clear on what basis the dimensions and the indicators should be selected. Often a conceptual framework or theory does not exist or is ambiguous. The lack of an internationally accepted framework to determine the dimensions and individual components adds to this problem. The selection of dimensions and indicators is discussed in Sections 6.3.1 and 6.3.2.

6.16 In some economic composite indicators, the individual indicators or the dimensions can be weighted by their share in economic activity (e.g. GDP or other aggregates). For composite socio-economic indicators it is usually more difficult to determine the weights of the indicators and the dimensions. Composite socio-economic indicators often will have a normative character (Michalos (2014), Boelhouwer (2010)) and the weights may be interpreted to represent the relative importance of the indicators and the dimensions.

6.17 Weighting and aggregation also raise conceptual issues. Does it make sense, for example, to aggregate an indicator for health and an indicator for income, and how can such an aggregate be interpreted? Different methods for weighting and aggregating are discussed in Section 6.3.6 and at large in OECD (2008) Handbook on constructing composite indicators.

6.3 Steps for constructing composite socio-economic indicators

6.18 In this section, the construction of the indicator is divided in the following ten steps:

1) Developing a conceptual framework
2) Selection of data
3) Preparation of data
4) Multivariate analysis
5) Normalisation of data
6) Weighting and aggregation
7) Robustness and sensitivity
8) Evaluation: Indicator validity
9) Links to other statistics
10) Communication of the indicator

6.19 Although composite socio-economic indicators may differ from composite economic indicators in different ways, the steps suggested for the construction of both types of indicators are the same. The following sections provide a brief explanation of each step. More detailed information can be found in OECD (2008), Land (2014) and Boelhouwer (2010), on which this section to a large extent is based.

6.3.1 Developing a conceptual framework

6.20 The first step is to set up a conceptual framework for the composite indicator. Such a framework should include:

- The purpose of the indicator: what does the indicator aim to measure and for what purposes is it intended to be used.
- The dimensions that are part of it.
- A description of related concepts or phenomena.

6.21 For instance, a composite indicator on households' satisfaction with their housing situation may be compared with available quantitative statistics on housing or other information related to housing. If the composite indicator has a reference series, this should also be defined and explained.

6.22 The framework should be specified carefully considering the relationships between the individual indicators and the dimensions, since it should provide the conceptual basis for the construction and compilation of the indicator. The framework may also indicate how the individual indicators should be weighted and, eventually, how indicators of the different dimensions should be aggregated into an overall composite indicator.

Concepts and dimensions

6.23 As shown in the example in Box 6.2, various theoretical concepts can be included such as 'life situation', 'well-being', 'environment', or 'public services'. Suppose a composite indicator for the concept

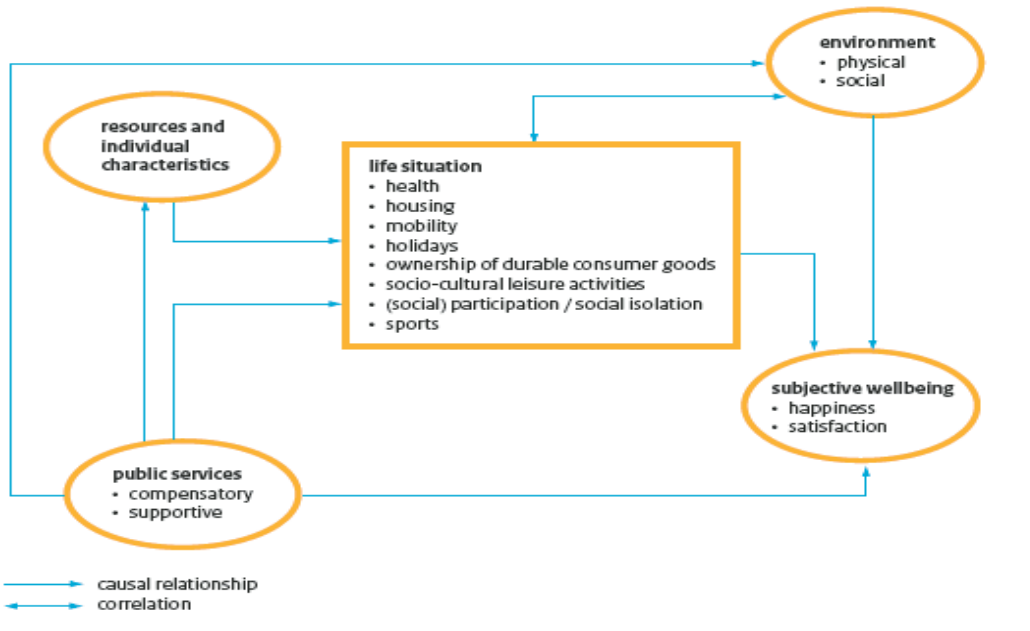
quality of life has to be constructed. In this case, each dimension must constitute a separate but substantial dimension of this concept. Examples of such dimensions of quality of life are education, safety or health. For each dimension, there may be one or more indicator variables, e.g. years of schooling, burglary figures or subjective health, respectively. Important to the selection of the indicator variables as well as the dimensions is that they must be related to the concept and be sensitive to change (as well, of course, being valid and reliable). Box 6.3 provides an example of a composite socio-economic indicator for subjective well-being that consists of eight dimensions that are considered relevant for the perception of quality of life.

6.24 The number of dimensions must be manageable and hence limited. If the aim is to measure progress or decline for the whole population, the chosen variables within the dimensions should apply to the whole population, and not to specific groups. If, for example, a composite indicator includes employment as one of the dimensions and this is measured by an indicator of employment conditions it would exclude the part of the population not in employment. Of course, this is not the case if the indicator aims to describe the changes in conditions of the population in employment.

Box 6.2 **The life situation index in the Netherlands**

The life situation index provides a measure of the life situation of citizens based on quantitative, non-sentiment indicators. The index combines eight dimensions, each of which contains two or more individual indicators. The conceptual framework for the index is illustrated in the figure below. The framework also includes *determinants* of the life situation: *Resources and individual characteristics* (e.g. age and household composition, work, health and income) and *Public services* that aim to prevent or reduce social problems. The *environment* also plays a role for the life situation. This includes both a physical component (the city and neighbourhood a person lives in, is it safe?) and a social component (the demographic composition of the neighbourhood). The life situation index includes only quantitative indicators that relate to the actual situation. The index is constructed in one step using nonlinear canonical correlation analysis (Van der Burg, De Leeuw, & Dijksterhuis, 1994). In the broader context, it is assumed that the life situation will affect subjective wellbeing (happiness and satisfaction) of the citizens.

Conceptual framework for the life situation



This index is constructed by the Netherlands Institute for Social Research (SCP). The SCP Life Situation index is based on a survey among 2000 respondents, based on a representative sample of the Dutch population, 18 years or older. The data are collected by the SCP in collaboration with Statistics Netherlands.

Source: Boelhouwer (2010)

Selecting dimensions

6.25 An important question is what dimensions to choose? A socio-economic composite indicator involves figures in several different dimensions. It is, however, important that the number of dimensions does not become too large, because otherwise there is a danger of losing the overall picture.

6.26 It might seem, at first sight, that the range of dimensions is nearly endless. But, in practice, the dimensions of the different existing composite indicators are relatively small and there is a substantial correlation between those that each separately uses. (See Table 6.2 for an overview.) Although different wording is sometimes used, the content and indicators used resemble each other closely. This suggests a consensus exists about the most important socio-economic dimensions. In fact, the literature suggests this consensus can be traced back at least for some decades (Johansson, 2002, pp. 25-26).

Box 6.3 **The composite subjective well-being index in the Netherlands**

The model for composite subjective wellbeing consists of eight dimensions which are considered relevant for the quality of life. These dimensions, which are based on perceptions, such as satisfaction, are: (1) Material living conditions; (2) Education and work; (3) Economic risks; (4) Health; (5) Social relations; (6) Participation and trust; (7) Safety; and (8) Environment. These dimensions are based on the recommendations and the dimensions distinguished by Stiglitz, Sen and Fitoussi (2009).

The calculation of the Personal Wellbeing Index has 3 steps. In the first, each dimension gets a score: when there is only one indicator, the dimension-score and the indicator-score are identical. When there are more indicators, the dimension-score is the average score of the indicators. Each indicator is a number between 1 and 10. In the second step, the dimension-scores are added into the index-score; thus, this index has a minimum of 8 and a maximum of 80. In the third step, the index-score is divided by 8, to get a score between 1 and 10 again. All 8 dimensions are equally weighted when calculating the overall composite indicator.

The composite subjective wellbeing index has been compiled annually since 2013. The index uses data collected by Statistics Netherlands in the survey on Social Cohesion and Wellbeing (7.300 respondents), based on a representative sample of the Dutch population 18 years or older.

For more information, see: https://www.cbs.nl/en-gb/our-services/innovation/project/happiness-meter The website also provides a possibility for users to calculate their personal happiness score by rating their satisfaction within eight dimensions of their lives (financial situation, health social life etc.) which can be compared with the average score of the Dutch population or of a specific population group.

Source: Van Beuningen, Jol and Moonen (2015)

6.27 As a starting point, therefore, consideration is recommended [1)] of the dimensions in Table 6.2 for possible inclusion. This does not imply that all dimensions mentioned should necessarily be included. Nor should the list be used mechanically. For a particular country, national circumstances, the specific purpose of the indicator and the availability of suitable data sources should be taken into account.

6.28 Another possibility for selecting both dimensions and indicators of a new composite indicator is through social debate. The two examples in Box 6.4 show how productive this can be. Consideration of this option is therefore recommended.

Table 6.2 **Dimensions covered by a selection of social reports**

	Stiglitz, Sen, Fitoussi	OECD Better Life	France (Portrait Social)	Germany (Data Report) [1)]	Ireland (Measuring Irelands Progress)	Netherlands (Social State of the Netherlands)	Switzerland (Sozialbericht)	UK (Social Trends) [2)]
Income	X	X	X	X	X	X	X	X
Poverty / social exclusion			X	X	X	X	X	X
Employment / work	X	X	X	X	X	X	X	X
Health	X		X	X	X	X	X	X
Housing		X	X	X	X	X		X
Education	X	X	X	X	X	X	X	X
Sustainability (nature and environment)	X	X	X	X	X		X	X
Leisure time (culture, sports, social contacts)	X	X	X	X		X	X	X
Mobility / transportation			X	X	X	X	X	X
Safety	X	X	X	X	X	X	X	X

Source: The table is taken and adapted from Noll and Berger (2014, p. 60)

[1)] The Federal Government of Germany produces the indicator *Wellbeing in Germany* (The Federal Government, 2019), which covers the same dimensions as those mentioned under *Data Report*.

[2)] UK's *Social Trends* was discontinued in 2011. The Office of National Statistics produces the *Measuring Social Wellbeing* (ONS, 2019), which covers the same dimensions as those listed for the *Social Trends*.

Box 6.4 **Selecting dimensions and indicators through societal debates**

United Kingdom

The Office for National Statistics (ONS) undertook a national debate on 'what matters to you?' between 26 November 2010 and 15 April 2011. In total, ONS held 175 events, involving around 7.250 people. The debate generated 34.000 responses, some of which were from organisations and groups representing thousands more. The debate helped to identify the key areas that matter most and ensure that the measures used would be relevant not only to government but also to the wider public. This is crucial to allow for effective development and appraisal of policy for individuals to use information to identify ways of improving well-being, and to allow for assessment of how society is doing overall.

Source: (ONS, Measuring what matters. National Statistician's Reflections on the National Debate on Measuring National Well-being, 2011)

Italy

In December 2010, the Italian National Council of Economy and Labour (CNEL) and Istat committed themselves to provide the society with a measurement tool capable of identifying the underlying elements of well-being in Italy. This was achieved through the involvement not only of key experts in the various aspects which contribute to well-being (health, environment, employment, economic conditions, etc.), but also of the Italian population at large, through discussions and exchange of views with thousands of citizens, along with meetings held with institutions, social partners and NGOs. The intention is that the BES indicators (Benessere Equo e Sostenibile or in English: Equitable and Sustainable Well-being) become a shared point of reference for the Italian society to structure debate about societal progress.

6.3.2 Selection of data

6.29 Individual component indicators should be selected to provide a sound and reliable measure of the phenomenon the composite indicator aims to capture. The selection of the individual indicators should be carefully explained as well as their relationship with the composite indicator, underpinned by theory or research where possible.

6.30 The number of individual indicators may vary depending on which phenomenon they are intended to measure and on the availability of suitable data sources. Some issues are easier to measure than others and may require fewer individual indicators while more complex issues may require more individual indicators to give an adequate representation of the phenomena. In cases where a survey is used for collecting data, information about personal opinions or attitudes, for instance concerning self-reliance or resilience, cannot always be collected through one single survey question. It may require several questions which in an indirect way provide a reliable measure.

6.31 Both input and output indicators may have a role to play. For instance, a composite indicator on health may include input measures such as smoking, exercise patterns, diet and the number of physicians, as well as a component series on self-assessed health situation, which would be an output or outcome measure. Similarly, a decision is needed whether to use subjective (sentiment) or objective (non-sentiment) component indicators, or a combination of these. Weighting and aggregating different types of individual indicators, input and output measures and objective and subjective measures, into one composite indicator may present difficult issues. On the other hand, all of these types on information are likely to be relevant to a full depiction of reality.

6.32 Some composite indicators do include both objective and subjective component indicators, the OECD Better Life Index, for example. However, objective and subjective indicators are different in nature, their relationship with other indicators may be different and they may exhibit different behaviour over time (Boelhouwer (2010), Hagerty et al. (2001)). These points would argue for combining the two types only with due caution.

6.33 If the aim is to measure trends, component indicators should be chosen which can be observed over time. To this end, time series should be available or, if not, be constructed. Further, component indicators should be consistent over time. Breaks in time series of component indicators because of methodological changes, changes in coverage or the wording of survey questions, should be adjusted for to ensure a coherent measure over time. The Handbook on Cyclical Composite Indicators (Eurostat and UNSD, 2017) in Chapter 4 provides more detailed information about the prerequisites for time series used to construct cyclical composite indicators.

6.34 The possibility of disaggregating the composite indicator should also be considered. Doing so, requires that the individual indicators can be disaggregated by population or socio-economic characteristics (such as male and female, younger and elderly, lower and higher educated), or by regions or other geographical areas. Data based on person or household surveys can be easily disaggregated into a variety of background characteristics, but limited sample size and sampling error often prohibits disaggregation into small groups of the population. Register based data are not hampered by sampling error, but usually include less background information for dividing the whole population into subgroups. An example of regional indicators is provided in Annex G: Well-being index for provinces of Turkey.

6.3.3 Preparation of data

6.35 A composite indicator should be robust to incomplete data or other data issues. It may not always be possible to obtain data for individual indicators that enter the composite indicator (data source may dry out or there may be a delay in their production). Missing observations will have to be estimated by imputation, e.g. by using the mean value of the variable or by applying a suitable regression model.

6.36 The treatment of outliers, which can disturb the picture, should also be considered. This should be fully transparent and well documented. If outliers are distorting the overall picture, they should be treated separately. However, that does not necessarily mean they should be discarded and they can

provide useful information. In the case of social exclusion, for example, outliers could be the most socially excluded people.

6.37 Depending on the individual indicators, some transformations of the series may be required. This may include, e.g., first-differencing or using logarithms. When comparing countries or regions, indicators may have different definitions reflecting local circumstances. In that case, there is value in a supplementary analysis based on common definitions, to enable national or international comparisons to be made.

6.3.4 Multivariate analysis

6.38 Multivariate analyses may be used to examine the relations between the individual indicators to facilitate grouping them into different dimensions of the overall composite indicator. The analyses should include an assessment of the direction of the impact of the individual indicators: do all indicators show the expected correlation with the composite indicator? Results based on the statistical analysis may not always correspond to the conceptual framework. If that is the case, the individual indicators should be analysed, and it should be assessed whether they are allocated to the right dimension, or whether the definition of dimensions should be changed or dimensions merged or split. For instance, when including indicators of leisure time activities, it could be that sport activities and cultural activities do not belong to the same dimension but should be included in two different dimensions.

6.39 A question of practical importance is whether all relevant individual indicators are available at the micro level. This may be the case if all the indicators stem from one single data source, such as a census or a single survey. A full set of micro data allows multivariate analysis to explore to what extent individual indicators contribute to the composite indicator. However, if some indicators are not available at micro level but only as an aggregate, for instance the percentage of employed persons, it is not possible to calculate such combined effects of individual indicators by multivariate analysis. Nevertheless, various time series analysis may still be used to guide the groupings of the individual indicators in different dimension and explore their contribution to the overall composite indicator. The Handbook on constructing composite indicators (OECD, 2008) provides more details of other weighting and aggregating techniques that can be used.

6.3.5 Normalisation of data

6.40 Socio-economic indicators often do not have the same unit of measurement and can differ in scale. It is, therefore, necessary to *normalise* the indicators into a comparable scale before they are aggregated into a composite measure or adopt some other procedure to deal with this issue. The creation of z-scores, i.e. subtracting the average and dividing by the standard deviation, is the standard treatment, but may not always be appropriate. In general, the normalization method needs to respect the data properties. Annex H provides an example where the individual indicators are not normalised but where the differences in scale are adjusted for in the weighting of the indicators.

6.41 Another aspect for the data treatment is the direction of individual indicators. For instance, a composite indicator on the quality of employment may include indicators of the employment rate, income and reported job satisfaction, which would correlate positively with the concept of quality of employment, and indicators of e.g. injuries during work and involuntary part time employment work, which would be negatively correlated. In this or similar cases, changing the sign of the negatively correlated indicators (by multiplying the data with (-1)), and thus making the correlation of all components positive, can facilitate the interpretation of the composite indicator and related analyses.

6.3.6 Weighting and aggregation

6.42 Typically, a composite indicator will involve two steps of aggregation: from individual indicators to dimensions, and from dimensions to a composite index. To some extent, the weights may follow from the conceptual framework of the indicator or from the use for which the indicator is constructed.

However, in most cases, weights will have to be estimated. The most commonly used methods to do this include:

- Equal weighting
- Weights based on statistical methods
- Experts' judgement
- Public opinion

6.43 In the following, the weighting methods are briefly presented, together with their main advantages and disadvantages.

Equal weighting

6.44 Equal weighting can be applied at both of the aggregation steps noted above. Equal weights may be applied if the individual indicators and/or the dimension can be considered equally important, based on the conceptual framework and the purpose of the composite indicator. Equal weighting will often be a suitable solution and perform well compared to other methods. It also has the advantage of being transparent and easy to explain to users.

6.45 Composite indicators may cover a broad range of dimensions, for example a composite indicator of well-being may include 8-10 dimensions that are different in nature and cover very different aspects of well-being. For such broad types of composite indicators, it may not be possible to estimate and apply explicit weights, or the foundation for such weights could not be justified. Hence, at the level of dimensions, equal weighting might be the preferred option. Any explicit weights for the dimensions, whether estimated by statistical methods, experts' judgments or public opinion, might be interpreted as judgements about the relative importance of the different dimensions and raise criticism. The criticism can hold for equal weights, too. Nevertheless, it can prove to be of advantage due to the simplicity and transparency of the method.

6.46 An example of using equal weighting is the composite social exclusion index based on the 2010 EU-SILC survey conducted in the Netherlands, in which 42 indicators are included for four dimensions: (1) participation; (2) material deprivation; (3) access to basic rights; and (4) value orientations, which are equally weighted (Coumans & Schmeets, 2015). Eurostat's indicator "at risk of poverty or social exclusion" is another example. This indicator is based on 9 individual indicators included in EU-SILC 2010, distributed into three equally weighted dimensions: (a) at risk-of-poverty after social transfers, (b) persons severely materially deprived; and (c) persons living in households with very low work intensity.

Weights based on statistical methods

6.47 Different statistical methods may be used for grouping and weighting individual indicators. The two most commonly used are principal component analysis (PCA) and factor analysis (FA), which are available in statistical software packages such as SPSS and STATA. Based on the correlation between the variables, PCA and FA estimate the statistical optimal grouping of the variables into one or more dimensions ("components" or "factors") and the weights of the variables.

6.48 The two methods differ in their perspective on the relation between the variables and the dimensions. In PCA, the component is seen as the result of the observed variables. The components are the best grouping of the variables based on a linear combination (a weighted average) of the variables. In FA, it is assumed that there is an underlying, latent factor that causes the observed variables, which can be determined through correlation analyses. In many cases, the two approaches will give very similar results, but there may be significant differences. The compiler should carefully consider the choice of method based on the conceptual framework of the composite indicator and data analyses.

6.49 Often, the dimensions of a composite indicator will be given by its conceptual framework. Also, the individual variables that are used to form the dimensions may be implied by the framework. Since the grouping of the variables into dimensions is based only on statistical correlations, the implied dimensions and weights proposed by the statistical models may not necessarily align with the

framework. However, PCA and FA may still be useful as an adjunct to assessment of the choice of individual indicators and their distribution in the dimensions of the composite indicator.

6.50 Both PCA and FA are based on statistical assumptions and have their limitations. For instance, the estimation process assume that the variables are normally distributed and that the estimated dimensions (components or factors) are linearly related to the variables. The methods are not recommended for variables with a highly non-normal distribution or where the relations are nonlinear.[1]

6.51 If statistical methods are used, the quality of the provided solution should be carefully evaluated. This would include a critical evaluation of the estimated weights and the extracted factors, i.e. the dimensions, and their statistical properties.

6.52 Detailed information about PFA and FA and other statistical methods and guidance on how to apply these methods are provided in OECD (2008) and in Booysen (2002). Partial Least Square (PLS) technique is an alternative method that may be applied, see for example DG ECFIN (2018; pp.18).

Experts' judgements

6.53 The weights for individual indicators and for dimensions of composite indicators may both be estimated based on expects' judgement about the relative importance of the individual indicators or the dimensions. The relevant expertise could include information both from field experts and researchers. However, for composite indicators that cover a broad set of dimensions, it may be difficult to access the very broad expertise required. A composite indicator of well-being, for example, might cover 8-10 dimensions, each of which require special expertise; weighting these together in a composite indicator would require knowledge or expertise on their relative importance, not just in their individual areas. For composite indicators with a more limited scope, e.g., composite indicators on health or social exclusion, there may be more expertise or studies available that could be used to decide on the weights. Indeed, proposed weights which clashed with such expertise should be considered with care.

Public opinion

6.54 In this approach, weights are based on the outcomes of polls or surveys, where people are asked to express which areas matter to them most. Public opinion can be used to estimate weights for both individual indicators and for dimensions but is probably more suitable for estimation of weights of dimensions since estimation of weights for individual indicators usually will require more detailed knowledge. Obviously, the survey should be of sufficient quality to ensure that the weights are of sufficient precision and reliability.

6.55 Of course, public opinion may legitimately change. This may warrant that not only the indicators but also the weights of the dimensions should be updated. There are obvious advantages in not changing the dimension weights over time, without good reason. However, if public opinion about the relative importance of the dimensions changes significantly, the weights may need to be updated to reflect the new reality. Changing the weights implies that the development in the composite indicator will not only be the result of changes in the individual indicators but also in their relative weights.

6.56 There is also the possibility of a web based interactive approach. In this approach, the weights are typically by default set equal. The user then has the possibility to manipulate the weights according to their own preferences and to calculate their individual indicator. In turn, the individual indicators may be aggregated into one measure which will reflect an average indicator of the individually compiled indicators. An example of this facility being provided is the earlier mentioned OECD Better Life Index.

6.57 Irrespective of which method is used, some composite indicators may be produced for different regions or different socio-economic groups of the population. When aggregating such indicators to an

[1] Methods to address nonlinearity are available, e.g. optimal scaling techniques such as categorical principal component analysis and nonlinear canonical correlation analysis (Van der Burg, De Leeuw, & Dijksterhuis, 1994). Partial Least Squares (PLS) may be used to deal with non-normal distributed data and multicollinearity between indicators.

indicator for the whole country suitable weights should be applied. Usually, a weighted arithmetic mean would be the preferred solution. Depending on the purpose of the indicator a geometric or harmonic mean may be used, which would give more weights to those regions or socio-economic groups with lower scores.

6.3.7 Robustness and sensitivity analysis

6.58 Checks of the robustness and the sensitivity of the composite indicator should be carried out. This would include analysing how much the composite indicator changes in response to changes in the individual indicators. It should also include assessing whether the composite indicator can be considered sufficiently robust and whether the sensitivity to changes in the individual indicators appears reasonable and can be interpreted as consistent with the conceptual framework. Similarly, analysis of the effects of changes in the weights give useful information.

6.3.8 Evaluation: Indicator validity

6.59 Ensuring the plausibility and validity of the composite indicator is of crucial importance. If the correlations between the individual indicators and the composite are ones that would be expected, that would offer some reassurance about the validity of the composite indicator. On the other hand, if individual indicators exhibited a different correlation from that expected, and perhaps assumed in the conceptual framework, the selection of individual indicators, data sources and the construction of the composite indicator should be critically reviewed.

6.60 The acid test is whether the composite indicator gives a good and reliable measure of the phenomenon it is intended to represent. For this reason, it is important to analyse the links to other relevant statistics and information, as set out in the following section.

6.3.9 Links to other statistics

6.61 Composite socio-economic indicators often aim to measure complex and multidimensional phenomena, e.g. safety, well-being or quality of life, that cannot be observed directly, and where there will not be a reference series that the indicator could be compared to. In such cases, and where possible, it is recommended to compare the indicator to other relevant statistics. For example, an indicator on well-being may be compared to statistics on personal or household income, education or employment situation, or to available subjective measures of the quality of life (see Boelhouwer (2010)). If the composite indicator behaves differently from expected when comparing with other related statistics, it should be reviewed. Also, differences compared to related statistics should to be explained when the composite indicator is published.

6.3.10 Communication

6.62 This last step in the compilation process is especially important for socio-economic composite indicators. It is necessary to communicate the concept and the intention behind these new kinds of indicators, with which the users might not be familiar. Guidance on the correct interpretation of the indicator would help avoid misunderstandings. For instance, the use of rankings can be misleading, and it is often unclear what differences mean. For example, the difference in HDI (Human Development Index) score between Norway and Sweden is only 0.037 in 2015 but makes a difference in ranking between 1st and 14th. Without clear guidance, the significance of this marginal difference could easily be misunderstood.

6.63 In multidimensional phenomena, which such indicators are intended to address, it is likely that different user groups and different parts of the society see differing priorities. Hence, special emphasis could be given to description of the chosen dimensions, variables and their weights as well as the

reasoning behind these. Issues related to communication of indicators are presented in more detail in Chapter 7, which also provides examples of visualization techniques.

6.4 International comparability of composite socio-economic indicators

6.64 Socio-economic composite indicators are often used for comparing developments in various aspects of the quality of life between different countries, either in time series or at a certain point of time. It is therefore important that the construction of the indicators is comparable, and consequently are based on harmonized data.

6.65 Heterogeneity in the development of socio-economic composite indicators can be explained by the fact that some countries develop their own methodology, and even if internationally recommended methods are used, they may be applied in different ways. Socio-economic composite indicators produced by NSOs, often in collaboration with national research institutions and/or regional institutions (e.g. Eurostat), are probably the most internationally comparable.

6.66 Harmonisation between countries should be encouraged, based on agreed guidelines. In this area, NSOs have an advantage as they can collaborate in developing comparable socio-economic composite indicators. A first step in harmonization would include common definitions of concepts and variables. Further harmonisation would include other aspects such as, e.g., sample design, selection and phrasing of survey questions as well as weighting and aggregation methods.

6.5 Summary of recommendations

6.67 Drawing from the discussion in this chapter, the following recommendations can be made:

- The first and crucial step in developing a composite socio-economic indicator is to establish a conceptual framework of the phenomenon to be measured, including the dimensions and the individual indicators and how these are related. Stakeholders, experts and user groups should be engaged in developing the framework to ensure that it meets user needs and to draw on their expertise.
- The quality of the individual indicators should be validated and checked. It should also be ensured, as far as possible, that data will be available for future updates of the indicator.
- After forming the framework of the indicator and selecting dimensions and individual indicators, data series and the relation between these should be analysed. This would include imputation of missing observations, multivariate analysis and normalisation of data. There are different ways to normalise data. Statistical offices should select the most suitable methods, taking data properties into account. It is important to keep in mind that choices in each step can have implications for next steps.
- Decide how weights should be constructed at the different levels of aggregation, from individual indicators to composite indicators of dimensions, and from dimensions to an overall composite indicator. The weights are crucial for the performance of the indicator and its interpretation. Hence, the choice of weights should be in line with the conceptual framework and the intended use of the indicator and should be justified and documented and explained to users.
- Carry out robustness and sensitivity tests to evaluate the stability of the composite indicator. Does the indicator behave as expected in response to changes in the individual indicator or in the weights and can the results be interpreted and explained? Depending on the results of the

evaluation it may be necessary to go back in the process and implement changes, for instance in the selected individual indicators, in the normalisation of indicators or in the weightings.

- The indicator should be compared with available related statistics which can help to assess the quality and relevance of the indicator.
- The indicator should be published with enough documentation and explanations to facilitate correct understanding and use of the indicator. Both the composite indicator as well as the individual component series should be made available to users.

7 Communicating LCS indicators

7.1 Introduction

7.1 Leading, composite and sentiment indicators provide a powerful way of communicating information. Indicators can be used to shed light on new areas, reaching out to new user groups and be used to support evidence-based decision making. However, there are also challenges in their communication. In particular, indicators are produced for specific purposes and in a specific context, which need to be communicated to users. At the same time, indicators produced by statistical offices must be based on the *Fundamental Principles of Official Statistics* and meet the quality requirements of official statistics.

7.2 As noted in Chapter 3, communication should not be regarded as the final stage in the statistical process, confined to post production of indicators. On the contrary, it should be the theme throughout. Good communication with stakeholders and potential users at the beginning of the process is essential to ensure that the indicators are chosen and designed in ways which maximise their usefulness and relevance. Continuing communication throughout the design and compilation stages will also maximise the exploitation of expert and user experience and insight, to mutual benefit.

7.3 This chapter deals with issues arising after design and compilation when the indicators are ready for publication and dissemination. But even this should not be regarded as the end of a linear process. On the contrary, feedback and issues raised during dissemination may well play an important iterative role underpinning further examination and refinement of all the previous design and production stages.

7.4 Section 7.2 lists the main challenges associated with post compilation communication of LCS indicators. The key quality criteria for communicating official statistics and recommendations on how to meet them are presented in Section 7.3. In Section 7.4, the possibility of publishing as experimental statistics is discussed. Section 7.5 gives advice on how to present indicators in their right context to ensure their proper understanding and use. Section 7.6 provides brief recommendations for targeting user groups. Section 7.7 gives a brief overview of means of communication and visualisation methods and provides examples of dissemination of composite economic and socio-economic indicators. A summary of recommendations is presented in Section 7.8.

7.5 The chapter draws in particular on *Towards a harmonized methodology for statistical indicators* (Eurostat, 2017a) where more details about the communication of indicators can be found.

7.2 Challenges in communicating LCS indicators

7.6 LCS indicators should be disseminated and made available to users as other statistics produced by NSOs, according to the principles of official statistics. However, the communication of LCS indicators raises particular challenges.

7.7 LCS indicators are developed for specific purposes and in a specific context. The indicator gets its meaning from its context in terms of the theoretical/conceptual model or framework that forms the basis of the indicator. The user of the statistics will interpret, the meaning of the indicator, based on the provided information and her/his specific context. Hence, there is a risk that the receiver's interpretation of the meaning of the indicator may deviate from the intended meaning.

7.8 Compiling and disseminating LCS indicators may be controversial. The methods used and the validity of the indicators may be subject to political dispute and the impartiality of the NSO could be questioned. Further, some indicators, for an example a composite indicator on health, personal security or standard of living, may include a normative interpretation of the statistics in terms of desired or favourable development of the indicators. This is different from the traditional situation, where the NSO

is seen as the provider of bare statistical information and where it is left to the users to make any judgment whether the development of the statistics is desirable or favourable. That said, some NSOs increasingly engage in analysis and commentary based on evidence provided by statistical information, so the situation is not entirely black and white.

7.9 Disseminating LCSs indicators may include interactive solutions, where the users can adjust the visualisation or even the underlying selection of data (for example by changing weights), as well as multi-dimensional visualization techniques. Nevertheless, simple visualisation methods can still have advantages over more sophisticated solutions in terms of usability[1].

7.10 Successful development and communication of LCS cannot be ensured through only one-way communication but will require reaching out to and communicating with stakeholders and users in an on-going manner from the outset, beginning with the identification of user needs. Information gleaned from two-way communication can be invaluable for the NSO.

7.3 Quality criteria for communicating LCS indicators

7.11 Indicators produced by NSOs must meet user needs and at the same time be based on the quality requirements of official statistics. Several quality assurance frameworks for official statistics were mentioned in Chapter 3. While they diverge to some extent and provide different levels of detail, the criteria of relevance, accuracy and reliability, coherence and comparability, accessibility and clarity and timeliness and punctuality stand out as essential in the communication of indicators.

Relevance

7.12 The relevance of statistical information reflects the degree to which the information meets user needs. But user needs vary in extent and importance. The NSO's challenge is to weigh and balance the conflicting needs of current and potential users to produce statistics that satisfy the most important needs within given resource constraints.

7.13 LCS indicators can provide information about areas not covered by existing statistics and help reaching out to new user groups. In this way, LCS indicators have the potential to increase the relevance of official statistics. To ensure the relevance, potential users of the indicators should be consulted. Users will be able to give information on, e.g., what they consider more important, what documentation and additional explanations will be useful and in what form data may be released to serve user needs. Consultation with users may, for instance give information on what component series should be included in a composite indicator (and their relative importance) or which specific questions should be included in a survey-based sentiment indicator.

7.14 Users can be consulted through reaching out to agencies, individuals or groups that are known to have an interest and knowledge in the area. Broader user groups can be reached through surveys.

Accuracy and reliability

7.15 Statistics should accurately and reliably portray reality. Accuracy reflects the degree to which the information correctly describes the phenomena it was designed to measure, i.e. the degree of closeness of estimates to true values. Reliability concerns whether the statistics measure the reality that they are designed to represent consistently over time.

7.16 A distinction can be made between indicators with references series (a series that an indicator aims to approximate or predict) and those without, as explained in Chapter 2. The accuracy and the reliability of indicators with reference series can be illustrated and analysed in a simple way by comparing the indicator with the reference series in graphs or tables. Leading indicators, for instance an economic

[1] e.g. the ONS replaced their "Wheel of well-being" with interactive line charts for each indicator to increase usability, see https://blog.ons.gov.uk/2017/03/28/national-statistical-blog-reinventing-the-well-being-wheel/

business cycle indicator, should be assessed against its ability to anticipate turning points and periods of booms or recessions. While leading indicators aim to anticipate the development in a reference series, the GDP growth rate, for example, NSOs should be careful not to publish these as the NSO's forecast of GDP growth.

7.17 For indicators without references series, it is not possible to illustrate the accuracy or the reliability of the indicator by comparing to the reference series. However, providing time series of the indicator can give an impression of the reliability of such indicators, if they are moving in the expected directions compared with related statistics or indicators. For instance, sentiment indicators on households' subjective satisfaction with their economic situation, their health or their commuting time for work can be provided together with existing statistics on income, health or transport. While the indicators may not relate to these measures specifically, comparisons may be useful and give an indication of the accuracy and reliability of the indicators.

7.18 It is important to provide information about the uncertainty of the statistics and the associated limitations in their interpretation. If exact figures are published, the range of uncertainty should be communicated, e.g. where possible by providing confidence intervals or fan charts. Other options are to publish only intervals or magnitudes, rather than point estimates, or only the direction of the movement of the indicator. For detailed information, readers are referred to the Handbook on Cyclical Composite Indicators (EU & UNSD, 2017a).

Coherence and comparability

7.19 Coherence and comparability imply that statistics are consistent internally and over time and comparable over statistical domains and geographical areas. This also implies that the statistics should be produced using common standards with respect to scope, definitions, classifications and units.

7.20 Detailed communication of the scope, definitions, classifications and units of published statistics are essential to ensure their correct and efficient use.

7.21 Caution is needed if methods or practices concerning the choice or weighting of component series or survey questions for sentiment indicators are changed. Changes of component series, and other changes in data sources or methodology, may be seen as an attempt to change the development of the indicator. Hence, such changes should be communicated and carefully explained to users, if possible in advance. Similarly, choices in survey questions that enter sentiment indicators may be changed, which should also be documented and communicated to users.

Accessibility and clarity

7.22 Statistics should be made available in a clear and understandable form, accessible to all users on an impartial basis in suitable and convenient formats. Documentation and supplementary explanation, which are necessary for the proper understanding of the statistics and the appropriate uses to which they can be put, should be made available by the statistical agencies. This information should normally cover the underlying concepts and definitions, origins of the data, the variables and classifications used, the methodology of data collection and processing, and indications of the quality of the statistical information.

7.23 Transparency is essential when communicating indicators, and users should be provided with the necessary explanations and documentation of data sources and methods to facilitate the correct use of the statistics and to avoid their misinterpretation or misuse. Not only the composite indicator should be provided but also component series should be made available to users. Questions, which are used in surveys, should also be made available. To ensure proper understanding and use of indicators, the context of the indicators should also be provided and explained to users. This is dealt with in more detail in Section 7.5.

7.24 How to present data needs to be considered. Is the key indicator a measure of developments over time or a snapshot of the situation at a given point in time? Should only the raw, unadjusted

indicator be provided or should also e.g. trends be published? If the indicator is sub-annual, should data should be seasonally adjusted and/or trends provided?

Timeliness and punctuality

7.25 Timeliness refers to how fast after the reference period data are released. Punctuality refers to whether data are released on the expected, preannounced dates. LCS indicators should be released according to international recommendations on timeliness and punctuality, which should not raise particular issues compared to the release of other official statistics.

7.4 Experimental statistics

7.26 LCS indicators are a relative new terrain for many NSO. The indicators may not necessarily meet the quality criteria usually applied and the NSO may wish to collect reactions from users. In such cases, one solution is to publish the indicator as "experimental statistics". When using this approach, it should be explained that the indicator does not meet the quality criteria of official statistics applied by the NSO. Dissemination as experimental statistics can be a useful way to collect feedback from stakeholders and experts and will allow the NSO to gain experience on the accuracy and reliability of the indicator. This information can be used to improve the compilation of the indicator, which eventually could be disseminated with the stamp of official statistics once the quality criteria are met.

7.27 One example is INEGIs publication of the indicator of subjective wellbeing classified as "experimental", following the recommendations of OECD. As another example, Eurostat publishes experimental statistics[1] which use new data sources and methods in an effort to improve its response to users' needs. Experimental statistics are compiled from new data sources and methods and are marked with a clearly visible logo and accompanied by detailed methodological notes.

7.28 However, experimental statistics status should be a temporary stage in the development of LCS indicators and not a permanent solution. Ultimately, a decision is needed as to whether such indicators are fit for purpose or not.

7.5 Presenting indicators in the right context

7.29 Indicators are context-specific. It is therefore of crucial importance that the context of the indicators is accurately and transparently communicated to provide the users with the right background. This allows them to interpret and use the indicator correctly.

7.30 A description of the context of an indicator should include documentation and explanations of the following issues:

- The purpose of the indicator
- How the indicator is compiled
- The use of the indicator

The purpose of the indicator

7.31 The purpose of the indicator has two aspects that should be explained to users: why it is being produced, and what the indicator aims to measure.

7.32 Indicators may be produced to shed light on particular phenomena or developments, such as the economic business cycle, well-being in general or particular dimensions of well-being or households' perception or expectations on their employment or health situation. The indicator may be produced in response to a general interest or with the purpose of providing statistical information to be used in social

[1] http://ec.europa.eu/eurostat/web/experimental-statistics/introduction/

or economic programmes or for policy decision. Information about why the indicator is being produced is part of the context of the indicator and helps to ensure correct understanding of the indicator. The purpose of the indicator in terms of what it aims to measure should be presented in a clear and understandable way for the intended users.

How the indicator is compiled

7.33 Composite indicators can most fully be understood with knowledge of their component series. It is recommended, therefore, to publish detailed component series together with the composite indicator. As an example, a composite indicator on the quality of employment may show an unfavourable development, but to be useful as input to the public debate or to the formulation of policy on how to improve the situation it is necessary to know how the component series developed. The indicator and its component series should be therefore be documented and explained in sufficient detail for users to understand the composite indicator, evaluate its relevance and quality and make correct use of it.

7.34 The selection of the component series should be explained as well as their (expected) relationship with the composite indicator and the methods and weights used for their aggregation. It is also useful to explain if the component series are input or output measures compared to the composite indicator. The indicator and the component series should ideally form a consistent system that facilitates coherent communication and narrative.

The use of the indicator

7.35 When looking at the way indicators may be used a distinction can be made between instrumental and conceptual use. *Instrumental use* refers to the use of indicators "as direct input to specific decisions" (Lehtonen, Sébastien, & Bauler, 2016, p. 3). For instance, the indicators can be used for monitoring and assessment and feed into decision-making. *Conceptual use* is the use of indicators to shape conceptual frameworks for assessments and ways of thinking. It relates to the "percolation of new information, ideas and perspectives into the arenas in which decisions are made" (Weiss, 1999, p. 471). The conceptual use does not directly influence a decision but provides a context for discussion and improves users' information base.

7.36 Presenting indicators in the right context and providing suitable documentation and explanation helps to reduce the misinterpretation and misuse of indicators. In addition, it is useful to explain more explicitly the intended use of the indicator to guide users on its correct use. Two problems frequently associated with the use of indicators, *decontextualisation* and *goal displacement,* are presented in Box 7.1.

Box 7.1 **Problems associated with the use of indicators**

Decontextualisation is a common risk in the use of indicators. It occurs when indicator information is taken out of context and interpreted in an incorrect way. In such cases other information that may be important for understanding the problem at hand might be ignored. Documentation that accompanies an indicator can help to avoid decontextualisation, provided it clearly explains what the indicator aims to measure and how it should be interpreted and used.

Goal displacement happens when a measure becomes a target, in which case it may cease to be a good measure. When a goal is represented by a specific measure, stakeholders may start striving towards that measure and lose sight of the goal behind it. For example, if a country focuses on the 'number of physicians per thousand people' as an indicator of quality of health services, the target might be shifted towards increasing that number while neglecting the quality of the service provided by these physicians, the state of medical facilities and other essential elements of healthcare.

7.37 Composite indicators may have a normative association in the sense that the indicator and its component series are associated with favourable or desired directions of development. Many users, including the media, would be interested in simple messages if developments are 'good' or 'bad'. As with other official statistics, NSOs will want to communicate the implications of composite indicators carefully, as set out above.

7.38 The conceptual framework of a composite indicator may imply favourable or desired directions of development of its component indicators. Explaining desired developments in the context of the indicator and the purpose it serves will help to prevent that these are seen as expressing the views or judgment of the NSO.

7.39 An example of providing desired directions of development is shown in Table 7.1. The example shows the quality of employment dimension of the Israeli Well-being, sustainability and national resilience indicators. The composite indicator of quality of employment is made up of eight component series, each one presented with a desired direction. For instance, an increase in the employment rate is desired and will add to the composite indicator, while an increase in part time involuntary employment is not desired and will decrease the composite indicator.

Table 7.1 **Well-being, sustainability and national resilience indicators, Israel**

Trends in Selected Indicators of Quality of Employment 2015

	Desired direction	% change compared with previous year	Direction of change compared with previous year	% change compared with base year 2002	Direction of change compared with base year
Employment rate	↑	0.5	↑	24.8	↑
Rate of persons employed part-time involuntarily	↓	13.0	↓	72.7	↓
Median gross income from work per household*	↑	2.6	↑	22.2	↑
Satisfaction with work	↑	1.0	↑	8.5	↑
Satisfaction with income	↑	-0.9	~	31.6	↑
Rate of persons injured in work accidents*	↓	2.8	↓	50.7	↓
Rate of prolonged unemployment (over six months)	↓	-4.8	↑	25.8	↓
Average*	↑	3.5	↑	31.8	↑

Source: CBS-IL (2015)

7.40 In summary, NSOs need to find a balance between maintaining their impartiality and the general trust in official statistics while meeting user demands. To this end, the indicators should meet the quality criteria applied by the statistical offices and be carefully communicated to users and the public in general. This includes providing documentation of methods and data source and explanation of the purpose and the context of the indicator and guidance on its correct use and interpretation.

7.6 Targeting user groups

7.41 For effective communication of indicators, it is important to identify the target audience and to adapt communication tools to the characteristics of the different user groups. The use of appropriate communication packages/channels combining different products allows NSOs to reach a wider audience.

7.42 The first question is: 'Indicators intended for use by whom?' A broad distinction can be made between:

- the specialists, i.e. statisticians, academia, specialised journalists and policy analysts, who possess expert-level statistical knowledge and are able to process and interpret detailed data sets.
- Citizens or the general public, i.e. people without or with limited statistical knowledge.

7.43 These two broad groups have different communication needs and should be approached through different communication channels.

7.44 The primary interest of *specialists* is precise and detailed information, including exact methodological definitions, presentation of the statistical trends, coherent time series, detailed metadata, etc. Given their familiarity with the topic and ability to analyse related data, they have less need for additional explanations for the correct interpretation and use of the statistics.

7.45 *Citizens* normally do not have specialist knowledge in statistics. Their main need is easy accessibility to the content of the indicators and careful explanations on their use and interpretation. Communication tools and channels need to be chosen which will facilitate this.

7.46 Conducting a segmentation analysis of users may help to identify communication needs. One may outline user groups such as policy-makers, youngsters, university students, pensioners, families, representatives of the civil society or journalists. Each of these groups has different needs which could be considered in order to select appropriate communication channels.

7.7 Means of communication and visualization methods

7.47 LCS indicators can be communicated through the same channels as other statistics. For example, they may be disseminated in the online database or on the webpage of the statistical office and through newsletters and on social media.

7.48 Web-based applications or platforms can be important ways of communicating LCS indicators. Many users and analysts are active within the social medias, such as Twitter, Facebook or Instagram, which may be used for the dissemination, in addition to making the information available on the NSO's website. If possible, the indicators may be produced in formats that allow for communication through different platforms or applications and reaching out to different user groups. Before engaging in communication through social media, the connected risks and limitations must be considered. This includes restrictions on the format and amount of information, as for instance on Twitter, which can make it harder to communicate properly.

7.49 Indicators can be presented in tables with their values and in various graphical forms. The value of the indicator or its development may also be presented by using simple symbols or icons. The symbols can be used to indicate the direction of the development of an indicator, and for instance if the indicator has moved in a favourable direction or closer to some agreed target. Possible symbols that could be used would include arrows (up, down and horizontal) traffic lights and smileys, for instance, which easily catch the attention and communicate the message.

7.50 It is important to choose the most appropriate visualization method(s) and medium for the indicator of interest, taking care that these channels facilitate the intended narrative of the indicator. Interactive ways of dissemination can foster the use and exploration of the data by the users.

7.51 Additional guidelines on communicating and visualizing statistical indicators can be found in "Towards a harmonized methodology for statistical indicators - Part 2: Communicating through indicators" (Eurostat, 2017a), and in "Making Data Meaningful Part 1-4" (UNECE, 2009-2014).

Sentiment indicators

7.52 Socio-economic sentiment indicators may have a quantitative series that can be compared with them. The association between the two may itself be of interest as also their development over time. A simple yet powerful visualization method for this kind of exercise is use of are scatter plots, which are a well-known representation of potential correlation. Box 7.2 gives a good example from Columbia in terms of the degree of correlation between feelings of insecurity and actual crime rates.

Box 7.2 **Example: Colombia**

In Colombia, the perception of insecurity (PIC) indicator reflects the percentage of the population over the age of 14 that feel insecure in the city where they live. The victimization rate of the population can be seen as related to the sentiment expressed in the PIC. Identifying clusters, if present, can help to improve the compilation of the indicator or to identify further needs.

Colombia Perception of insecurity and victimization rate

The graphic shows how not always the perception of insecurity is defined by the victimization rate of a city. There are cities like Bogotá, D.C. and Pasto that have the highest rates of victimization and where people feel more insecure. However, cities like Barranquilla or Cartagena report high levels of perception of insecurity, even though they have low levels of crime.

Source: DANE

Composite economic indicators

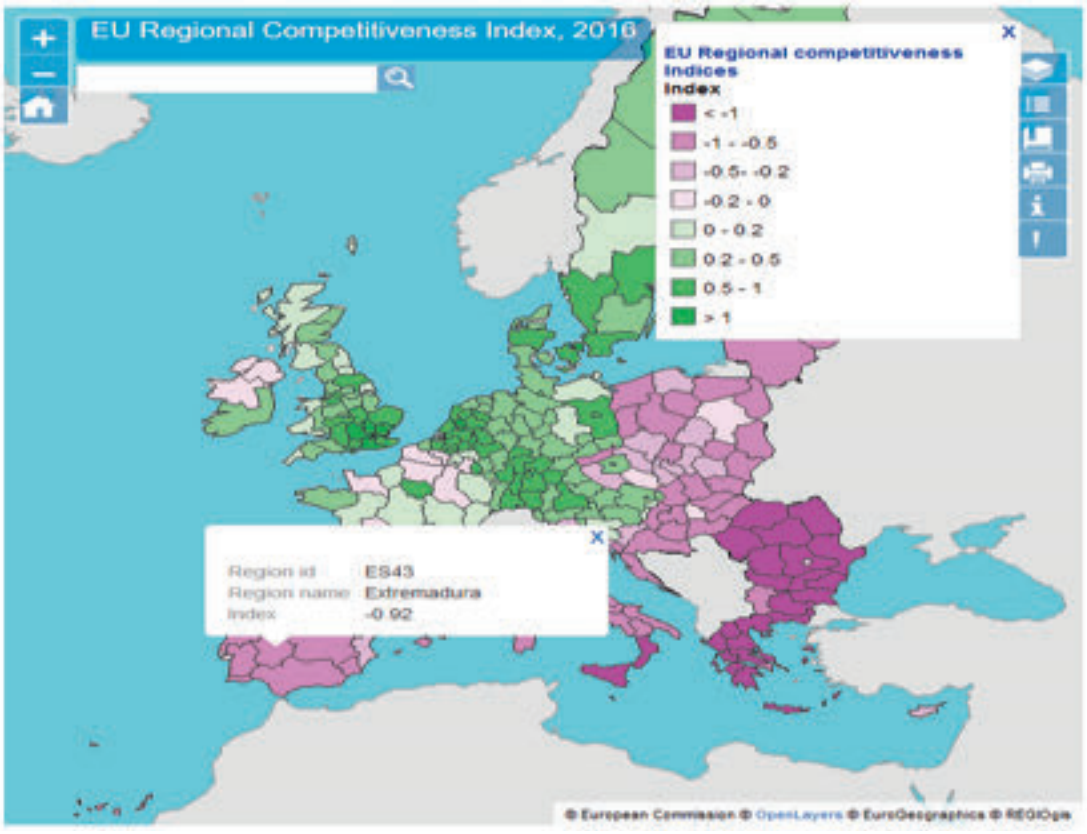
7.53 Many composite economic indicators aim to estimate or anticipate the development in a reference series, for example GDP. It is therefore suitable to show these as time series in graphs, in order to give to the user a first graphical idea of the movements of the two series. More precise measures on how well the indicator matches the development of a reference series can be also computed, e.g. measuring the distance between turning points in the two series.

7.54 Some composite economic indicators do not have a reference series, such as, for example, composite indicators which aim to capture structural properties of the economy. Such indicators are often used in the context of globalisation to explain economic differences between regions or countries. So, it can be illuminating to see a geographical visualisation of the data, as in the example in Box 7.3 from the European Union. Other common forms of communicating such results are scorecards for each region (or any other unit of interest) and rankings, which can have an indication of the position change, compared to an earlier point in time.

7.55 Indicators may also be presented in interactive video graphics, in particular to combine the evolution in time of an indicator with the change of a status. Box 7.4 shows a tool from Eurostat that allows displaying the evolution in time of the displayed economic indicator and shows the moves among different phases of the economic cycle; information is visible at once and can also be analysed in a convenient way.

Box 7.3 **Example: European Union**

The European Regional Competitiveness Index (RCI) is a composite economic indicator launched in 2010 and published every three years by the European Commission[1]. The RCI is compiled using qualitative and quantitative data from several sources in three dimensions: Basic, Efficiency and Innovative. These dimensions are based on several regional and national indicators, such as Institutions, macroeconomic stability, infrastructure, health and basic education for the Basic dimension. One way of visualising the results is shown in the map below, displaying Europe with regional borders. The colour of each region indicates the z-score[2] of the region, with more detailed information interactively accessible by clicking on the region of interest.



[1] See http://ec.europa.eu/regional_policy/en/information/maps/regional_competitiveness/

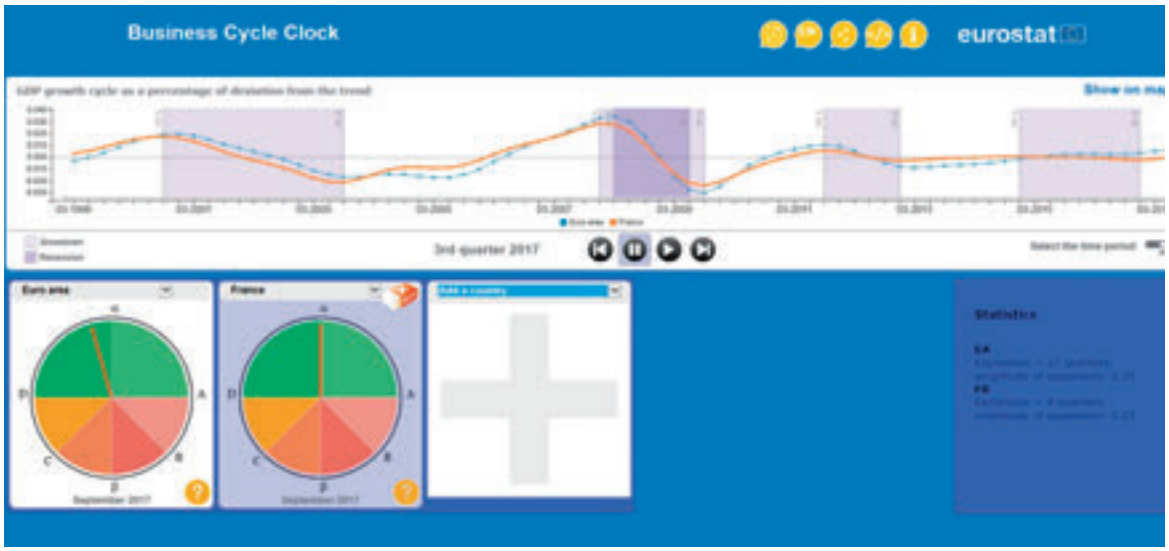
[2] The z-score or standard score is calculated by subtracting the population mean from the individual score and dividing this by the standard deviation of the population. Consequently, values > 0 indicate above average, and values < 0 indicate below average values.

Box 7.4 **Example: The Eurostat business cycle clock**

The Eurostat business cycle clock was released last quarter of 2017. It aims at providing a clear and easily understandable picture of the current and past cyclical situation of the euro area and of its member countries, plus the UK. The application is available at: http://ec.europa.eu/eurostat/cache/bcc/bcc.html

This online tool offers a friendly and easy way to illustrate complex phenomena such as the occurrence of turning points and the cyclical phases. It disseminates the outcome of two main set of cyclical indicators developed by Eurostat in the last years. The first is constituted by a set of historical dating chronologies for the business, growth and acceleration cycles based on the α, a, b, β, c, d sequence developed by Anas and Ferrara (2004) and presented in EU and UNSD (2017a, Chapter 21). In this sequence, α and β represent respectively the peak and the trough of the acceleration cycle, a and d of the growth cycle and b and c of the business cycle. The second group of indicators is constituted by three cyclical composite indicators for the real-time detection of turning points of the acceleration growth and business cycle still following the α, a, b, β, c, d sequence. The structure of the online tool is presented below.

The new Eurostat business cycle clock



In the upper part of the application appears a graphical representation of the quarterly GDP growth cycle highlighting the various cyclical phases as identified by the quarterly historical dating chronology. In the left corner of the down part, there is a clockwise representation of the current cyclical situation based on the three composite indicators for the detection of turning points. The clock is subdivided in 6 sectors delimited by the 6 turning points α, a, b, β, c, d. On the right corner of the down part within a square box, some relevant measures related to the cycles are displayed. It is possible to display and compare up to 5 countries. The business cycle clock is presented in detail in Mazzi (2015) and in EU and UNSD (2017a, Chapter 21).

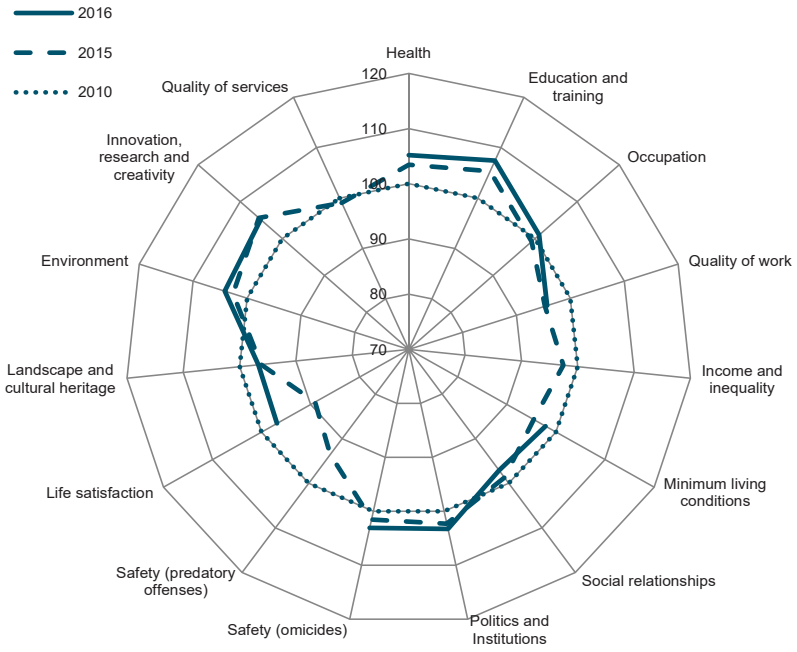
Composite socio-economic indicators

7.56 As noted earlier, composite indicators and their component series should usually all be published. The chosen visualisation method should allow these to be displayed clearly. An example from Italy is shown in Box 7.5. The possibility of adding results from different years yields further value in tracking developments.

7.57 A more interactive solution is to allow the user to change the weight of each component of the composite indicator individually, as it is possible for the OECD Better Life Index presented in Box 7.6. This powerful visualisation method should be accompanied by a clear explanation of the subjectivity of the results shown to the user.

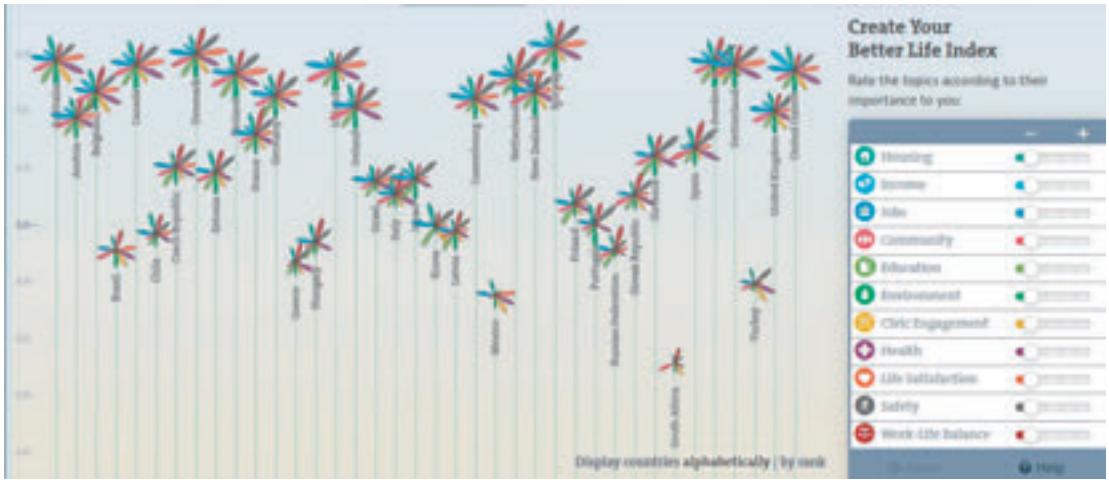
Box 7.5 **Example: Italian Equitable and Sustainable Well-being**

The Italian BES: composite indicators for Italian well-being – years 2010, 2015-2016. 2010 = 100



A spider web visualization is chosen in Italy. The 'Equitable and Sustainable Well-being' (BES) developed by Istat consists of 130 indicators within 12 domains. For each domain, a set of representative indicators has been identified in a way to give an image of the main attributes of the domain. The figure reports the evolution of the composite indicators for Italy for 2010 and 2015-2016 for a total of 15 composite indexes. Although the well-being domains considered in the BES framework are 12, for some of them two separate composite indexes have been calculated.

Box 7.6 **Example: OECD Better Life Index**



Source: OECD Better Life Index (taken from http://www.oecdbetterlifeindex.org/ accessed January 2018, equal weights used)

OECD's 'Your Better Life Index' for each country aggregates several dimensions of well-being into a single composite indicator. The graph shows the ranking of the countries in the case where the dimensions are equally weighted. Website visitors can assign their own weights to the dimensions, according to the importance each dimension has for them. If, for instance, a user considers health and environmental quality as the most important aspects of life, he/she will have the possibility to rank them higher than other dimensions and be able to see how countries perform in terms of overall well-being when these dimensions are given more weight. The interactivity that is built into the dissemination of the indicator makes it possible to collect information about users' evaluation of the underlying dimensions of the indicator. This gives information about what matters to people and may in turn be used to establish weights for the dimensions. This information is only collected if the user actively choses to share his index. Furthermore, by clicking on a certain country, the user can access that country's site, with a detailed presentation for each dimension.

7.8 Summary of recommendations

7.58 As stressed in earlier chapters, communication and engagement with stakeholders and users/potential users should be pursued vigorously throughout the statistical production process: from the decision whether to proceed or not, through the design and compilation stages and ultimately in the dissemination phase. The process should be viewed as a circular one, not linear, with feedback from communication in the dissemination used for further improvement and refinement.

7.59 The NSO should evaluate user needs and decide if the organisation should engage in the production of indicators. If so, the following recommendations are provided regarding their publication and related communication:

- Cooperation with stakeholders and users can help to ensure that the indicators are relevant and seen as legitimate. It is also a way to capture expert advice, and it can help to build a broader ownership of the indicators, to ensure they are used, supported and promoted.
- The purpose of the indicator, data sources and methods should be made available to users. The context of the indicators should be carefully explained to ensure correct understanding and use and avoid misunderstandings and misuse. Some LCS indicators may be unfamiliar to users and not straightforward to interpret. It may be necessary to explain what a certain value, direction, or change from a trend line etc. mean.
- Explanation should be given to the selection of component series and their weights in a composite indicator. Questions used to form sentiment indicators should also be documented

and made available to users. NSOs should explain clearly the implications of published indicators. But they are advised to avoid expressing developments as favourable or otherwise.

- If indicators do not meet the NSO's usual quality criteria, they may be published as experimental statistics. This may be a useful way to test different graphical presentations of the indicators and to collect feedback from users of the statistics. But this status should be a transitional phase and not used as a permanent solution.
- LCS indicators can be disseminated through the channels used for other statistical output, including databases, websites and newsletters. Communication should be targeted to intended user groups, which may also include groups that are not familiar with using statistical information. In many cases it is helpful to illustrate indicators or their developments by use of icons, such as arrows, different colours or traffic lights.

Annex A: Methods to compare economic sentiment indicators to reference series

An economic time series can be decomposed into a trend (T) component, a cyclical (C) component, a seasonal (S) component and an irregular (I) component. The business tendency indicator should follow the cyclical component, excluding the seasonal component and irregular fluctuations.

Filtering and de-trending methods

Various methods exist to remove the trend and filter out the seasonal, cyclical and irregular components. Seasonal adjustment methods were already touched upon in paragraph 4.51.

De-trending entails determining a time series's long-term trend component and then subtracting it from the remaining time series. A well-known method is the Hodrick-Prescott filter. Also well-known are the Baxter-King and the Christiano-Fidgerald filter methods (OECD, 2012). Some are built into seasonal adjustment software, such as Eurostat's JDemetra+[1] that is available for free. Such software also detects and filters out possible outliers, which were perhaps caused by external "shocks", such as election results, strikes or natural disasters.

The irregular component can be removed by a filter method, such as the above-mentioned Hodrick-Prescott-filter, or simply by smoothing the time series with moving averages. See also Section 5.4.3.

Different versions of the business cycle

Figure A.1 illustrates three possible versions of the cyclical component of an economic time series. If the seasonal and irregular fluctuations are removed, only the trend and cyclical components remain.

The classical cycle

The classical cycle is presented in the middle of Figure A.1. It shows the cyclical waves of the actual, observed data (with the seasonal and irregular components removed) in level form, moving along a long-term upward trend. Point B and C on the curve are the maximum and minimum respectively; the points where the cycle turns to negative and positive growth, respectively.

The growth cycle

The growth cycle (or trend deviation) is depicted in the bottom part of Figure A.1. It shows the de-trended cyclical component of the reference series. The maximum/peak (point A) appears before the peak in the classical cycle analysis (point B above). The minimum/trough (point D), in turn, appears later than the trough in the classical cycle analysis (point C above). The distance between A and B and between C and D is called the slowdown phase, which is before and after the actual recession period.

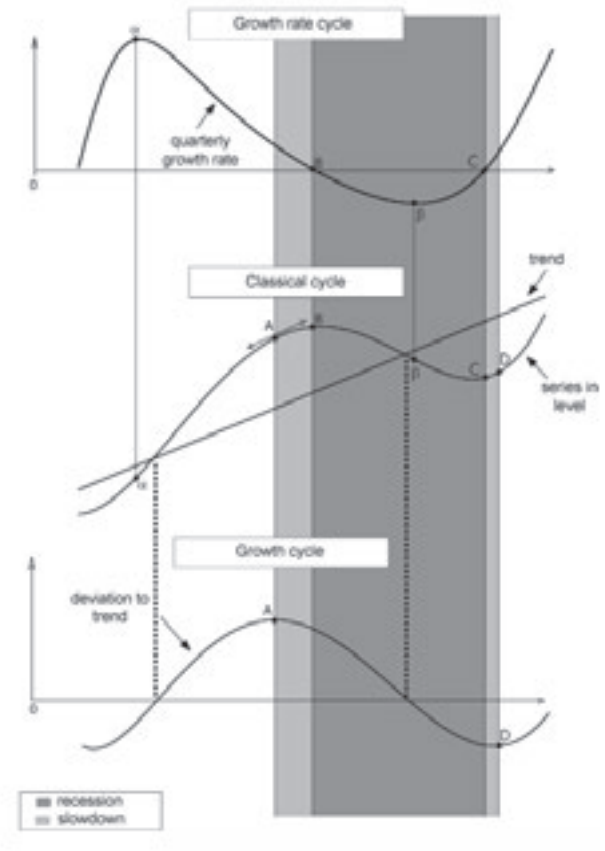
The growth rate cycle

The growth rate cycle is presented in the upper part of Figure A.1. It is calculated from the observed time series. This shows a phase shift: the peak α appears before the two other peaks (A and B), while the trough β appears in the recession period before the troughs (C and D). The growth rates can be calculated sequentially from month to month or from quarter to quarter.

The growth rate can also be calculated year-on-year. Depending on the data quality and availability, the period for the calculation could be a month or a quarter. Annual growth rates usually provide smoother curves than monthly or quarterly growth rates, but the cyclical movement of the former is later than the latter. It is thus better suited for overall comparisons than for detecting turning points.

[1] https://ec.europa.eu/eurostat/cros/content/download_en

Figure A.1 **Business cycle representations**



Source: Anas and Ferrara, 2004

Methods to compare sentiment indicators to reference series

Two frequently used methods to compare economic tendency indicators to economic reference series are presented in the following section. In method 1, the economic tendency indicator is based on an assessment of whether the current *level* is par with, above or below normal. In method 2, the indicator is based on an assessment of whether the *development* remained unchanged, increased or decreased. However, since sentiment indicators are often composed of component indicators covering both categories, the difference between methods 1 and 2 becomes less clear in practice. Since the composition often consists of indicators about past developments (e.g. past 3 month), future developments (next 3 month) and the current situation, this averaging usually results in a signal similar to the growth cycle definition (a cycle characterized by deviation from trend).

Method 1: Comparing business tendency indicators to the growth cycle of reference series

One method of comparing business tendency indicators to the reference series is to compare the indicator with the cyclical component of the reference series. To do so, seasonal effects and irregular fluctuations must be removed from the business tendency indicator by filtering. Seasonal effects and irregular fluctuations also need to be filtered from the reference series and the trend component must be removed. The resulting series is the so-called *growth cycle* (trend deviation) as shown in bottom of Figure A.1.

The remaining step is to compare the cyclical elements of the two series. Before this is done, normalising[1] the two series is recommended. This ensures that the unit of measurement of both series is the same.

[1] Normalisation is a method to make data series with different units of measurement and scales comparable. A widely used method is the z-score standardization, which transform the series into mean values equal to zero and keeping the unit variance equal to the standard deviation of the original series

The comparison is simply done by plotting the two series in one graph. Such a visual inspection allows rough analysis of the performance of the tendency indicator and establishes how the cyclical (upswing and downswing) phases and turning points (peaks and troughs) compare. A correlation analysis may also be conducted, which will show the strength of the co-movement of the two series as a value between -1 and 1.

A weakness of this method is that the trend component of the reference series can be estimated by use of different filtering methods and that the choice of method will influence the resulting de-trended business cycle component.

Specific issues related to the comparison of coincident, lagging or leading indicators are briefly touched upon below.

Method 2: Comparing business tendency indicators to the growth rate cycle of reference series

This method is based on first differences, where the growth rate of the reference series is calculated and compared to the business tendency indicator.

The reference series need to be seasonally adjusted and the irregular fluctuations must be removed before the growth rates (usually monthly or quarterly) are calculated. The growth rate cycle is illustrated in the top of Figure A.1.

The business tendency indicator also needs to be seasonally adjusted and the irregular fluctuations must be removed. Typically, the indicator is not transformed to growth rates, but compared as is to the growth rate of the reference series.

Visual and correlation comparisons can be done as described in previous paragraphs.

Box A.1 provides an example of comparing a confidence indicator with its reference series using methods 1 and 2. An important lesson to learn is that the two methods may give different results on the leading properties of the indicator, and indeed, if it is leading compared to the reference series. Hence, careful considerations and analysis must be carried out before the decision is made which approach to apply.

Coincident, lagging or leading properties

The two cycles (the business tendency cycle and the cyclical component of the reference series) can be compared by correlations and cross correlation analysis. The correlation analysis determines the strength of the co-movement of the two series and the cross-correlation analysis the time delay between the two series.

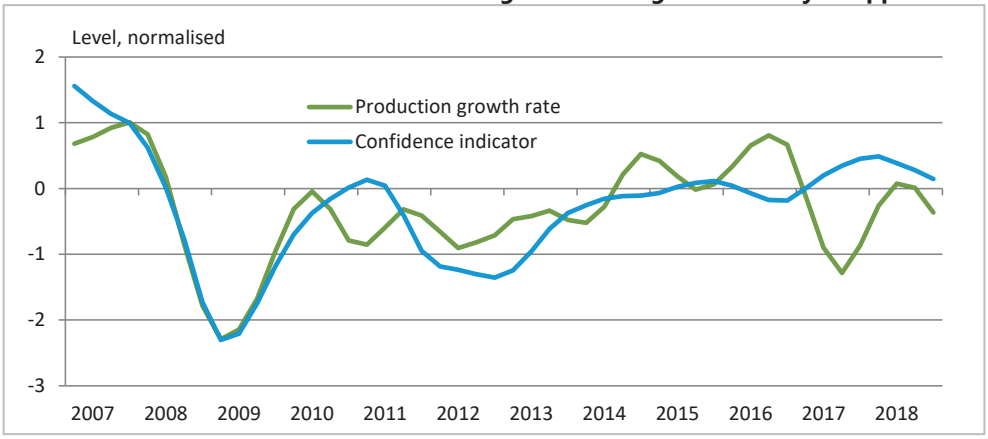
If method 1 is applied and the correlation coefficient becomes higher when the business tendency indicator is shifted forward or backwards by one or two quarters, this indicates that the business tendency indicator is not *coincident* but *leading/lagging* in comparison to the reference series. Coincident means that cycles coincide with the reference series, e.g. peaks and troughs occur at the same time. Leading means that cycles precede those of the reference series, while lagging means the cycles follow those of the reference series. The actual delay can be established through a cross-correlation analysis.

The procedure to determine coincident, lagging or leading properties is the same if method 2 is applied. When comparing a business tendency indicator to the growth rate of the reference series the different versions of cycles presented in Figure A.1 need to be kept in mind. If the business tendency indicator shows coincident properties, it will be leading in terms of the *growth* and *classical cycle* version of the reference series because of the phase shift that the growth rate version implies.

Box A.1 **Comparing with reference series by correlation analysis**

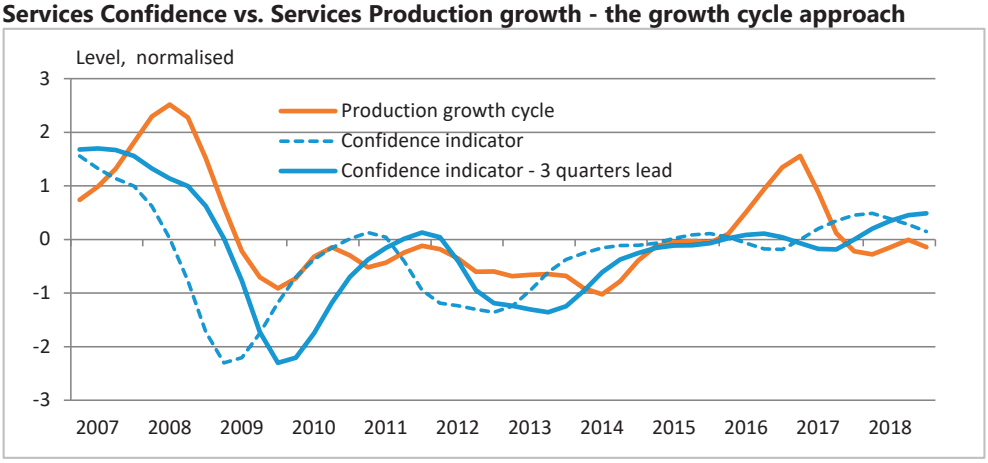
The graph shows the Service Confidence Indicator based on the services tendency survey of Statistics Denmark and the quarterly growth rate of services production obtained from the national accounts. The comparison method follows the growth rate cycle approach described in the text (method 2). The correlation between the two series is 0,78, which does not improve if the Services Confidence Indicator is moved forward with one or more quarters. The series could, therefore, be regarded as *coincident*. This implies that the indicator is *leading* to the original reference series, since the first difference of the reference series, the growth rate series, is itself leading to the original reference series' movements (see Figure A.1).

Services Confidence vs. Services Production growth – the growth rate cycle approach



In the graph below the Service Confidence Indicator is compared to the services production using the *growth cycle* approach (method 1, described in the text). With the use of Hodrick-Prescott filtering the trend is removed from the quarterly production output series (filter factor 1600). Also, the irregular component is filtered (factor 1). Since the series is seasonal adjusted beforehand, the resulting series may therefore be regarded as the cyclic component of the reference series.

Services Confidence vs. Services Production growth - the growth cycle approach



The Services Confidence Indicator correlates to the reference series with 0,34. If moved forward by three quarters the correlation coefficient increases to 0,80. This indicates that the Services Confidence indicator has *leading* property when comparing to the reference series' growth cycle. Throughout the example, data has been seasonally adjusted, normalized and smoothed for visualisation purpose. The smoothing improves the correlation.

Source: Statistics Denmark

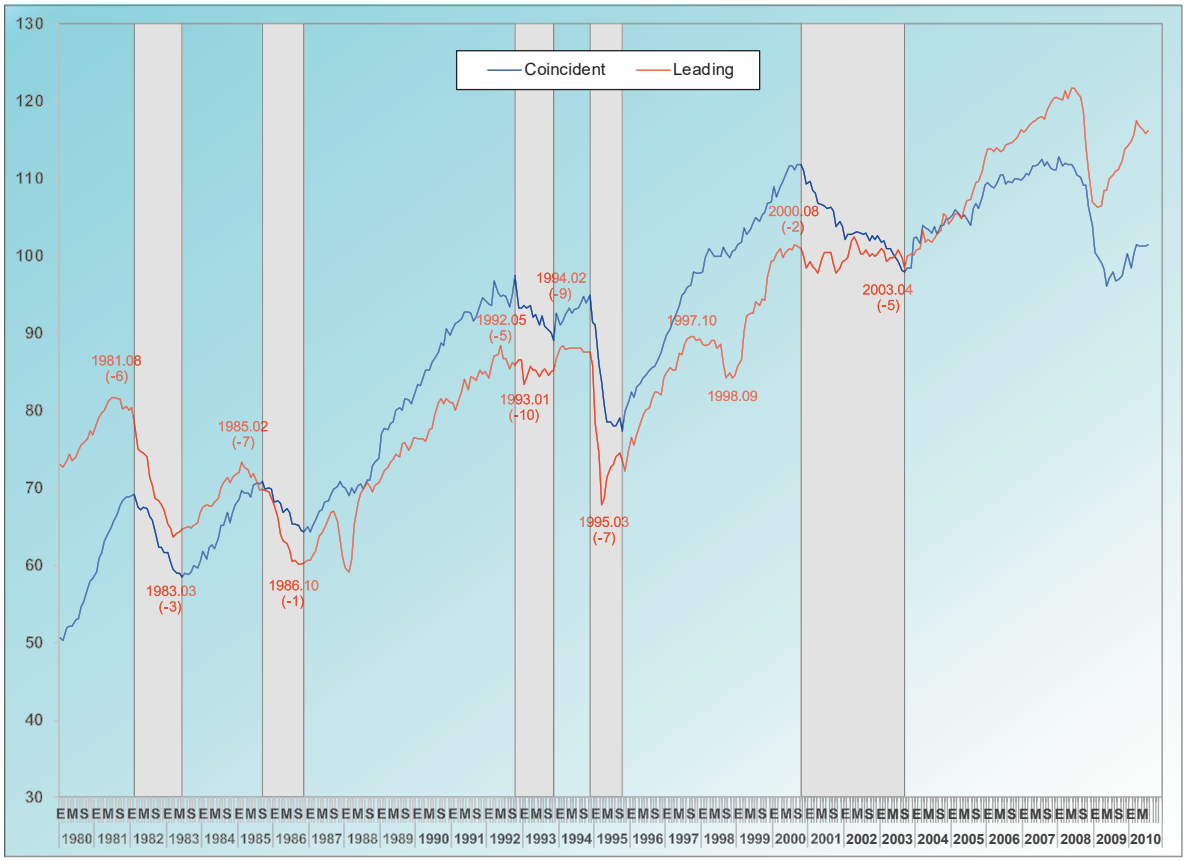
Annex B: Development of the Mexican System of Cyclical Indicators

Background

INEGI released the first System of Composite Indicators (SCI_1) in 2000. The system included a coincident indicator that reflects the general state of the economy and a leading indicator that aims to anticipate turning points (peaks and troughs) in the coincident indicator. The reference series of the coincident indicator is GDP.

The coincident and leading indicators were compiled based on the business cycle method developed by the National Bureau of Economic Research (Niemira & Klein, 1994) and published monthly until October 2010. The individual indicators selected for the two composite indicators are shown in Table B.1. In the business cycle approach, also sometimes referred to as the classical cycle approach, the indicators are expressed in levels, as shown in Figure B.1. The different approaches to describe the business cycle are discussed in Annex A.

Figure B.1 **Coincident and Leading Indicator Performance** (Business cycle, Base 2008 = 100)



Note: The years and months are the turning points of the leading indicator. The numbers in brackets indicate the number of months the turning point of the leading indicator precedes that of the coincident indicator.
Source: INEGI.

The components selected for both indicators comply with characteristics such as economic relevance, monthly frequency, timeliness, not subject to significant revisions and availability of long time series, besides being consistent with the turning points of the reference series. These individual indicators are aggregated with equal weighting.

In general, from 1980 to 2008, the leading indicator fulfilled its function to anticipate the turning points of the coincident indicator, averaging 5.8 months on peaks and 5.2 months on troughs.

However, the leading indicator did not anticipate the beginning of the recessive phase in 2008[1], because the recession came from abroad and was spread through a drop of Mexican exports, remittances by Mexican emigrants from the United States and a decline of foreign tourism[2].

INEGI, on this background, decided to review the composite indicators and their components. One question raised was if more weight should be given to the most recent recession when constructing the leading indicator.

A new system of composite indicators

Based on research of new tools to track the business cycle and considering international comparability, it was decided in 2010 to develop a new version of the system of composite indicators, the SCI_2. The new version applied the methodology developed by OECD (2012) and involved a change in some of the individual indicators. The methodology is based on the "growth cycle" approach, which defines the economic cycle as the deviation of the economy from its long-term trend (see Annex A). This allows identifying four phases of the economic cycle: growing above or below the trend and decreasing above or below the trend.

The components of the composite indicator are shown in Table B.1. As with the previous system, individual indicators were selected based on their economic relevance, monthly frequency, timeliness, and the availability of long time series. It was also a prerequisite that series should not be subject to significant revisions. A set of statistical measures was applied to assess the performance of the indicators, such as correlation analysis and analysis of the consistency in the cyclical conformation of the series and evaluation of "false alarms" (a component indicator that shows additional turning point to those of the reference series is displaying false alarms). In the aggregation, the components series have equal weight.

Series with leading properties are selected to construct the leading indicator. Cycles are extracted using the Hodrick-Prescott filter twice to remove the long-term trend and high-frequency fluctuations which are not relevant for business cycle analysis. Once the smoothed cycles are obtained, they are normalized. The aggregation is done by averaging the monthly growth rates of the component indicators. The average growth rates are chained to form the final indicator time series. The leading indicator anticipates turning points of the coincident indicator by 5.8 months on average.

An update of the indicators

In 2014, a planned update of the indicators was carried out. As a result, a sentiment indicator "Business confidence indicator: adequate time for investing" was introduced into the leading composite indicator because of its leading properties, while non-oil exports was dropped. In the coincident indicator, the monthly estimation of GDP was replaced by the "Global Indicator of Economic Activity" which is a monthly indicator that covers about 90% of GDP. No methodological changes were undertaken.

Within the update process, two workshops took place. The first was with users from the public sector and the other with economic analysts. They were invited to express their opinion about the variables to consider for the composite indicators.

INEGI analysed the time series proposed and it was determined that just a couple of changes were necessary. Results of the updating were presented to the same persons that attended the first meetings. In April 2015, the revised SCI_2 was released. The indicators are shown in Figure B.2.

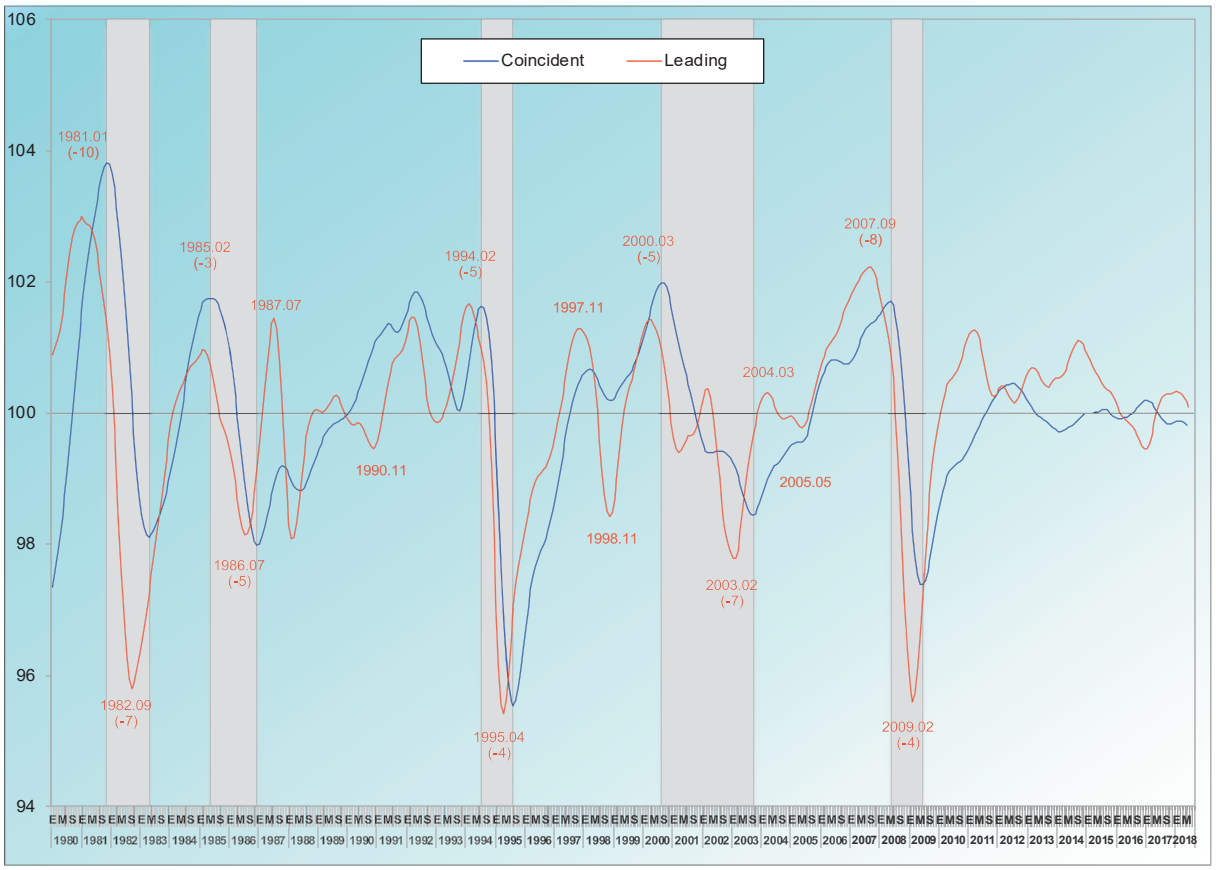
[1] Despite this fact, the analysis of many other economic indicators was showing that a recession was coming.
[2] Nevertheless, the leading indicator anticipated the recovery of the coincident one.

Table B.1 **The System of Composite Indicators**

Components		
SCI_1 Business Cycle approach December 2000	**SCI_2** Growth Cycle approach November 2010	**Updated SCI_2** Growth Cycle approach April 2015
Coincident Indicator	**Coincident Indicator**	**Coincident Indicator**
An estimation of monthly GDP	An estimation of monthly GDP	Global indicator of economic activity
Industrial production index	Industrial production index	Industrial production index
Retail sales	Retail sales	Retail sales
Workers registered at the Mexican Institute of Social Security	Workers registered at the Mexican Institute of Social Security	Workers registered at the Mexican Institute of Social Security
Rate of partial employment and unemployment	Urban unemployment rate	Urban unemployment rate
Real wages in the Maquiladora Export Industry [1]	Total imports	Total imports
Leading Indicator	**Leading Indicator**	**Leading Indicator**
Hours worked in manufacturing	Manufacturing employment trend	Manufacturing employment trend
Average price of Mexican crude oil export	Non-oil exports	Business confidence indicator: adequate time for investing in manufacturing
Price index of the Mexican stock exchange	Price index of the Mexican stock exchange	Price index of the Mexican stock exchange
Real exchange rate	Real exchange rate	Mexico-USA real exchange rate
Interest rate	Interest rate	Interest rate
Industrial production index: construction component	Standard & Poor's 500 Index (USA)	Standard & Poor's 500 Index (USA)

[1/] Included last time in March 2007 because the Program of the Maquiladora Export Industry was discontinued

Figure B.2 **System of Cyclical Indicators** (Growth cycle)



Note: The years and months are the turning points of the leading indicator. The numbers in brackets indicate the number of months the turning point of the leading indicator precedes that of the coincident indicator.
Source: INEGI.

Communication

When the first version of the composite indicators (SCI_1) were released in 2000, many users were not familiar with coincident and leading indicators. Therefore, extensive explanatory notes were provided explaining how to interpret the indicators and how to use. Users and analyst gradually became familiar with the indicators and more comfortable with using them. Users particularly welcomed that the indicators were published monthly according to a calendar announced one year in advance.

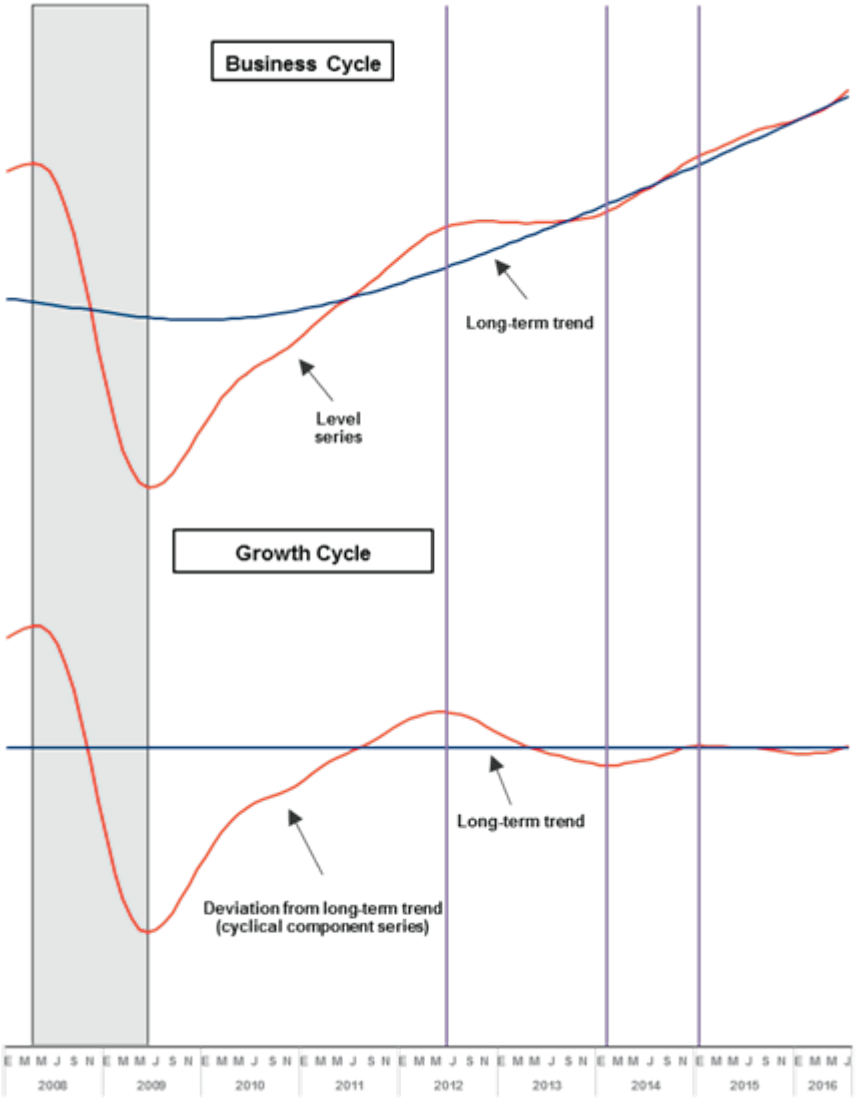
The first version of the composite indicators was based on the classical *business cycle* approach in which the indicators are presented in levels (see Figure B.1). The second version of the system of composite indicators (SCI_2) released in 2010 was based on the *growth cycle* approach, which shows the development in the indicators excluding the trend component (see Figure 2). There was a need to explain the differences between the two approaches, and particularly to explain the indicators compiled according to the growth cycle approach. A graphical illustration of the classical business cycle and the growth cycle was also introduced (Figure B.3) to help users in understanding the development of the indicators over time.

Revisions also required careful communication. Previously published figures of the coincident and leading indicators may change because of revisions to component series. Component series may be revised for a variety of reasons, including changes in data sources or compilation methods, and seasonally adjusted or otherwise filtered series may be subject to regular revisions. Press releases, therefore, gave clear explanations of the reasons for revisions.

An episode in March 2014 provides a clear example of the need for good communication. The coincident indicator went below 100, leading some commentators to suppose that the country had entered a

recession. It was necessary for INEGI to explain carefully that the fall to below 100 did not necessarily imply a recession but only that the economy was growing below its long-term trend.

Figure B.3 **Comparison between the growth cycle and the business cycle**



Source: INEGI.

Section 4.2.4 and Annex A give more details about the different business cycles models and comparisons with reference series. Here, it is important to note that the period when the indicator is above/below the trend may differ between the two approaches.

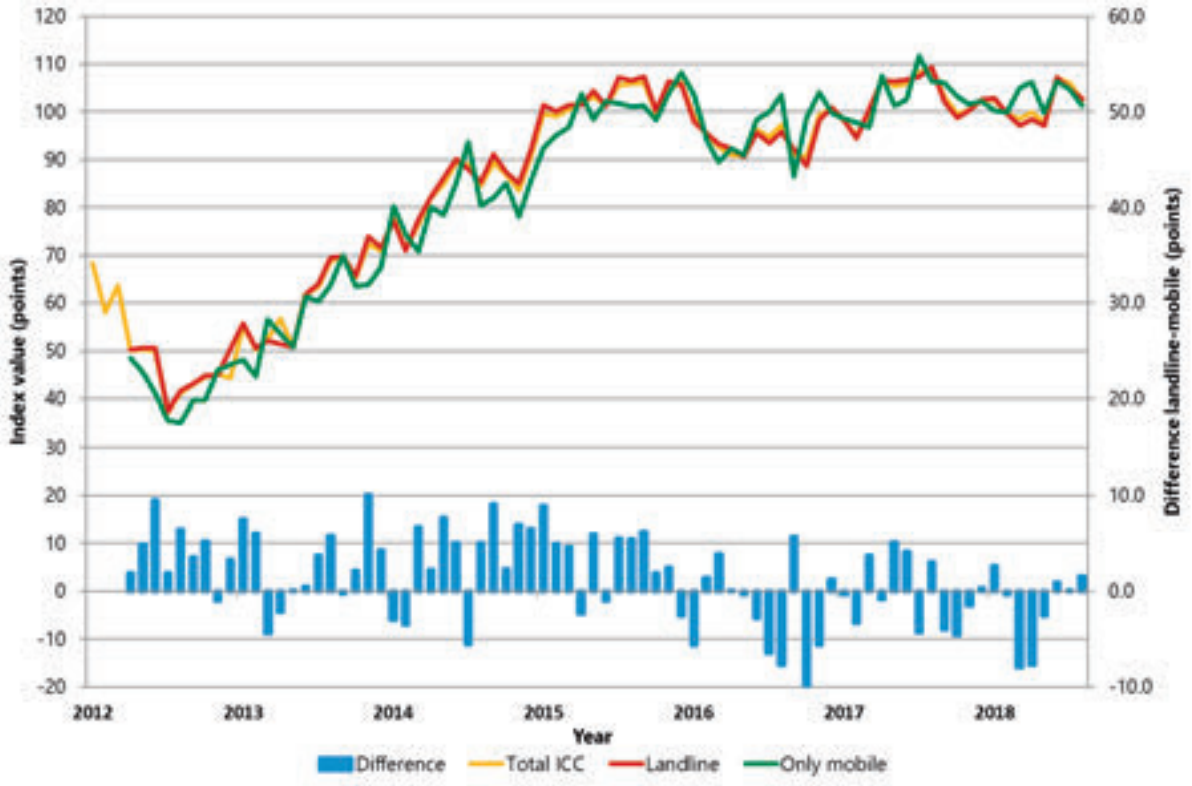
Annex C: Consumer Confidence Index in Spain

Over time, the Consumer Confidence Index (ICC) has shown a strong capacity to anticipate changes in household consumption in Spain. Its construction is mainly based on questions about consumers' perceptions of the economic development over the past 6 months and their expectations concerning the next six months. The ICC draws mainly based on the methods developed by the University of Michigan and the Conference Board in the United States.[1]

The ICC was established in 2004 at the initiative of the Official Credit Institute of Spain. Since 2011, the ICC has been produced under the responsibility of the Centro de Investigaciones Sociologicas (C.I.S.).

It is based on a monthly telephone survey of a representative sample of the resident population of 2.200 individuals older than 16 years. In 2014, it was decided to stratify the sample into two groups according to the type of telephone connection: a) those with landline connection, and b) those with mobile connection and without a landline connection, based on their weight in the population. Thus, the sample consists of 1.752 respondents in the former group and 448 respondents in the latter. The sample represents 99.5% of the population and does not require further weighting. The development of the overall ICC and its landline and mobile telephone parts is shown in Figure C.1.

Figure C.1 **Total ICC, by landline, mobile and difference landline-mobile in Spain (2012-2018)**



For land line telephones, the sample is stratified by regions and two extraterritorial cities, Ceuta and Mellilla. The regions are broken down into municipalities, which, in turn, are distributed into seven size classes depending on the number of inhabitants, from municipalities with less than 2,001 inhabitants to municipalities with over 1.000.000 inhabitants. In each stratum, telephone numbers are selected at random from available telephone lists. Among these, the individual respondents are selected according to sex, age and activity (employed, unemployed or inactive).

[1] See "The Quality and Economic Significance of Anticipations Data" (Universities-National Bureau, 1960) and "Essays on Behavioral Economics" (Katona, Essays on Behavioral Economics, 1980)

For mobile phones, the respondents are selected by Random Digit Dialing (RDD). Thus, the sample is created by generating telephone numbers at random. Individual respondents are selected through quota sampling according to the same characteristics as applied for land line respondents.

The overall sample reflects the distribution of the population by age, sex, region, size of municipality and activity. The margin of error for the total sample and under the assumption of simple random sampling is +/- 2.7%, for a confidence interval of 95%.

Field work begins on the day of the 15th of each month, or the first working day after this date, and last for five working days. Calls for telephone interviews are made from 15.00 to 21.00.

The survey questions for the ICC

The survey consists of questions about the current situation and future expectations, together with sociodemographic questions about the respondent concerning age, sex, study, occupation, structure of the household, income, vote, etc.

Questions concerning the current economic situation

These questions refer to the assessment of the respondents of the current economic situation, compared to that six months earlier. Three questions are asked:

- Do you consider that the current economic situation in your home is better or worse than six months ago?
- Do you consider that the situation in Spain to find/improve a job is better or worse than six months ago?
- Do you consider that the current situation of the Spanish economy is better than it was six months ago?

Questions concerning expectations of future economic developments

- Do you consider that the situation in Spain to find / improve a job within six months will be better or worse than at present?
- Do you consider that the situation of your home in six months will be better or worse than at present?
- Do you think that the situation of the Spanish economy in six months will be better or worse than the current one?

For each question there are five possible responses:

- Yes/no (the situation has/will improve, or the situation has/will worsen)
- The situation is/will be the same
- Do not know
- Do not answer

Calculation of the ICC

For each question, the balance is calculated as the difference between the percentage of responses that indicate an improvement minus the percentage that indicates a worsening. The other answering possibilities are excluded from the calculation of the balance.

The ICC is composed of two separate indicators, the current situation index (ISA), which is based on the three questions about the development over the previous 6 months, and the expectation index (IE), which is based on the three questions about the development over the coming 6 months.

To calculate each of the two indicators, 100 is first added to the balance of each question. Secondly, the ISA/IE is calculated as the arithmetic mean of the results of the three questions of which they are composed. The Consumer Confidence Indicator is calculated as the arithmetic mean of the two separate indicators:

$$ICC = (ISA + IE) / 2$$

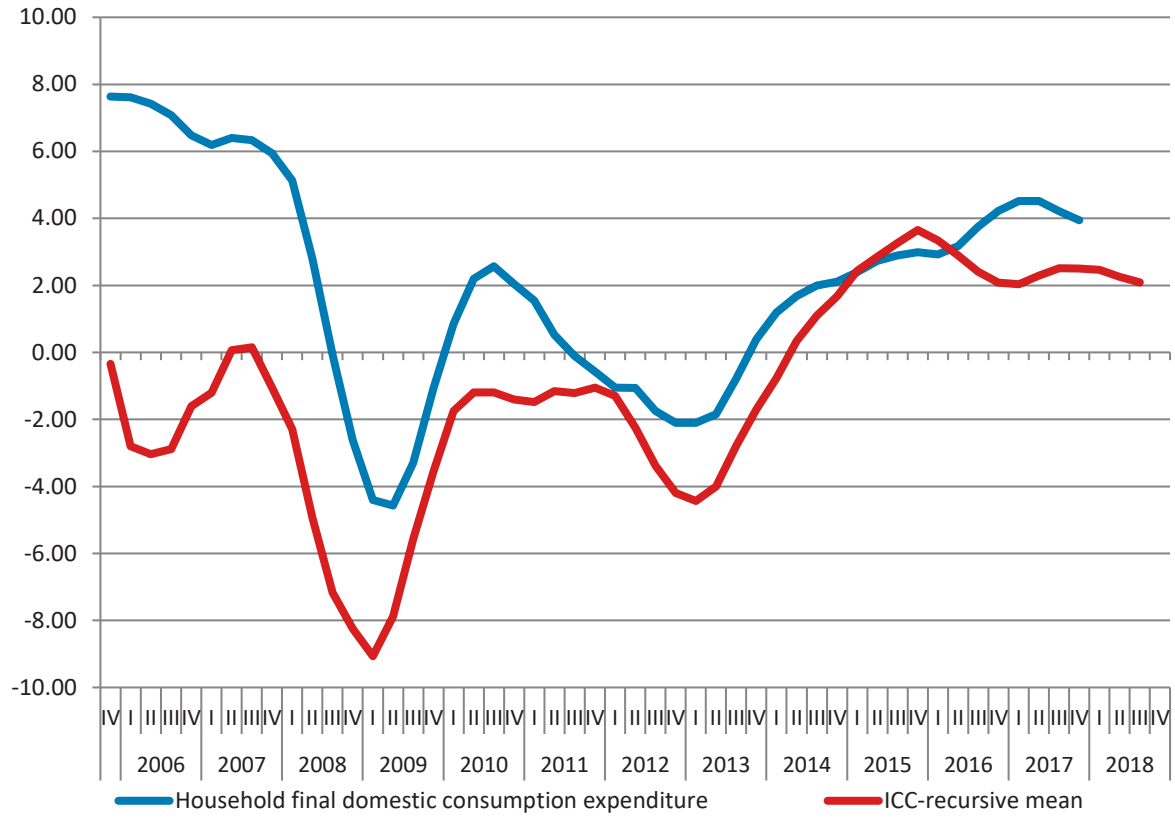
The value of the ICC runs from 0, where all interviewed responded "worse" option to all six questions, to 200, where all interviewed responded "improve" to all questions. A value of the ICC at 100 reflects a neutral attitude. Values below 100 indicate an unfavorable assessment of the economic development; values above 100 indicate a favorable assessment.

Dissemination

The ICC is published on the CIS website on the 3rd of each month (if a public holiday, the next working day) and is disseminated to the media. It is possible for users to access the detailed data from the website of CIS. The main users of the data are private companies, followed by other centres of the administration and universities.

The development of the ICC is shown in Figure C.2, together with annual rate of change of household final domestic consumption expenditure.

Figure C.2 **ICC and household final domestic consumption expenditure, annual rates of change**



Annex D: Tendency surveys in Mexico

Economic tendency surveys have been part of the work programme of the National Institute of Statistics and Geography (INEGI) since 2003. The indicators produced based on the surveys provides timely and reliable information to users which support the analysis of the economic development. The indicators provide early signals about the economic development which can be used by decision makers. Particularly, the indicators have proved to be useful as tools to monitor trends and impacts for business cycle analysis. The Indicators are used by different groups of users: businesses, analysts, commercial banks, professional associations, policy makers and the media.

Some of the indicators show leading properties of important variables for which hard data are published later. These tendency indicators predict the reference series well for the following month. But this is not universally true. In particular, the consumer confidence appears too pessimistic, leading, when the economy is getting worse, but lagging when the economy is recovering. The underlying conclusion is that sentiment indicators are not a substitute for traditional quantitative data but complement them.

Economic tendency surveys are conducted for both businesses and households to collect executives' and the consumers' views about past developments, the current position and their plans and expectations for the near future. The construction of these indicators is based on the data obtained by the Monthly Survey on Entrepreneur Opinion and the National Survey on Consumer Confidence.

Table D.1 shows the main characteristics of these surveys. The survey questionnaires ask respondents for qualitative answers, not for quantitative levels of output, sales, investment, employment or household finances, for example.

Table D.1 **Main characteristics of the tendency surveys in Mexico**

	Monthly Survey on Entrepreneur Opinion	National Survey on Consumer Confidence
Observation unit	Enterprises in manufacturing and construction with more than 100 employees and businesses in trade with more than 50 employees.	Individuals selected within a given household (at least 18 years old).
Representativeness	National	National
Sampling frame	2,069 businesses from Manufacturing, Construction and Trade businesses sectors.	2,336 households.
Frequency	Monthly	Monthly
Data collection	During the first three weeks of the reference month.	During the first 20 days of the reference month.
Dissemination	The first working day of the month following the reference month.	The first week of the month following the reference month.
Sample design	Probabilistic and stratified random sampling. The number of employees defines four strata for manufacturing and construction: 100-250, 251-500, 501-1,000, and 1,001 and more. For trade businesses: 50-250, 251-500, 501-1,000, and 1001 and more.	Probabilistic, stratified and by clusters.
Calculation method for	Producer confidence indicators for each of the three sectors manufacturing, construction and	The consumer confidence indicator is calculated from the results of five questions:

confidence indicators	trade are calculated from the simple average of the answers to the following questions: 1. Do you think this is the right time for investments to be made? 2. How do you view the country's economic situation today compared to 12 months ago? 3. How do you consider the economic situation of the country within 12 months, compared to the current one? 4. How do you consider the economic situation of your company today compared to 12 months ago? 5. How do you think the economic situation of your company will be within 12 months, compared to the current one? Each question has different response options with an attributed value (see below). Once the sum of weighted (with the corresponding values shown below) percentages shares of responses is obtained for each question, producer confidence indicators are obtained from the simple average of their five components.	• Two questions about the economic situation of the family. • Two questions about the macroeconomic situation. • One question on the possibility of purchasing durable goods. Each of the five questions has different options of response with an attributed value (see below). Once the sum of weighted (with the corresponding values shown below) percentages shares of responses is calculated for each question, the consumer confidence indicator is obtained from the simple average of their five components.
Balance	Values for each response option are: For the producer confidence indicator: 1. Much better/yes= 1.00 2. Better = 0.75 3. Same = 0.50 4. Worse = 0.25 5. Much worse/no = 0.00	Questions about the economic situation of the family and the macroeconomic situation have five response options/values: 1. Much better = 1.00 2. Better = 0.75 3. Same = 0.50 4. Worse = 0.25 5. Much worse = 0.00 Question about purchasing of durable goods has three response options/values: 1. Much Larger = 1.00 2. Same = 0.50 3. Much smaller = 0.00
Main results	- Producer Confidence Indicator (and its components) for manufacturing, construction and trade businesses. - Manufacturing orders indicator (and its components). - Indicators of tendency.	- Consumer confidence indicator (and its components) - Other topics: possibilities to buy clothes, shoes, food, go on vacation, to save, to buy a car or a house, expectations about inflation and employment.
Seasonal adjustments and calendar effects	Yes, when series show seasonal pattern or calendar effects.	Yes, when series show a seasonal pattern or calendar effects.

Annex E: Tendency surveys in the Netherlands

Statistics Netherlands publishes several business and consumer surveys. The methods applied are broadly in line with the Joint Harmonized EU Programme of Business and Consumer Surveys (DG ECFIN, 2017). The Dutch experience is that they are in high (and still increasing) demand and that there is a lot of interest from analysts, researchers and the media. Amongst others, sentiment indicators from business and consumer surveys can be very useful in nowcasting rapid economic indicators, like flash estimates of economic growth. The earliest (T+30) estimate of Dutch quarterly GDP is partly based on an econometric model using, amongst others, information from consumer and business surveys.

The Producer confidence indicator

The Producer confidence indicator[1] is a sentiment indicator that indicates the direction in which manufacturing production is expected to develop, based on opinions and expectations of manufacturing companies.

Definitions and methods

The indicator is an unweighted arithmetic average of three component indicators from the business tendency survey of the manufacturing industry.[2] Before the Producer confidence indicator is calculated, seasonal and bias effects are removed from the three component indicators. The questions concern the expected activity in the next three months, opinion on order books and opinion on stocks of finished products.

The more optimistic or pessimistic manufacturing companies are, the more positive or negative the value of the producer confidence indicator is compared with the zero line, and the greater is the expectation that manufacturing production will increase or decrease, respectively, in the coming months. The producer confidence indicator has been available since 1985. The confidence indicator has been produced for the branches of the manufacturing industry since 1994.

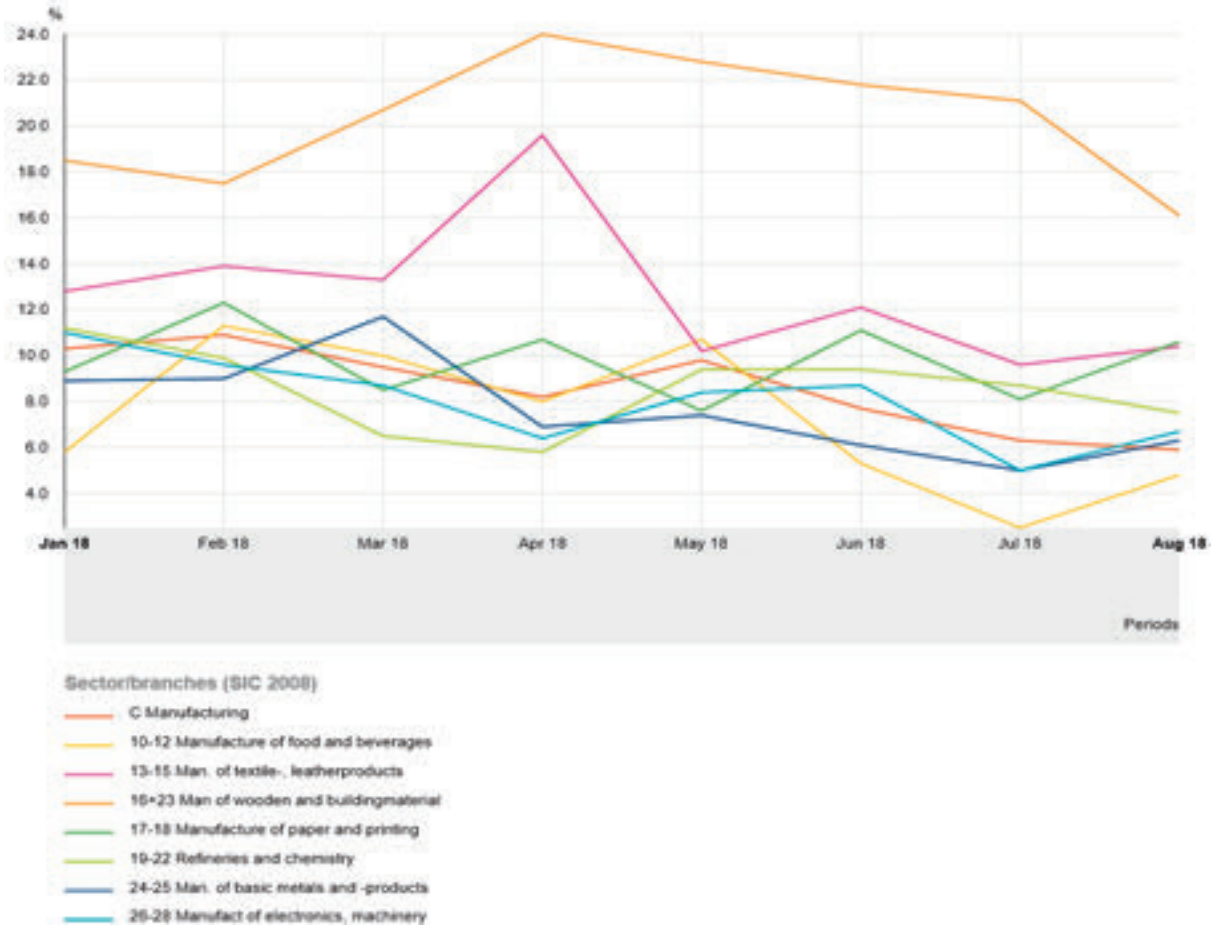
Every month, Statistics Netherlands surveys approximately 1.700 manufacturing companies to evaluate the economic situation (the business tendency survey). The survey aims to report on the monthly development of several indicators: production, received orders, stocks etc., within three weeks after the beginning of a month. By asking simple, mainly qualitative questions, it aims to provide prompt, relevant information.

Respondents are not asked to specify exact quantities. The business tendency survey asks two types of questions: those focusing on developments: have certain indicators 'increased', 'remained fairly stable' or 'decreased'; and those focusing on opinions, which invite the respondents to assess a number of dimensions. Possible answers are: 'large', 'normal' and 'small'. The direction in which the indicators develop is instantly verifiable from the results of that specific month. Evaluation questions call for comparison with the results from previous months. Some questions in the survey recur monthly, other questions every quarter (January, April, July and October).

[1] http://opendata.cbs.nl/statline/#/CBS/en/dataset/81234eng/table?ts=1536571849501

[2] https://www.cbs.nl/en-gb/our-services/methods/surveys/korte-onderzoeksbeschrijvingen/producer-confidence

Figure E.1 **Producer confidence in the manufacturing industry by branches (Netherlands)**



Questions about developments:

Monthly

- Production in most recent month
- Production expectations for the coming months
- Selling price expectations for the coming months
- New orders in most recent month:
  - Domestic market
  - Export orders
  - Total
  - Employment expectations for the coming month
  - Order books (in months)

Quarterly

- Competitive position in recent past: on the domestic market
- Competitive position in recent past: on the foreign market inside the EU
- Competitive position in recent past: on the foreign market outside the EU
- Capacity utilisation: in %
- Export expectations for the quarter

Assessments

Monthly

- New orders in most recent month
- Export order books
- Total order books
- Stocks of finished product

Quarterly

- Total capacity
- Limits to production:
  - None
  - Insufficient demand
  - Shortage of labour
  - Lack of equipment
  - Others

The consumer confidence indicator

The consumer confidence indicator[1] is produced to reflect the perceptions and expectations of consumers regarding the developments of the general economic situation and their household's financial situation.

Definitions and methods

Every month, Statistics Netherlands surveys approximately 1,000 households to evaluate their financial situation and the general economic situation. *The consumer confidence indicator* is the average of the (seasonally) adjusted balances of positive and negative answering options, measured as percentage points of the total answers to the questions on:

- the economic situation of the last and upcoming 12 months;
- the financial situation of the last and upcoming 12 months and;
- whether now is the right time to make large purchases.

The economic climate indicator is the average of the (seasonally) adjusted balances of positive and negative answering options, measured as percentage points of the total answers to the questions on the economic situation of the last and upcoming 12 months.

The willingness to buy indicator is the average of the (seasonally) adjusted balances of positive and negative answering options, measured as percentage points of the total answers to the questions on the financial situation of the last and upcoming 12 months and whether now is the right time to make large purchases.

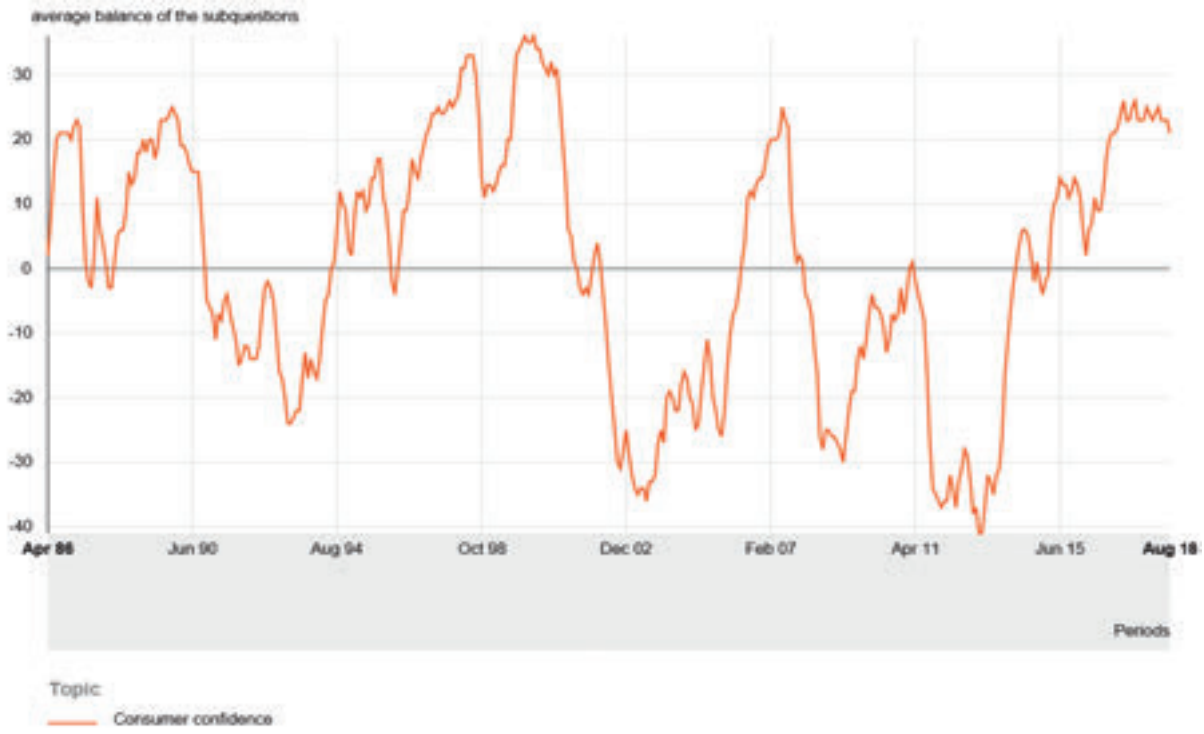
The indicators have a range between minus 100 (every balance is negative) and plus 100 (every balance is positive). If an indicator has a value of zero, the shares of positive and negative answers are equal.

The data are weighted and the indicators are adjusted for seasonal patterns and statistical noise using a structural time series model.

The survey also includes questions about consumers' expectations with respect to unemployment, inflation, saving behaviour and prospective purchases of Dutch households.

[1] http://opendata.cbs.nl/statline/#/CBS/en/dataset/83693ENG/table?ts=1536566747290

Figure E.2 **Consumer confidence (Netherlands)**



Annex F: The Export managers' index in Sweden

A Swedish case study of leading indicators

The purpose of the Export manager's index (EMI) is to generate information about the Swedish exporting industry. The EMI was first launched in 2007 and is published by Business Sweden[1]. Statistics Sweden is contracted to collect data from interviews and perform methodological work. It is intended to provide focus on small and medium-sized enterprises and how economic developments in different regions of the world affect the Swedish economy.

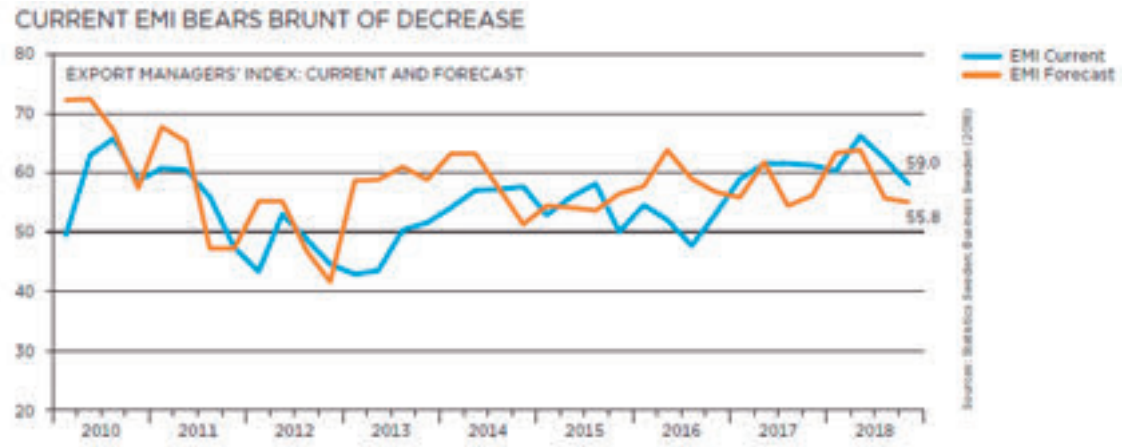
The EMI is a survey-based index, with data based on responses from export manager respondents in 225 Swedish companies divided into one half of larger (export revenue exceeding 250 million SEK) and smaller companies (export revenue 25-250 million SEK). The selection of companies in the EMI is based on information from the VAT register and thus covers exports of both goods and services. The surveys are conducted quarterly by Statistics Sweden. Analysis, presentation, and compilation are carried out by Business Sweden.

The study is based on seven questions to the respondents, as shown below;

1. How do you assess the company's export sales last 3 months?
2. How do you assess the size of the company's export order book?
3. How do you assess the profitability of export sales is at present?
4. How do you assess the demand for the export market will develop in the next three months?
5. How do you assess export sales will develop in the next three months?
6. How do you assess the profitability of export sales will develop in the next three months?
7. How do you assess the company's delivery time for exports will develop over the next three months?

The answers to the first three questions form the sub-index *EMI Current*. The answers to questions 4-7 form the sub-index *EMI Forecast*. All seven questions are equally weighted. The index is set so that an overall neutral outlook is represented by the number 50. A number higher (lower) than 50 represent a positive (negative) assessment. For the total aggregation of the index, the responses are weighted by the company's export revenues.[2]

Figure F.1 **Export Managers' Index, Current and Forecast (Sweden)**



[1] See https://www.business-sweden.se/

[2] https://www.business-sweden.se/contentassets/14dc83efad744e47a871413393742c40/emi-q4-2017-eng.pdf

The graph displays both the EMI Current and the EMI Forecast, whose weighted average generate the total EMI.

The EMI index has a high timeliness and transparency and is easy to understand for users. There are no revisions of data. One disadvantage may be an increasing shortfall of respondents chooses not to respond to the survey.

Annex G: Well-being index for provinces of Turkey

The Turkish Statistical Institute (TurkStat) began work on regional well-being in 2012, which led to the first life satisfaction survey at province level in 2013. From 2014, a working group developed the well-being index for the provinces of Turkey, in cooperation with stakeholders and the OECD. The first results were published in 2016. The working group consisted of experts from TurkStat, relevant ministries and academia.

The purpose of the index is to measure people's well-being by province, in a way that allows monitoring and comparison over time. More specifically, the objectives are:

- to provide individual, household and outcome-based well-being indices,
- to measure life standard of residents in provinces and monitor changes over time,
- to have a policy sensitive composite index, consisting of improvable indicators and
- to combine all quality of life dimensions into one index.

Figure G.1 **Map of Well-Being Index for Provinces 2015 (Turkey)**

The map of well-being indices for provinces shows the ranking values of provinces obtained from the general index values. The calculation method is explained below.

Selection of dimensions of well-being

Dimensions and indicators for the Well-Being Index for Provinces are determined by reference to country specific circumstances as well as the OECD Better Life framework. The index consists of 11 dimensions, which are considered equally important, significant and irreducible (i.e. they cannot be combined):

- Housing
- Work life
- Income and wealth
- Health
- Education
- Environment
- Safety

- Civic engagement
- Access to infrastructure services
- Social life
- Life satisfaction

Selection of indicators

The individual indicators used to measure the dimensions were selected based on the following criteria:

- Appropriate to main target and outcome-oriented,
- Reflect the well-being of people residing in the province,
- Improvable through policy change,
- Reflect the distinctions between provinces
- Contribution direction (positive / negative) can be clearly identified,
- Comprehensible, robust and accurate
- Updated periodically

The main data source for the subjective indicators of the index is the Life Satisfaction Survey by Provinces. The quantitative indicators are sourced from different available data sources.

Due to problems in obtaining province level indicators, trade-offs between the indicator selection criteria were faced. In cases where the intended indicators (e.g. on water quality, green areas, household financial wealth, assault rate) were not available, the best available proxy indicators were selected based on experts' opinions. When output oriented indicators are not available, indicators reflecting access to a certain good or service are used instead.

For each dimension, at most five indicators are selected to retain manageability and ease of comprehension. If, during the selection process, individual indicators showed high correlation with each other, only one of the correlated indicators was kept to avoid problems of multicollinearity.

In total, 41 indicators that were assessed to be the most important were selected for measuring the different dimensions of well-being. The Dimensions and the indicators are shown in Table G.1, which also shows the expected direction of impact each indicator has on well-being. While the study involves indicators which positively affect life, indicators that have negative effects on the index are also included. Only indicators whose direction of impact was agreed by all working group members were considered.

Calculation

For every province, indicators are compiled for each dimension and for aggregate well-being. The compilation process consists of the selection of the individual indicators, normalization of indicator values, weighting and aggregation. The indicators are compiled only at regional level, not at country level.

The individual indicators are collected from different data sources and often denominated in different units. To make the data sets comparable, the data was normalized according to the method of Min-max normalization. Min-max is a method that normalizes indicators at the range of 0 and 1. Indicators which have negative effects on the index (unemployment rate, murder rate etc.) were coded inversely at index calculation.

$$_{i} = \frac{x_i - x_{min}}{x_{max} - x_{min}} \qquad \tilde{}_{i} = 1 - \frac{x_i - x_{min}}{x_{max} - x_{min}}$$

G_i: normalized indicator of x_i when the effect of x_i is positive
$\tilde{}_i$: normalized indicator of x_i when the effect of x_i is negative
x_i: value of indicator
x_{min}: minimum value of indicator
x_{max}: maximum value of indicator

The composite index is calculated according to the hierarchical equally weighting method, Weights of dimensions and indicators according to this method are as follows;

$$\text{Weight of dimensions, } w_B = \frac{1}{N}, N = \text{number of dimensions}$$

$$\text{Weight of indicators, } w_G = \frac{1}{n}, n = \text{number of indicators in the dimension}$$

The indicators for the dimensions are calculated by multiplying each normalized indicator by the weight of the indicators within the dimension and aggregating these products:

$$\text{Dimension indicator} = \sum (w_{Gi} * \ _i)$$

W_{GI}: weight of indicators in the dimension $(\sum w_{Gi} = 1)$
G_i: normalized indicators

The overall well-being index is obtained by multiplying each normalized indicator by the weight of dimension and indicator and aggregation of these products. The aggregation method, which is used to obtain overall index can be expressed as follows;

$$\text{Overall well} - \text{being index} = \sum (w_{Bi} * w_{Gi} * \ _i)$$

W_{BI}: weight of dimensions, $\sum w_{Bi} = 1$

Table G.1 **Dimensions and indicators of well-being index for provinces**

Dimensions	Indicators	Contribution Direction	Reference Year
Housing	Number of rooms per person	Positive	2013
	Toilet presence percentage in dwellings	Positive	2013
	Percentage of households having problems with quality of dwellings	Negative	2013
Work Life	Employment rate	Positive	2013
	Unemployment rate	Negative	2013
	Average daily earnings	Positive	2014
	Job satisfaction rate	Positive	2013
Income and Wealth	Savings deposit per capita	Positive	2014
	Percentage of households in middle or higher income groups	Positive	2013
	Percentage of households declaring to fail on meeting basic needs	Negative	2013
Health	Infant mortality rate	Negative	2014
	Life expectancy at birth	Positive	2013-2014
	Number of applications per doctor	Negative	2014
	Satisfaction rate with health status	Positive	2013
	Satisfaction rate with public health services	Positive	2013
Education	Net schooling ratio of pre-primary education between the ages of 3 and 5	Positive	2014-2015
	Average point of placement basic scores of the system for Transition to Secondary Education from Basic Education	Positive	2015
	Average points of the Transition to Higher Education Examination	Positive	2015
	Percentage of higher education graduates	Positive	2014
	Satisfaction rate with public education services	Positive	2013
Environment	Average of PM10 values of the stations (air pollution)	Negative	2014
	Forest area per km2	Positive	2012
	Percentage of population receiving waste services	Positive	2014
	Percentage of households having noise problems from the streets	Negative	2013
	Satisfaction rate with municipal cleaning services	Positive	2013
Safety	Murder rate (per million people)	Negative	2014
	Number of traffic accidents involving death or injury (per thousand people)	Negative	2014
	Percentage of people feeling safe when walking alone at night	Positive	2013
	Satisfaction rate with public safety services	Positive	2013
Civic Engagement	Voter turnout at local administrations	Positive	2014
	Rate of membership to political parties	Positive	2014
	Percentage of persons interested in union/association activities	Positive	2013
Access to Infrastructure Services	Number of internet subscriptions (per hundred persons)	Positive	2014
	Access rate of population to sewerage and pipe system	Positive	2014
	Access rate to airport	Positive	2015
	Satisfaction rate with municipal public transport services	Positive	2013
Social Life	Number of cinema and theatre audience (per hundred persons)	Positive	2014
	Shopping mall area per thousand people	Positive	2015
	Satisfaction rate with social relations	Positive	2013
	Satisfaction rate with social life	Positive	2013
Life Satisfaction	Level of happiness	Positive	2013

Annex H: The Active Ageing Index

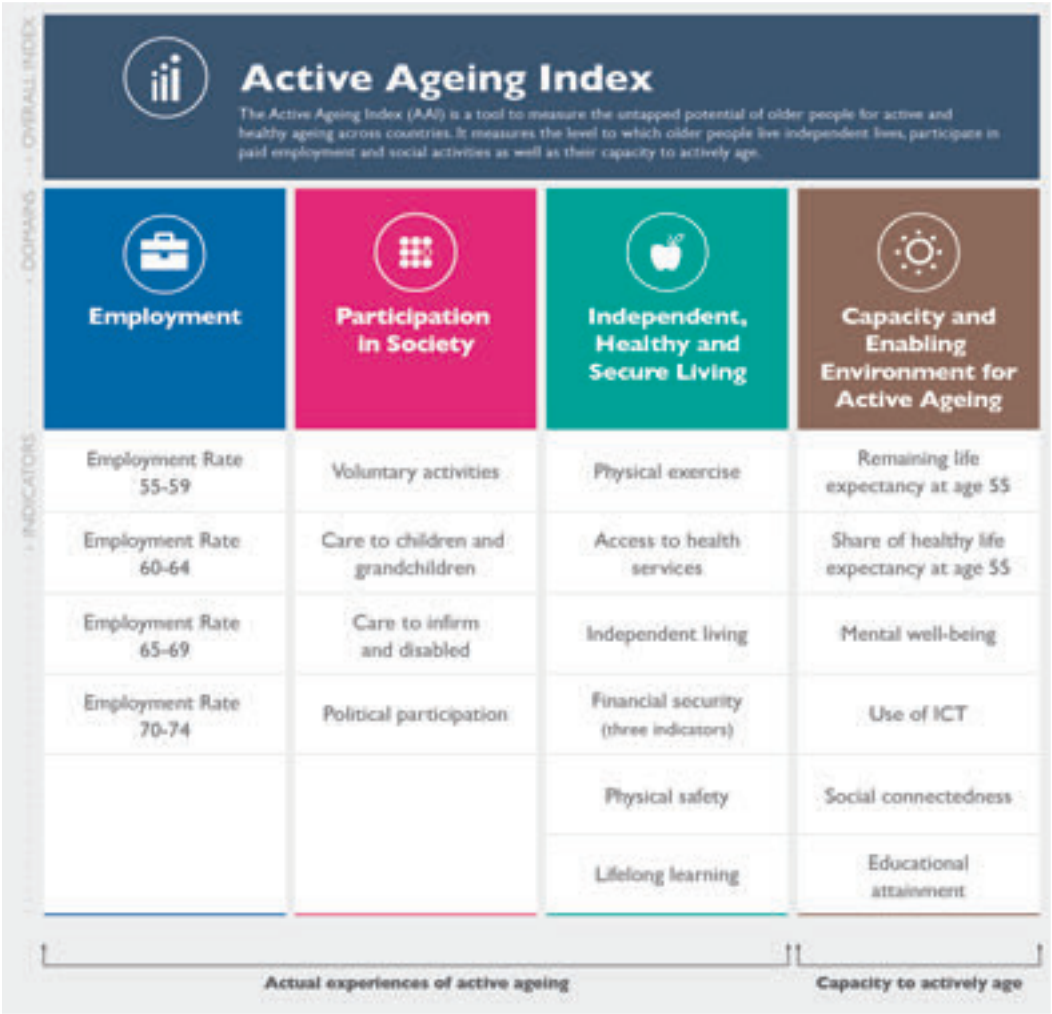
Active ageing is a multidimensional concept referring to people continuing to participate in the formal labour market, engaging in unpaid productive activities (such as care provision to family members and volunteering), and living healthy, independent and secure lives as they age.

The Active Ageing Index (AAI) has been developed to encompass the multiple aspects of active ageing and to provide a tool that can be used to inform active ageing policy.

The AAI is maintained jointly by the Population Unit of the United Nations Economic Commission for Europe (UNECE) and the European Commission's Directorate General for Employment, Social Affairs and Inclusion (DG EMPL). The work benefits from the advice of the Expert Group on AAI which includes representatives of different stakeholder groups: researchers, statisticians, civil society and policymakers.

The AAI consists of 22 individual indicators grouped into 4 domains: employment; participation in society; independent, healthy and secure living; and capacity and enabling environment for active ageing. The first three domains reflect the actual experiences of active ageing. The fourth domain measures the capacity of the older population to age actively. The structure of the index and the selected indicators are shown in Figure H.1.

Figure H.1 **The structure of the Active Ageing Index**



The index values range from 0 to 100. Higher values indicate a greater extent of realizing the potential of older men and women. All the indicators are measured separately for men and women, which makes it possible to detect gender gaps in active ageing. AAI offers a flexible framework that can be applied to different countries and at national as well as subnational levels. It depicts the current situation and highlights areas where gains can be made. A country might have high results in one domain, for example employment, while relatively low results in another one, such as independent living. If calculated regularly, AAI allows monitoring progress over time.

The conceptual framework of the AAI

The conceptual framework of the AAI is based on the WHO definition of active ageing and the 2012 Vienna Ministerial Declaration goals. The framework was developed by the UNECE/EC Project Team, the European Centre for Social Welfare Policy and Research (ECV) in cooperation with the Expert Group on AAI under the auspices of the 2012 European Year for Active Ageing and Solidarity between Generations.

Selection of domains and individual indicators

Based on the WHO definition of active ageing and the 2012 Vienna Ministerial Declaration the domains and the individual indicators were selected by the Expert Group on AAI to reflect the key aspects of active aging.

Data Sources

The AAI for European Union member countries is calculated based on existing data sources including EU SILC, EU-LFS, European Social Survey (ESS), European Quality of Life Survey (EQLS) and EU ICT use survey. For countries not covered by these surveys, other available sources providing relevant data f are used. At subnational level, the data are also usually selected from available sources, though in some cases ad-hoc surveys were carried out.

Calculation of domain-specific scores and the overall AAI

Initially, domain-specific scores were compiled using equal weights for all indicators within each domain. Similarly, the AAI was compiled as the equally weighted average of the four domain-specific scores. A main reason for using unweighted aggregation was that this method did not involve value judgement of experts and researchers concerning the relative importance of individual indicators or domains. However, the approach of equal weighting was questioned, and it was agreed to revise the weighting method. After discussion, the Expert Group decided that different weights should be used both for the individual indicators and for the domains.

In the absence of unequivocal theoretical and empirical grounding on the contribution of each indicator to a certain domain and of each domain to active ageing, it was decided to use weights recommended by the Expert Group. Based on weighting simulation exercises and suggestions for weights by the Expert Group members and project partners, weights for the individual indicators and for the domains were agreed. Hence, domain-specific scores are calculated as the weighted arithmetic average of the indicators that enter the domains. The overall AAI is calculated as the weighted arithmetic average of the domain-specific scores.

The Individual indicators differ in measurement unit and in scale. In such cases, a common practice before aggregating the indicators would be to normalise these to a common scale, for instance through standardisation by the z-scores. However, while normalisation provides a convenient way to make indicators comparable by centring them around a common mean, this also makes comparisons over time more difficult without additional transformations of the data. Indicators referring to period t will be normalised around the mean values observed in period t, while indicators referring to period $t+1$ will be normalised around the mean values of $t+1$, which will make them temporally incomparable. In addition, the use of the original data series was considered an advantage in the communication of the AAI and in

ensuring its credibility. The Expert Group, therefore, agreed not to normalise the individual indicators before they are aggregated into domain-specific indicators. Similarly, the domain-specific indicators are not normalised when aggregating into the overall AAI.

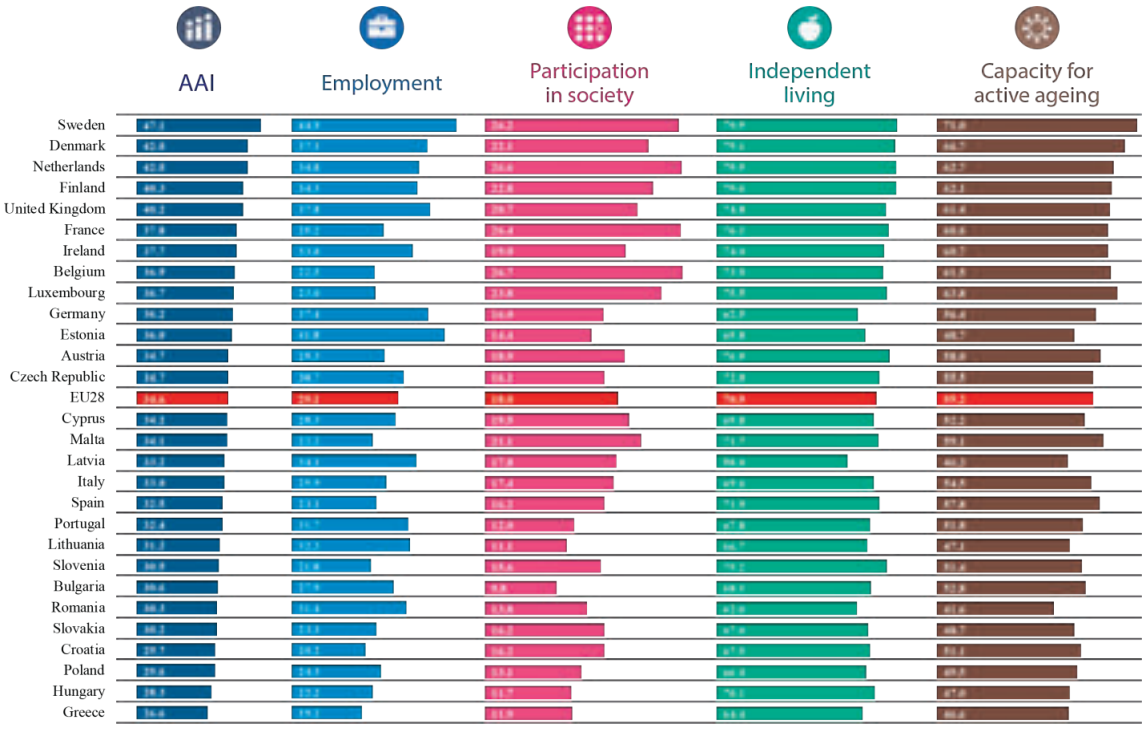
Instead of normalising the individual and the domain-specific indicators, weights are introduced to compensate the differences in magnitude of the indicators and domains. These weights (labelled *explicit weights*) are equilibrated to ensure that the effective weight of the indicators and the domains corresponds to the weights proposed by the experts (labelled *implicit weights*).

For instance, the implicit weights of the four domains agreed by the Expert Group are 28%, 19%, 21% and 32%, respectively. When calculating the overall AAI, the explicit weights 35%, 35%, 10% and 20%, respectively, are used to offset the impact caused by the different magnitudes of the domain-specific scores and ensure an effective weight of the domains as recommended by the Expert Group.

Publication

The AAI has been published every second year since 2010. In general, data are published two years after the reference period. The Active Ageing Index for 2014 that was published in 2016 is shown in Figure H.2.

Figure H.2 **The Active Ageing Index, overall and by domain, 2014**



More information

Detailed background information and methodological documentation of the AAI is available from the UNECE website https://statswiki.unece.org/display/AAI/Active+Ageing+Index+Home

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Guidelines on producing leading, composite and sentiment indicators

Leading, composite and sentiment indicators make it possible for official statistics to shed new light on aspects of the economy and the society, for instance through compilation of leading indicators on the economic development or composite indicators measuring the well-being of households.

This publication gives guidance to statistical offices that produce or consider producing leading, composite and sentiment indicators. The Guidelines provide a typology of the indicators and offer a structured decision-making process based on the Principles of Official Statistics that statistical offices may use when deciding whether to engage in the production of such indicators.

For statistical offices that already produce or decide to produce leading composite and sentiment indicators, the Guidelines give practical guidance on how to produce the indicators and how to communicate them to users of statistics. The Guidelines include practical examples from countries that can serve as inspiration for developing and communicating LCS indicators. The publication is targeted principally at national statistical offices, others interested in the compilation and use of LCS indicators will also find it useful.

An electronic version of the Guidelines is available from the UNECE Statistical Division's website, www.unece.org/statistics

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CH - 1211 Geneva 10, Switzerland
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E-mail: unece_info@un.org
Website: http://www.unece.org

ISBN 978-92-1-117219-5

Printed at United Nations, Geneva – 1915797 **(E)** – October 2019 – 899 – **ECE/CES/STAT/2019/2**