Chapter 5: Composite Economic Indicators

Contents

5.1 Introduction

Composite Economic Indicators (CEI) has been in use for many years. One of the first and most known composite indicators is the Conference Board Leading Indicators[1]. The main reason for developing composite economic indicators was to anticipate movements of the reference variable that the indicator aimed to measure, mainly GDP. The Handbook of Cyclical Composite Indicators (forthcoming)[2] presents a historical overview of this area. Starting in the midst of the 19th century the first theories provided the first "exogenous cycles" relating economic cycles to other exogenous cycles found in "nature" such as weather. At first, a single indicator was formed to appropriately describe economic fluctuations. This was developed to synthetic indicator (or barometer) which combined homogenous set of single indicators representing a specific economic sector or a particular aspect of the economic fluctuations[3]. This "synthetic indicator" was the first composite economic indicator.

Although, Composite economic Indicators (CEI) has been in use for a long time, to assess the present economic situation, it was not until the aftermath of the Great Recession of 2008-2009 that users demanded indicators that were more streamlined. This was required, as a more homogenous set of statistical indicators would make it possible to give a reliable overall picture of the economic situation and allow for cross-country comparisons and users would more easily be able to make the correct decisions.

The main purpose for constructing and producing economic composite indicators have been a search for early warning measures, such as leading or coincident indicators as measures of cyclical turnings points. The indicators are used to compare economic development between countries. The methodology used in the construction of CEIs has varied over time and between producers. The indicators should be based on statistical reliable data and economically sound methods to secure good quality.

[1] The Conference Board (2012)
[2] UN/Eurostat (forthcoming)
[3] UN/Eurostat (forthcoming)

Structure of the chapter

This chapter aims to present the most used standard model for Composite Economic Indicators and discuss their usage to give guidance to NSOs how to deal with these models. The guide will also highlight issues and pitfalls that the NSOs should be aware of when constructing CEIs and give examples of their construction today.

Section 5.2 presents gives an overview of different definitions for Composite Economic indicators. Section 5.3 describes cyclical indicators with or without reference series. Chapter 5.4 discusses structural indicators and Chapter 5.5 gives an overview of the recommended model for construction of Composite Economic Indicators, which includes a discussion of quality issues and dissemination. Finally, a few examples are presented in the annex, which illustrates indicators produced within the official statistics.

The chapter draws upon the Handbook on Cyclical Composite Indicators (UNSD, Eurostat forthcoming), the Handbook on constructing composite indicators (OECD 2008) and the OECD system of Composite leading indicators (OECD 2012).

5.2 Arguments for and against composite economic indicators

There is an ongoing discussion on pros and cons for using composite indicators. The main advantages is that the indicators can summarize complex, multi-dimensional concepts in an easier way and make it easier to compare country performance over time. From a policy-makers point of view it will also be easier to follow the trend of few composite indicators than exploring large amount of statistical datasets. Composite economic indicators may also offer leading abilities that makes it possible to predict the present economic development in a convenient way.

However, there are also many arguments for not producing composite economic indicators. The methods used are not in line with the statistical requirements regarding the choice of individual indicator and methods for weighting and aggregations. Often the conceptual model or theory does not exist and there is a need for time and resources for further research to clarify these requirements. Even it a robust model is applied, there is a risk of failure over time as the economic conditions are changing. This means that the NSO have to put in more work in evaluation and further development to secure quality in the composite indicator over time. As resources are often scarce, this will be a disadvantage.

Even if the composite indicators is demanded by users there are risks as users do not have the skills to judge the indicators and it might send misleading messages if poorly constructed or misinterpreted. Users may make simplistic conclusions, as they do not know the underlying data well enough. The composite indicators may also be misused to support a desired policy, or they may be misunderstood if it is not transparent enough for users to understand.

The NSOs have to weigh the pros and cons and it might be a matter of resources for many of them. Larges countries with NSOs that have enough resources to hold a methodology department with an analytic capacity will have abilities to develop composite economic indicators for national use. For smaller countries, or NSOs with restricted budgets, this may be something that has to be down-priorities as it is not possible to hold enough methodological resources. Some NSOs have found ways to cooperate with research institutions, such as Switzerland or the Netherlands, to make it possible to produce composite indicators, but this might not be an option for everyone.

5.3 Composite Economic Indicators, some definitions

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[4].

The Composite Economic indicators (CEI) are the most used composite indicators and the components that build these indicators usually origins from statistics.

The CEIs have two dimensions; macroeconomic indicators and structural indicators, which both describe the economic change. A structural change in the economy is permanent or very long-lived, while a macroeconomic disturbance tend to return to its previous level over a few years.[5]

The macroeconomic indicators have two dimensions; cyclical or non-cyclical indicators depending on whether they have reference series or not. The cyclical indicators that have a reference series, usually GDP, can be leading, coincident and lagging indicators depending on their timing. The non-cyclical indicators do not follow any reference series but give additional information of the causes for the short-term change in the economy.

The advantage of using CEI compared to the use of individual component series is that it achieves a better tradeoff between responsiveness and stability. The CEI have the capacity to react to various sources of economic fluctuations, no matter whether the causes are endogenous or exogenous at the same time can they be resilient as only part of the components are affected.

Due to the large interest in predicting business cycles, Composite Economic Indicators have mainly been used in a cyclical context. However, these indicators are increasingly used also in a structural context, as the importance of the real understanding of the causes for permanent change in the economy are increasing. Examples on this are analysis of phenomena's such as innovation, productivity, digitalization and organizational learning, as a base for all policy areas associated with these challenges.

CEIs, that compare country performance, are a useful tool in policy analysis and policy communications. Using composite economic indicators to identify common trends across many separate areas (countries) may be a complementary tool, when comparing many different indicators presented at a "dashboards" or "scoreboards". While the composite indicators give a time series perspective over the economic situation for a set of indicators, the dashboard/scoreboard presents many indicators at one point in time, or in relation to a set goal. Further analysis and research is needed to analyze the present situation over time. Composite indicators and dashboards/scoreboards can be complementary tools and the choice of tool depends on user's needs. While the CEI signals a changing trend, the dashboard/scoreboard can give more information on the cause of the change.

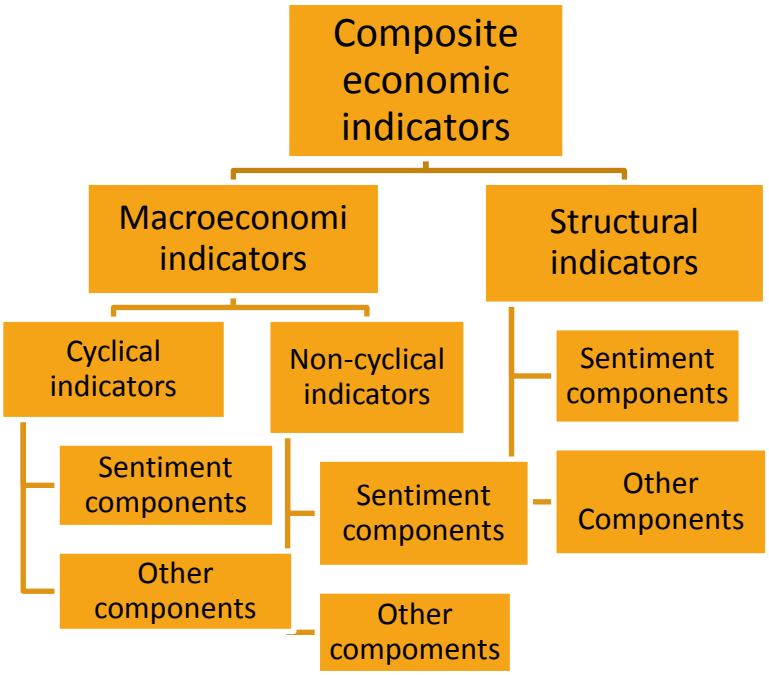
As CEIs are complex tools, they should be used with care. If not carefully constructed and evaluated on a regular basis the CEI may not be up-to-date as a measure of the phenomena that it initially was constructed for. The construction of these indicators is important to secure that the CEI will be as transparent and easy to understand as possible, and thereby avoid being misleading or misused. Transparency is important but this does not mean that the CEI should be too simplistic as this may be subject to political dispute.

[4] Definition from chapter 3
[5] Swanson, Eric FRBSF Economic letter 2012-18, 2012

By constructing and presenting composite economic indicators, statistical information with leading properties can be presented at an earlier stage to show a change in trend. It facilitates communication with users and specially policymakers to want as early indicators as possible. Comparisons will be easier between countries and over time.

In figure 5.1 below a scheme of the different Composite economic indicators, dimensions and components are shown. The different composite indicators are constructed by the use of sentiment components as well as other components. A special case is a composite sentiment indicator, which have only sentiment components included[6].

Figure 5.1: Composite Economic indicator (CEI,) concept



Some Definitions

Macroeconomic indicators mainly explains the short-term economic development in the economy. They can be divided in two groups; cyclical indicators following a reference series, i.e. GDP, and non-cyclical indicators that measure special phenomena such as productivity or competitiveness. These indicators aim to measure the state of, and efficiency in, the national economy.

Cyclical indicators (with reference series), which are the most common cyclical indicators, measures the business cycle development. They show the same cyclical pattern as their reference series, usually GDP or IPI. They can be leading, coincident or lagging in their pattern toward the reference series.

Non-cyclical indicators do not show the same pattern as GDP, but can give additional information of the short-term economic change. They do not usually have reference series and may be based on mathematical models. They may seem less transparent for users.

[6] See also chapter 4.

Structural indicators, such as IT-development or globalization, describe situations or developments of the national economies that involves a permanent change. They can be used to measure policy implementation regarding employment, innovation, economic reform or the environment. These indicators can also be related so special markets or product sectors, risk indicators or imbalance indicators for financial markets.

The components of the CEI are sentiment components, usually collected in surveys or other components, mainly statistical indicators, register data etc. They may be of mixed frequency or not.

5.4 Cyclical composite economic indicators

Cyclical CEI have an ambition to follow and forecast the business cycle, which has led to the use of the cyclical composite indicators, mainly leading indicators. In practice, most composite indicators that have a reference series are economic indicators, and the reference series are usually various transformations of GDP or IPI. (See definitions in chapter 3.3.1)

In business cycle analysis, leading indicators are frequently used, as they aim to anticipate the movements of its reference series. These are often based on single sentiment indicators, as these are timelier than other indicators. The main aim are to present an "early signal" of changes in trend patterns, such as leading indicators for sales or interest rate development. These "market composite indicators" are usually very simple indicators, such as the Purchasing Managers index (PMI) or Share price indices.

Cyclical economic indicators with reference series

After the Great Depression in 1929, empirical studies aimed to analyze and forecast cyclical movements. During this period a definition of a business cycle was according to the UN Handbook (2016) first introduced by Burns and Mitchell;

"Business cycles are a type of fluctuation found in aggregate economic activity of nations that organize their work mainly in business enterprises; the sequence of expansions and contraction cycles is recurrent but not periodic".7

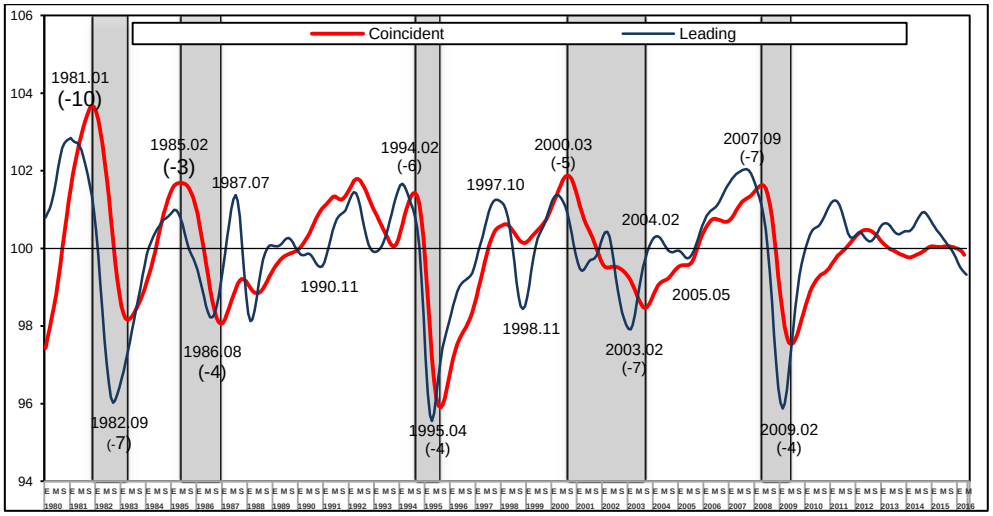
This definition formed a base for the National Bureau of Economic research (NBER) business cycle program and since then both U S Department of Commerce Bureau of Economic Analysis and The Conference Board have relied on the definition that still forms the base for the Conference Board Leading Indicator. The chronologies of business cycles developed based on this approach and the classifications of economic indicators into leading, coincident and lagging indicators have been useful ingredients in the measurement and analysis of business cycles over the years in many countries. Within the NBER approach, mentioned above, composite indexes serve as handy summary measures on the current behavior of the cyclical indicators and of the state of the economy. As they are averages, they tend to smooth out some of the volatility of individual series. In particular, composite indexes can reveal common turning points patterns in a set of economic data in a clearer and more convincing manner than the behavior than any individual component.

[7] UN/Eurostat Handbook of CCI (forthcoming),

Example 5-1: Mexico - System of cyclical indicators

The System consists of two composite indicators: a coincident and a leading. The first one provides a general vision of the economy performance, while the second seeks to anticipate possible turning points in the coincident indicator. The system applies the methodology of the growth cycle, which refers to recurrent fluctuations in the economic activity around its normalized long-run trend. The 100 line represents the long-term trend of coincident and leading indicators. Numbers in the graphic represent the year and month in which turning points of the leading indicator occurred: peak or trough. Numbers in parenthesis indicate the number of months that the leading indicator anticipated the turning point of the coincident indicator. These numbers may change over time. Grey areas show periods between a peak and a trough in the coincident indicator.

(Points)



Source: National Institute of Statistics and Geography (INEGI).

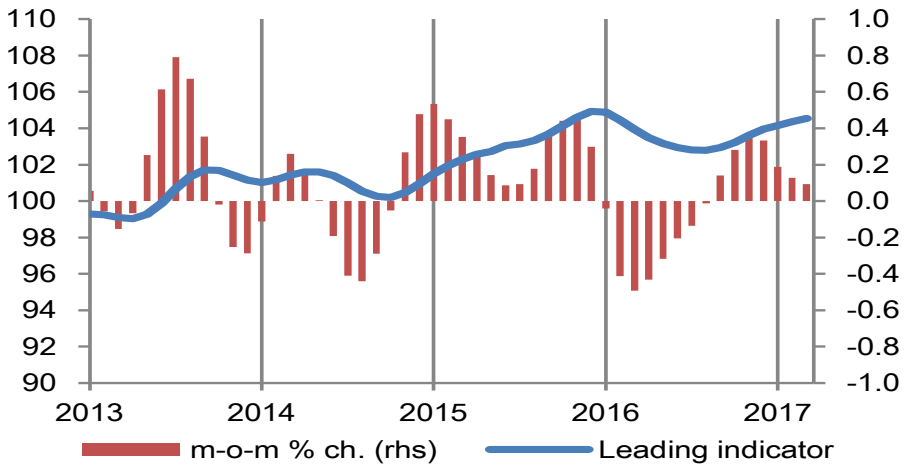
The reason for compiling composite indicators is mainly to fill gaps in existing statistics and may highlight underlying phenomena. Composite indicators are constructed to 1) provide an estimation of the current evolution of the reference variable ant its future anticipation, 2) estimating some unobserved components of the reference variable such as the trend or cycle, 3) providing an estimation of the occurrence of rare events such as the cyclical turning points for the current period and the near future.[8]

The main use for composite economic indicators historically has been as Leading indicators for the business cycle, were GDP has been the natural reference rate.

[8] EURONA 2015-2 p.75

Example 5-2 Italy – Coincident and leading indicators

The methodology for the leading indicator calculation is based on the methodology described in the paper ”The Italian Business Cycle: Coincident and Leading Indicators and Some Stylized Facts” (Altissimo, Marchetti and Oneto, 2000).. However at the moment the system works on the basis of the identification of two composite coincident and leading indicators. The methods used combines traditional NBER methods with that of other techniques of cyclical analysis. A more detailed description is presented in the annex.



Leading, Coincident or Lagging Indicators

The main properties of Cyclical Composite Economic Indicators[9] are; a) consistent timing, b) economic significance, c) strategic reliability of data collection, d) prompt availability without major revisions and e) smooth month-to-month changes.

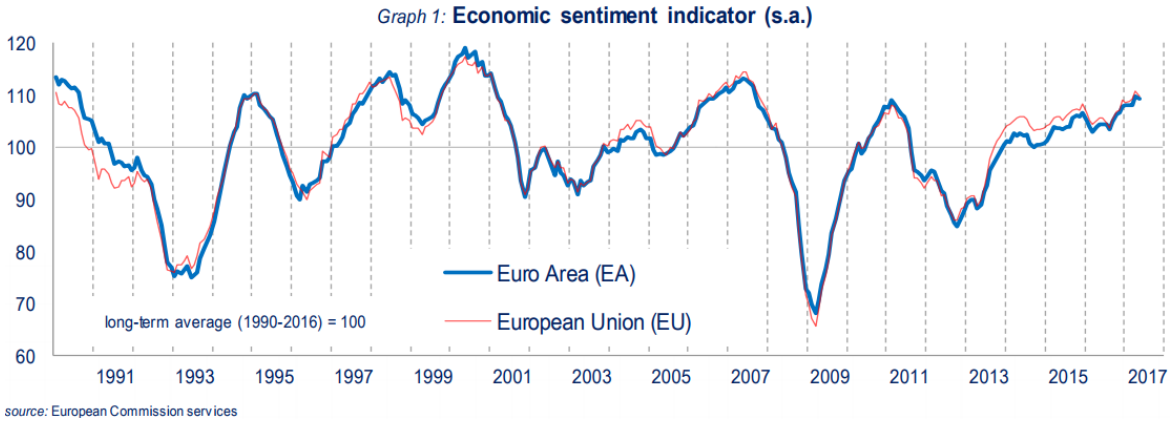
Concerning timing the composite indicators usually are classified into leading (anticipating the movements of its reference series), coincident (which movements occur at the same time as those of its reference series) and lagging (with movements that follows those of its reverence series) indicators.

The leading and coincident indicators are used for business cycle analysis while lagging indicators are less used. The leading indicators are based on components that had shown leading abilities, such as order data or expectations, while the coincident indicators are based on components within the same “time frame”, such as monthly production data within a quarter. Timing should be chosen in a consistent manner.

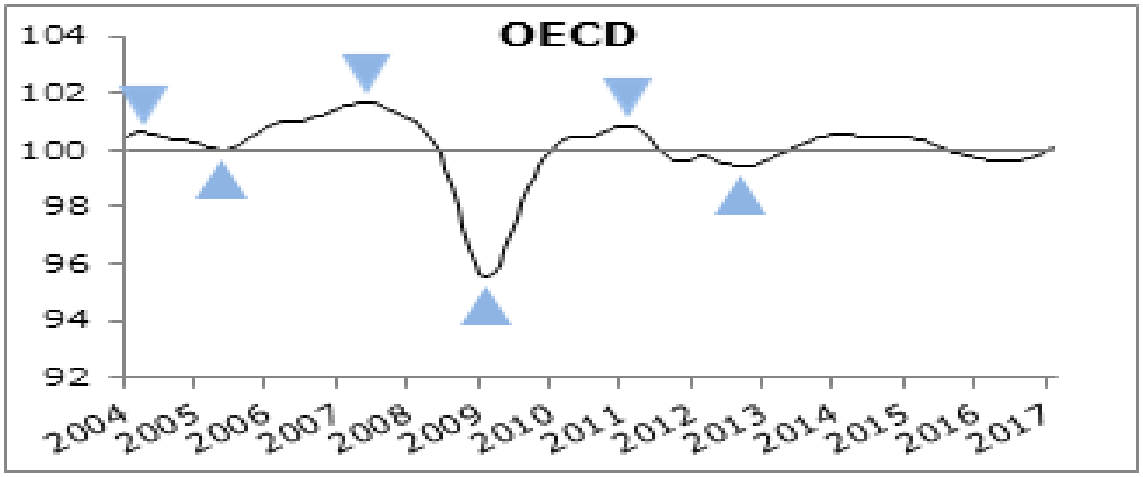
Leading composite indicators are being produced by many parties, the most known might be the OECD Composite Leading Indicator (CLI) (graph 5.1) and EU Economic sentiment indicator (ESI) (graph 5.2. Many National Statistical Offices (NSO) and central banks are also producing leading indicators on a regular basis, as this is an important measure for policy makers.

[9] UN/Eurostat Handbook (forthcoming)

Graph 5.1 : EU Economic Sentiment Indicator (ESI)



Graph 5.2 OECD Composite Leading Indicator (CLI)



Source: OECD

Economic significance is important, as the quality of the underlying components should mirror what the CEI aims to show. Strategic reliability of data collection is a quality assurance that the underlying data will be as good as possible. Prompt availability show that the indicators should be as timely as possible. Therefore, the choice of the components in the construction of composite indicators is essential from many points of views. By using methods to show smooth month-to-month changes, the result will be easier to understand. Beside that the choice of methods, e.g. for seasonal adjustment, will also be crucial for the result presented.

5.5 Non-Cyclical indicators

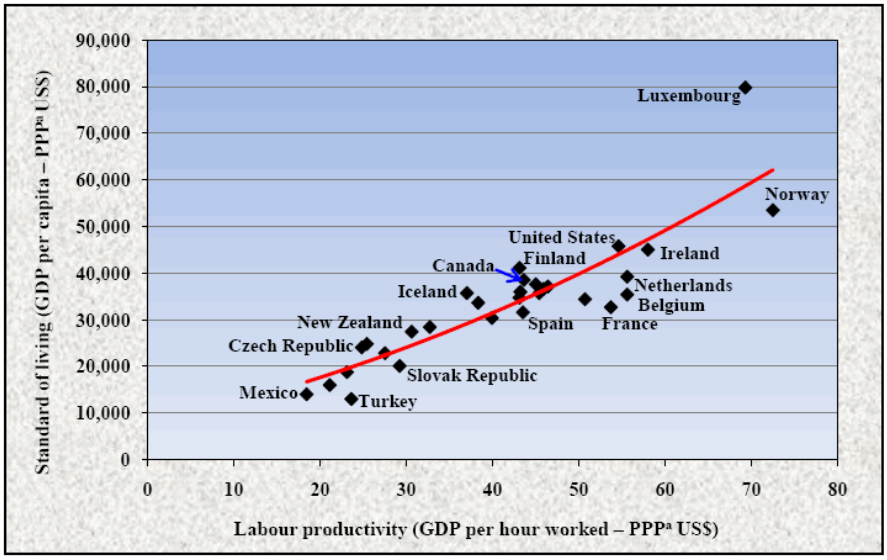
The non-cyclical economic composite economic indicators are found in areas such as competitiveness, productivity, globalization and innovation, and are constructed in a more standardized manner. The non-cyclical economic indicators do not usually have a reference series as they are mostly used to for comparative studies.

The non-cyclical composite economic indicators can be useful tools in policy analysis in tracking signals of change in the economy in a short-term perspective that is not related to the cyclical

change. One area were they have been used recently is productivity analysis, see graph 5.2. These indicators may also be used for comparing and benchmarking different countries.

Non-cyclical composite economic indicators are often based on mathematical models and they may be seen as more complex to understand than the cyclical indicators, especially as the result cannot be compared to any reference series. Non-cyclical composite economic indicators may be similar to structural indicators, but differs from there in that they are macro-oriented and have a shorter time horizon.

Graph 5.2 Non-Cyclical indicators - example Productivity data



Source: Shaw

5.6 Structural indicators

In the field of structural economics, it is especially in microeconomics that composite indicators are frequently used. The aim of these indicators is to show the long-term or permanent structural change in the economy by studying the behavior of the firm. In recent times, innovation and ICT [10] have been two driving forces that are very much in focus for policy as they change the conditions for economic growth in almost every perspective. One example is given I graph 5.3.

By the use of microeconomic analysis it is possible to study the underlying forces of the economic change Here the composite indicators are frequently used in order to catch some broader areas that could not be directly measured as ICT-level of a firm or if it is a learning organization or not.

These phenomena cannot be measured directly in a meaningful way. The result from the microeconomic surveys give answers that are very subjective and biased. By the use of composite indicators this phenomena can be measured using a basis of discrete variables. These structural composite indicators have shown good results with significant relationships to both economic and social variables. These indicators are also used for long-term comparative studies of development, i.e. for innovation.

Graph 5.3: Structural indicators: Global Innovation index 2015

[10] Hagén(2016)

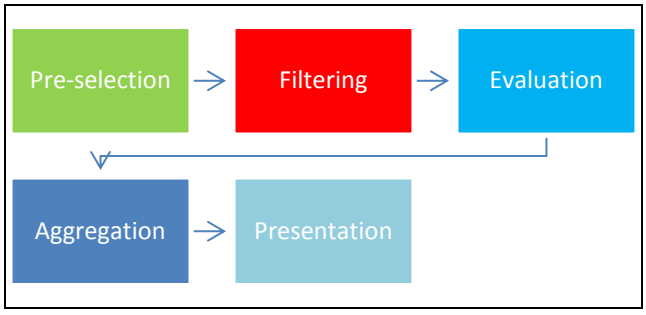
Source: World Intellectual Property Organization

5.7 Steps for construction of composite economic indicators

The construction of composite economic indicators can be divided in five major processes and several steps. These are in detail described in The Handbook for constructing composite indicators[11] and the OECD System of Composite Leading Indicators[12]. These handbooks are recommended as a primary tool for NSOs that want to follow a standardized approach for construction of composite indicators. Below a short description is presented of the different steps in the construction and difficult steps are being discussed and described further.

The process of constructing a CEI is illustrated in figure 5.2, based on the OECD CLI production process. The different steps in the production process are based on the structure in the OECD Handbook on Composite Indicators.

Figure 5.2 Production Process for Composite Economic Indicators



During the PRE-SELECTION process a theoretical framework should be set up and the data selection should be performed. This includes the steps of creating a theoretical framework of the aim of the composite indicator (step 1) and the selection of data (step 2).

[11] OECD/Eurostat (2008)
[12] OECD system of Composite leading Indicators, (April 2012)

During the FILTERING process several methodological steps has to be elaborated, such as imputation of data (step 3), multivariate analysis (step 4), and normalization (step 5).

For a **cyclical composite economic indicator** the EVALUTATION process is important as this is performed to judge the cyclical conformity and performance versus the reference series. This step can also be part of the data selection process for leading indicators. This includes analysis of Performance, Cyclical conformity and consistency (step 6).

During the AGGREGATION process, the most important step is the weighting and aggregation (step 7), which is regarded as a crucial step in the construction process, as the choice of weighting methods will have a large impact on the outcome of the composite indicator. It is recommended to be extra cautious when choosing methods for weighting and aggregation. An analysis of robustness and sensitivity (step 8) is an important part of this process

The PRESENTATION process will make it easy for users for follow the composite indicators and be able to analyze the results. The presentation can be done in several ways; by showing the indicator in relation to its details (step 9) or linking the indicator to other indicators (step 10). Finally, the Visualization (step 11) will be crucial for how the users interpretate the composite indicator. The steps are described in detail below.

Step 1 - A theoretical framework

To construct a composite indicator, a theoretical framework must be clearly defined of what will be measured and its sub-components. This step can take some time, as it is important to define the "scope" of the measure and who it is aimed for. To construct a leading indicator for GDP, it is important to define what input data that is the main drivers for GDP. As GDP can be compiled from either the production, user or income side, an analysis must be performed of the underlying from a theoretical point of view, to judge what framework to use. In this step, this should be done without considerations of data availability. It is also important to take into account the leading ability of the theoretical framework. Most measures for leading or coincident indicators for GDP are trying to measure GDP, and often the production approach is used as statistics for industrial production are considered a leading indicator.

Step 2 - Data selection

This step also is of high importance, as the outcome of the composite indicators will rely on the quality of the input data. It recommended searching for high quality statistics as input data to these calculations.

Suppose we want to compose an indicator that for forecasting GDP. Then each domain within GDP should be reflected in a substantial part of the calculation such as manufacturing, services and construction. The underlying measurement systems of the different components may also differ, e.g. in industry value added is measured while hours worked is the measure for services and construction is regarded as an investment. The goal is to measure total change in production for all parts of the economy, while the measures chosen has to apply to the total economy and not to specific sectors.

The possibility of disaggregating the composite indicator is an issue that has to be taken into account. To be able to do this it is necessary that the components should be able to disaggregate in

subgroups such as industry, services or different sectors. Data based on surveys are easily disaggregated while data such as investment or project started can be more difficult to disaggregate.

If the goal with the composite indicator is to measure trends, components should be chosen with which it is possible to tell whether things are increasing or decreasing. Moreover, in that case creating a time series is necessary, to be able to monitor developments. In doing so, it is important to bear in mind that indicator variables should be consistent in time. Time series that are interrupted due to a change in method must be reconciled in order to measure the cyclical movement in a correct way.

The builder of the composite indicator should also pay close attention to whether the data selected are dependent on GDP or other size-related factors. Proxy measures can be used when the desired data in unavailable. If value added is not available, production data or deliverances can be used instead. Hours worked may also be a proxy for production in some cases.

The quality of the available components could be carefully checked before choice. A discussion of strengths and weaknesses of the selected indicators is important in the documentation, to be able to follow the construction of the indicator. The indicator will never be stronger than its weakest link. Finally, the constructor should create a summary table on data characteristics and availability and type of sources.

Step 3 - Imputation of missing data

Missing data often hinder the development of robust composite indicators. The missing patterns may be missing completely at random (e.g. people who do not report income have, on average, the same income as people who report income), missing at random (e.g. income data covariates with marital status) or not missing at random (e.g. high income households are less likely to report their income).

There are three general methods for dealing with missing data; a) case deletion, b) single imputation or c) multiple imputations. Method a) simply omits the missing values while method b) and c) consider the missing data as part of analysis and try to impute values by special imputation methods. The uncertainty in the imputed data should be reflected by variance estimates. This makes it possible to take into account the effects of imputation in the analysis of data.

The possibility of outliers should also be taken into consideration as these can disturb the picture. The treatment of outliers should be fully transparent and well documented. If outliers are disturbing, they have to be treated separately. Before going on to the next stage, make sure that you have a complete data set without missing values. If imputation has been used a measure of the reliability of each imputed value should also be available. If treatment of outliers have been performed this should be discussed.

Step 4 - Multivariate analysis

In this step, an analysis of the underlying structure of the data selected is performed to judge whether these are the best available data for the intended composite indicator. These are several methods of how to perform a multivariate analysis, with are explained in the OECD handbook [13] such as Principal Component(PCA)/ Factor Analysis(FA), Cronbach Coefficient Alpha or Cluster Analysis. Take some time to have a look at the overall structure of the indicators, assess the suitability of the

[13] OECD/Eurostat Handbook (2008) p 63

data set and explain the methodological choices, e.g. weighting, aggregation, and the statistical models.

In the multivariate analysis, sub-groups of data that are statistically similar are identified and the structure of the data set are analyzed and compared to the theoretical framework.

Step 5 - Normalization of data

Normalization is required prior to any data aggregation as the indicators in the data set often have different measuring units. There are several methods for normalization available[14], which methods that are used depends on the underlying data. There are e.g. methods for cyclical indicators or percentage of annual differences.

It might be wise to recode the values so that a higher number always implies a better position and vice versa. This also makes it easier to interpret correlations and other analyses.

Step 6 - Performance, Cyclical conformity and consistency

When constructing a cyclical composite indicator with a reference series it is important to evaluate the cyclical performance versus the reference series. This is done by measuring the length of and consistency of the lead, and is measured by reflecting the time that passes between turning points in the component and reference series. For evaluation, both mean and median leads are used. The consistency of leads is measured by the standard deviation from the mean lead.

To measure cyclical conformity a cross correlation function or the average lead of the cyclical indicator is used, measured by the lag at which the closest correlation occurs. This should not be too different from the median lag of the composite leading indicator is to provide reliable information,

Step 7 - Weighting and aggregation

When used in a benchmarking framework, weights can have a significant effect on the overall composite indicator and the country rankings. A number of weighting techniques exists[15], but regarding of what method that are chosen, weights are essentially value judgments.

Most composite indicators rely on equal weighting (EW), e.g. all variables are given the same weight. This implies that all variables are “worth” the same in the composite indicator, but it also disguises the absence of a statistical or empirical basis, e.g. when there is insufficient knowledge of causal relationships etc. It should be noted that EW does not imply “no weights” but implies that the weights are equal. When using EW on data with a high correlation 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.

Aggregation methods also vary. The linear regression method is useful when all individual indicators have the same measurement unit, provided that some mathematical properties are respected. Geometric aggregations are better suited if the constructer wants some degree of non-compensability between individual indicators or dimensions.

Typically, an aggregation consists of two steps: (1) from indicators to sub-dimensions or domains; and (2) from domains to a composite index. In the second step weighting the domains is mostly a matter of personal taste or current policy making preference. For example, one could opt for

[14] OECD/Eurostat Handbook (2008) p 83
[15] OECD/Eurostat Handbook (2008) p 89

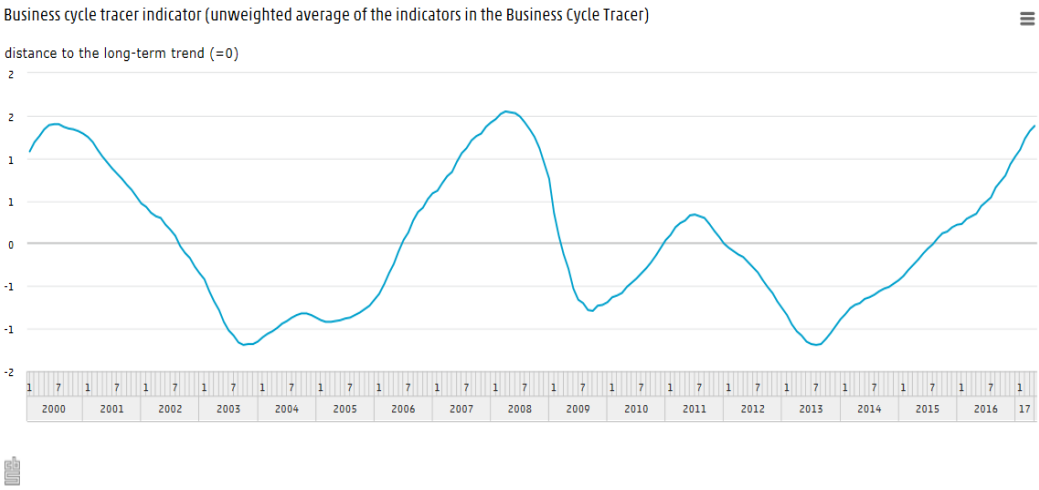
assigning equal weights to all domains if from a theoretical and/or policy perspective all domains are equally important. Also in the first step weights can be assigned. Also statistical considerations like homogeneity and the data properties play a role as well. Both steps can be combined in one analysis by using statistical software.

It should be noted that the absence of an "objective" way to determine weights and aggregation methods does not necessarily lead to rejection of the validity of composite indicators, as long as the entire process is made transparent. The objectives must be clearly stated in the outset and the chosen model must be tested to see to what extent it fulfills the modeler's goal.

Finally the selection of the appropriate weighting and aggregation procedures with reference of the theoretical framework should be presented and considerations should be made regarding the use of alternative methods, e.g. the multi-modeling principle. Correlations issues between components should be discussed as well as compensability among indicators.

Example 5-3 Netherlands – Business Cycle Tracer16

The Business Cycle Tracer indicator is the unweighted average of the indicators in the CBS Business Cycle Tracer (BCT). The indicator will be updated every month and adjusted in retrospect (end-time) based on the most recent information. The Business Cycle Tracer however shows real-time data.



Step 8 - Robustness and sensitivity analysis

Judgments are an important part of constructing composite indicators, e.g. on selection of indicators, data normalization, weighting and aggregation methods etc. The robustness of the composite indicators depends on the underlying assumptions and methods chosen. By using a combination of uncertainty and sensitivity analysis the robustness of the CEI can be gauged and transparency can be improved.

To assess uncertainties in the composite indicator, the following measures can be taken into account. a) inclusion and exclusion of individual indicators, b) modeling data error on information from variance estimates, c) use of alternative editing schemes, d) use of alternative data normalization schemes, e) use of different weighting schemes, f) use of different aggregation

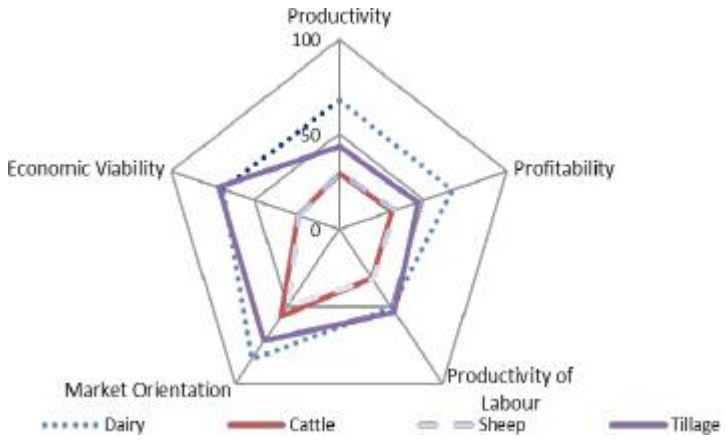
16 https://www.cbs.nl/nl-nl/achtergrond/2010/07/a-cross-sectional-approach-to-business-cycle-analysis

systems or g) use of different plausible values for the weights. The sensitivity analysis results are generally presented in terms of the sensitivity measure for each input source of uncertainty.

Step 9 - Back to the details

Composite indicators provide a starting point for analysis. They can be used as summary indicators to guide policy makes and other data users, but they can also be decomposed and the sub-components and individual indicators can be identified and analyzed. One way to do this is to use a "spider diagram" that show the stretch of the different components in the composite indicator.

Example 5-4 : Spider diagram



Source: De Gruyter : developing farm-level indicators

Step 9 Links to other indicators

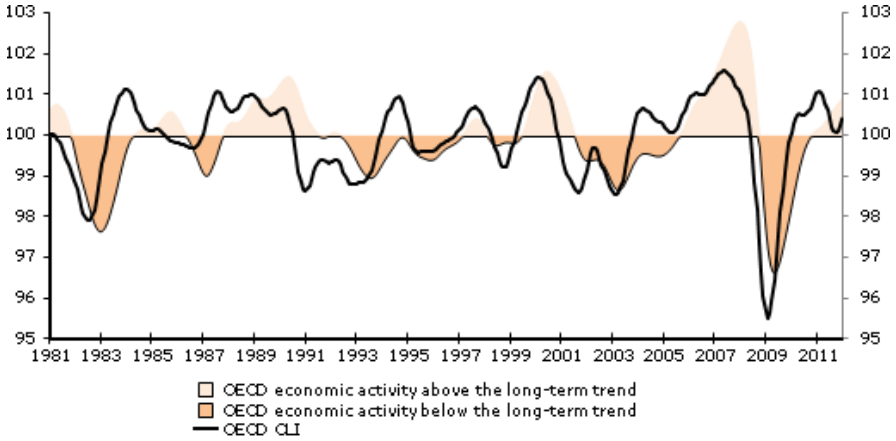
Composite indicators often measure concepts that are linked to well-known and measureable phenomena, e. g. productivity growth of entry of new firms. These correlation links are used to test the explanatory power of the composite indicator. Simple cross plots are the best way to illustrate this. Linkages can also be identified through regressions.

Step 10 Visualization of the results

Dissemination of the final indicators is very important, as this is the first meeting with the users. It is important that the presentation of the data give the correct interpretation, in a way it is about telling the true story. The presenter needs to decide, in each situation, whether to include a graph or table. The most common way to present economic composite indicators is by time series shown in a graph, which makes it possible to compare development over time. In graph 5.4 below the indicator is compared to a long-tern trend. A short video can help to explain the indicator, se link below[17]

[17] http://www.oecd.org/std/leading-indicators/compositeleadingindicatorsclifrequentlyaskedquestionsfaqs.htm

Graph 5.4 The OECD Composite Leading indicator (CLI) – relation to long-term trend



Source: OECD

There are also other ways to present the data such as bar charts, traffic lights, dashboards or comparing indicator using a cluster of countries. As users have little time to congest, the data dissemination becomes a very important issue and should be carefully considered before publication of data.

The most appropriate tool for presentation depends on the audience. A selection of visualization technique should be done that communicates the results of the composite indicator in a clear and accurate manner. There are different ways to present ECI as we have seen in the chapter.

The interaction with users [18] is important as different user groups have different expectations of presentation. The choice of communication channel can then be crucial for the interpretation of the indicators. Users can be divided by their frequency of statistical usage and proficiency. User groups are mainly;1) Specialists, i.e. statisticians, academia, specialized journalists and policy analysts and

2) Citizens or the public, i.e. people without or with limited statistical knowledge.

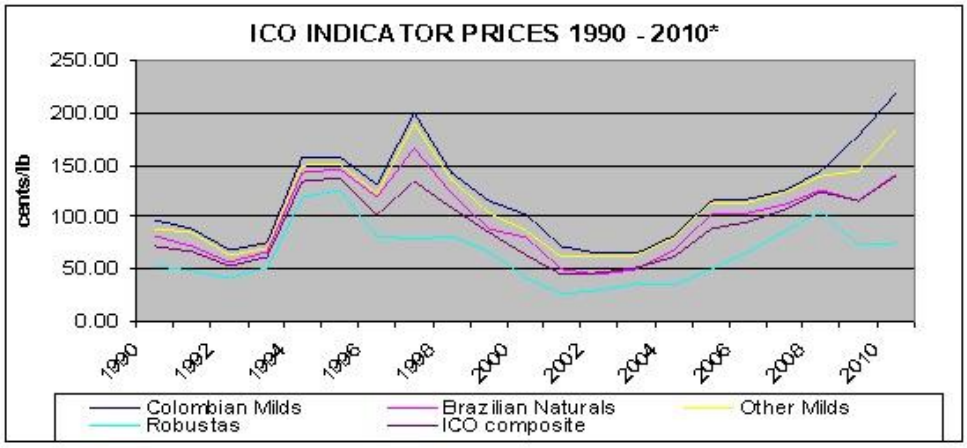
The primary interest of specialist is to receive precise and detailed information, including methodological definitions, harmonized time-series etc. while citizen's main need is high-level accessibility to the content of the indicators. Some examples of this are shown below;

The cyclical movement over time of the composite indicators is shown in the table 5.1 below. This is the main presentation form for composite economic indicators. Table 5.2 shows the values of the different components in a composite indicator and can also be presented as a scoreboard that set the values in comparison with the expected goal for each component. Finally, a dashboard – or traffic lights -, see table 5.3, show what components or indicators that are within the expected range. More examples of visualization are available in The UNECE Handbook "Making Data meaningful"[19]

[18] Towards a harmonized methodology for statistical indicators, part 2 communications through indicators p 15

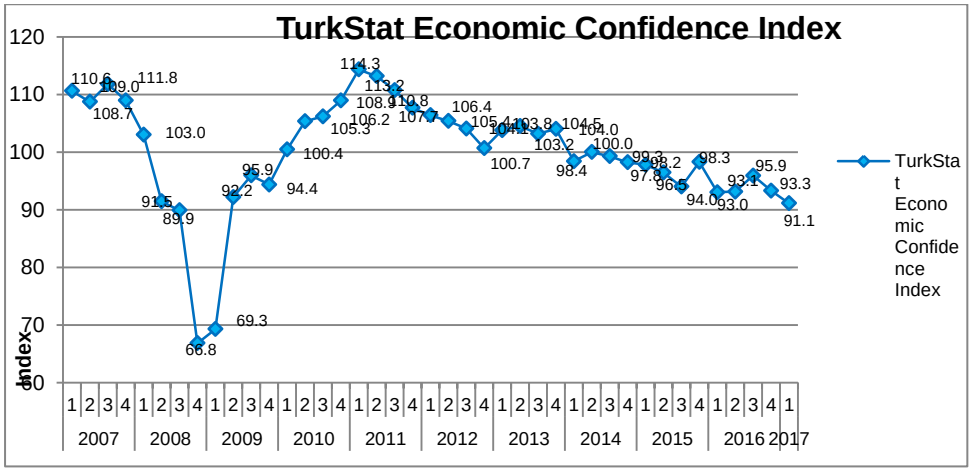
[19] UNECE, Making data meaningful" part 1-4 (2014)

Table 5.1 Graph diagram



Source: OECD

Table 5.2 Turkey Economic Confidence Index

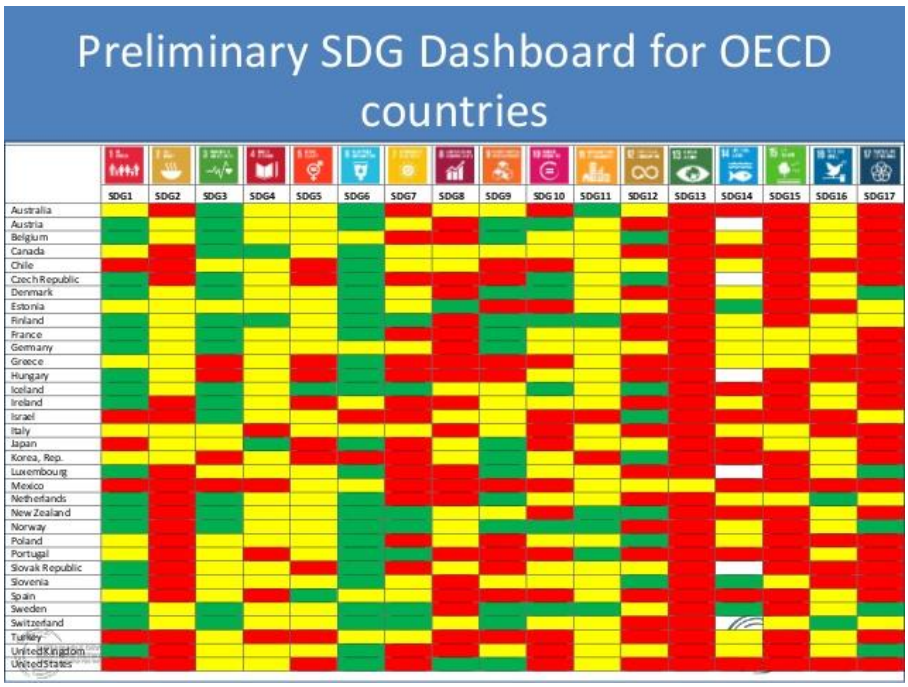


Source: TurkStat

Table 5.3 Scoreboard

Source: Eurostat

Table 5.4 Dashboard - or traffic lights



Source: UN Sustainable Development solution network

5.8 Recommendations

Recommendation 5-1:

The pros and cons for using composite economic indicators has to be carefully considered. There are many good examples of CEI in use, but there are also examples of misuse or misinterpretation. It is important to be able to set aside enough resources to develop composite economic indicators of good quality and to evaluate these on a regular basis.

Recommendation 5-2:

Construction of composite economic indicators should follow a standardized model, e.g. the OECD model or the UN/Eurostat model presented in the guide. The theoretical basis should be carefully elaborated to form the most appropriate conceptual model for the composite indicator. Data selection is important and it should be secured that the underlying data is of good quality. Weighting and aggregation may be the most crucial steps in the construction of the indicator and therefore it is of high importance to have a high methodological skill in the construction work. The choice of methods will have a large impact on the outcome of the indicator and its interpretation.

Recommendation 5-3:

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 understood, such as pictures or graphs, while more initiated users, such as analysts or researchers also need explanations of underlying data and methods used in the compilation of the indicator. Visualization must be well design to give the correct message to the audience.

References

OECD/JRC EC: Handbook on Constructing Composite indicators, Methodology and User Guide (2008) Paris

OECD system of Composite leading Indicators, (April 2012), Paris

The Conference Board: Calculating the Composite Indexes (2012)

UN Handbook of Cyclical composite indicators, draft (forthcoming) New York

UNECE,: Making data meaningful 1-4 (2014)

Eurostat manuals and guidelines; towards a harmonized methodology for statistical indicators, Part 1: Indicator typologies and terminologies (2014)

Eurostat manuals and Guidelines; Getting messages across using indicators,. A handbook on experiences from assessing Sustainable Development indicators (2014)

Eurostat Manuals and Guidelines: Towards a harmonized methodology for statistical indicators, Part 2 – Communicating through indicators (2017) Luxembourg

European Joint Research Centre; Tools for composite Indicator building (2005)

UNECE: Fundamental Principles of Official statistics (2002), Geneva

UNECE: In-depth review of leading, composite and sentiment indicators ECE/CES (2014:10)

Statistics Sweden; Quality for official statistics, a handbook (2016) Stockholm

EURONA, Eurostat Review on National Accounts and Macroeconomic indicators 2015-2, Eurostat (2015)

Hagén, Hans-Olof IS a more advanced use of IT more common in the more innovative firm? (2015) Statistics Sweden

Hagén, Hans-Olof; learning organizations matter (2010) Stockholm

Shaw. D. Industry, Infrastructure and resource Division (2009), Parliament of Canada PRB 03-15E