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Sustainability performance in the Baltic Sea Region

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ABSTRACT

The importance of sustainable development issues requires the engagement of all stakeholders in decision-making processes, as well as developing tactics and strategies. The complexity of this task increases on regional and international levels, where a huge amount of interests intersect or even contradict each other. To develop proper policy measures towards sustainability, it is essential to use appropriate performance assessment. Regardless of the existence of some macro estimation methods, vast gaps in practical use still remain. In this paper, a set of methods for assessing the sustainability performance of countries is outlined and discussed. The main advantages and weaknesses of the prevalent approaches are considered. Using available statistical data from open sources, sustainability performance assessment in countries within the Baltic Sea Region in the years 2005–2010 is carried out according to different methods and discussed, thus obtaining the profile of sustainability performance for countries in the Baltic Sea Region. The results of the calculations may be used for sharing with communities, detecting sustainability gaps in the countries' economies, substantiating national and regional sustainable development strategies, and analyzing the investment attractiveness of the given region.

1. Introduction

Over the past decades, discussion on issues of sustainable development has gained particular importance among scholars and policymakers. Citing Persson (2013, p. 301): 'since 1987, sustainable development has become a household word applied to almost everything imaginable, and today it is hard to think of any activity, area, or achievement that is not supposed to be sustainable'. Thus, most countries work out and adopt national sustainable development strategies, in which the main economic, social and environmental targets are established. In the process of drawing up and monitoring the targets, the choice of the estimation method is of vital importance because resolving problems and planning future activities is impossible without the adequate assessment of the actual state and prospects, 'unless it can be measured, it cannot be managed' (Liesen et al., 2009, p. 7). Sustainability performance assessment is essential on all levels: from individual companies and economic sectors, to macro and international systems. Regarding the latter, this appears especially crucial because sustainability issues, due to cross-territorial features, can be resolved only on the base of a transnational consensus. This implies that countries united by a common ecosystem (sea, lake, forest area) should compare and coordinate their activities in terms of sustainability improvement. However, nowadays the question of consistency between the sustainable development trends of individual countries on an international level is not always resolved well. The Baltic Sea Region is a clear example of that. Despite the existence of such recognizable leaders and pioneers of sustainable development practice as Sweden and Denmark, we can observe the simultaneously increasing problem of pollution in the region (e.g. in maritime areas).

Sustainable development has increasingly become a major priority at all levels: from global to local, even in urban planning; e.g. Hassan and Lee (2015) highlighted several studies conducted to evaluate existing sustainable development conditions in urban areas and potential strategies that can be implemented to promote the sustainability of urban neighborhoods. Other research focused on analyzing (a) the sustainability of construction projects.

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The US Green Building Council (USGBC) also developed a neighborhood development rating system called Leadership in Energy and Environmental Design for Neighborhood Development (LEED-ND) in 2009. Despite the significant contributions of the aforementioned studies and existing standards, there has been little or no documented research focused on evaluating and quantifying SD performance in urban neighborhoods that is capable of integrating the different evaluations of multiple stakeholders. Other scientists, i.e. (Horlings and Kanemasu (2015), seek SD methods that can be applied in rural areas, as this sophisticated process creates challenges for local and regional governments to facilitate development trajectories in cooperation with stakeholders.

Despite the fact that there has been a lot of research and proposed approaches, modern science has no universal method for sustainability assessment at the macro level. Some of them are still not possible to implement in practice due to the absence of appropriate statistical data; others include controversial calculation procedures. These are all reasons why research in the sphere of quantitative methods for assessing the sustainability performance of countries in a given region is still relevant.

The Baltic region, as an object for sustainability estimation, varies in a social, economic and historical context. It both consists of highly developed countries (e.g. Germany, Denmark and Sweden), new EU countries with socialist background (Poland, Estonia, Latvia, Lithuania) and countries with continuous influence of the state in social and economic spheres (e.g. Belarus and Russia). Different socio-economic positions and political systems lead to different approaches to the sustainable development challenges. Developed countries can be treated as a suitable reference point for less developed ones on their way towards sustainable development, thus emerging countries would be able to avoid some mistakes. On the other hand, less developed countries have the alternative challenge to catch up with more developed ones – economic growth. Analyzing the way how the countries of the region balance the need for economic growth with rational use of environmental and social resources is significantly important for general understanding sustainable governance on a macro level.

The purpose of this paper is to estimate the sustainability performance of countries in the Baltic Sea Region in different ways and provide a good understanding of the major drivers and weaknesses of sustainability in each country. In order to do this, we compare different methods and outline opportunities for their collaborative use for comprehensive analysis. We also estimate the sustainability performance of countries in the Baltic Sea Region according to some prevalent methods using current available statistical databases. Based on this analysis, policy recommendations can be justified. Studies covered the area of nine countries of the region: Sweden, Denmark, Finland, Germany, Poland, Estonia, Latvia, Lithuania, and Belarus. Russia was excluded from observation due to absence of specific data (belonged only to the Baltic region).[1]

The remainder of this paper proceeds as follows: the following section provides an overview of the existing methods of sustainability assessment on a macro level and their comparative analysis. In Section 3, the main empirical results of sustainability performance estimation in countries within the Baltic Sea Region by way of different methods are provided and discussed. Lastly, a summary of the main conclusions and perspectives for further studies are considered in the conclusion.

2. Review of existing methods of country sustainability assessment

The problem of sustainability assessment on levels from that of a company to that of a country or region emerged immediately after establishing a consensus regarding the definition of sustainable development in 1987 (Liesen et al., 2009). In accordance to the definition of sustainable development, environmental, societal and economic components should all be taken into account in the sustainability assessment process. Traditional macroeconomic development indicators, such as: *Gross domestic product*, *Net domestic product*, *Domestic Income*, etc., calculated since the 1930s, can be used to reflect only the economic part, and are not suitable for direct comprehensive evaluation of sustainability (WCED, 1987; Hassel et al., 2005; Bartelmus, 2008).

As a result of disputes over to what extent the economy is developing 'without compromising the ability of future generations to meet their own needs', two distinguishing directions of estimates were carried out, i.e. *strong* and *weak* sustainability (Ang et al., 2011). Supporters of strong sustainability argue the impossibility of equivalent substitution between some parts of natural and man-made, human, and social capital, and require a subset of total natural capital to be preserved in physical terms (Dietz and Neumayer, 2007). This concept includes such sustainability measurements as *The Ecological Footprint* (Wackernagel and Rees, 1997), *Material Flow Account* (Dietz and Neumayer, 2007), *Hybrid Indicators* (Hueting, 1980), and *Sustainable Value added* (Figge and Hahn, 2004a). In contrast, adherents of the weak sustainability concept assume substitution of natural capital and assert the fulfillment of a special rule: natural capital depletion can be offset by compensation from other capital forms but, in the meantime, total net capital investment in all forms is not allowed to be persistently negative (Hamilton, 1994). Such assessment methods as *Environmentally Adjusted Net Domestic Product* (Repetto and World Resources Institute, 1989), *Adjusted Net Savings* (Pearce and Atkinson, 1993), the *Genuine Progress Indicator* (Talberth et al., 2007), the *Environmental Performance Index* (Hsu et al., 2014) and some others are practical measurements of the weak sustainability concept.

The Stiglitz-Sen-Fitoussi Commission (Beachy and Zorn, 2012) distinguishes three basic groups of sustainable development indicators on a macro level:

- approaches based on **Adjusting GDP** (e.g. *the Genuine Progress*, *Indicator and Genuine Savings*, *The Fleurbaey/Gaulier Indicator*);
- **Composite Indexes**: combining other indicators with GDP (e.g. *the Well Being Index, Human Development Index*, *Quality of Development Index*, *Regional Quality of Development Index*);
- **Subjective well-being measures** (Gross National Happiness, Happy Life Expectancy, Happy Planet Index).

For the assessment of numerous sustainability indicators, accounting systems were constructed (analogously *the System of National Accounts*). Here, we can mention the *System of Economic Environmental Accounts* (*SEEA*), the *National Accounting Matrix including Environmental Accounts* (*NAMEA*), and the *System of Economic and Social Accounting* (*SESAME*) (http://unstats.un.org/unsd/envaccounting/seearev/; Schaltegger and Burritt, 2000). Despite increasing attention to these systems and continuous improvements, substantial data collection problems remain.

In this short review we try to briefly describe the most widespread and popular methods. It is essential to note that we consider only those approaches that contain, at least indirectly, every (economic, social and environmental) dimension of sustainable development. Therefore, such methods of strong sustainability as *The Ecological Footprint*, *Material Flow Account* or *Hybrid Indica-*

[1] Macro-statistics of the Russian Federation is available, however, as the country has a huge territory with extremely various environmental (e.g. climatic) features in different areas, data was omitted as irrelevant for the specific estimation of the Baltic region.

tors, which do not encompass economic dimension, are outside of the focus of this paper.

In 1993 the System of Environmental-Economic Accounting (SEEA) was prepared in the framework of the United Nations Statistical Commission (Harris and Roach, 2013) as an addition to the System of National Accounts (SNA). It allows for the integration of environmental and economic statistics on a basis of correcting traditional economic indicators to include environmental components. One of the main indicators of SEEA is the *Environmentally Adjusted Net Domestic Product* (EDP), which can be formulated as:

$$EDP = NDP - DPNA - DGNA \quad (1)$$

where NDP – net domestic product, DPNA – assessment of natural resource depletion; DGNA – assessment of environmental degradation.

EDP reflects net domestic product taking natural capital depreciation into account in monetary terms (Pearce and Atkinson, 1993).

The World Bank suggests its version of the adjusted macro economic growth indicator, i.e. *Adjusted Net National Income* (ANNI), which is determined as the Gross National Income minus the consumption of fixed capital and natural resource depletion (http://data.worldbank.org/indicator/NY.ADJ.NNTY.KD). The following components are considered as natural resource depletion: energy depletion, mineral depletion, net forest depletion, carbon dioxide and particulate emission damage. A practical advantage of ANNI in comparison with EDP is the existence of an updated database for more than 150 countries on the World Bank site.

Similarly to *Net Savings* in the SNA, the World Bank has developed *Adjusted Net Savings* (ANS), which show 'the true rate of savings in an economy after taking into account investments in human capital, the depletion of natural resources and damage caused by pollution' (http://data.worldbank.org/indicator/NY.ADJ.SVNG.GN.ZS) and can be calculated as:

$$ANS = (GDS - DFC) + EDE - DPNR - DMP \quad (2)$$

where GDS – Gross Domestic Savings; DFC – Depreciation of fixed capital; EDE – Education Expenditure; DPNR – Depletion of Natural Resources; DMP – Pollution damage. DPNR and DMP are the same as in the ANNI approach.

EDP and ANS methods seem a bit restricted in terms of sustainability measurements due to difficulties in the adequate assessment of all potential environmental damage, such as climate change and loss of biodiversity.

Another alternative for the sustainability assessment of a country is the *Genuine Progress Indicator* (GPI), calculated as an alternative to GDP. The GPI is an updated version of the Index of Sustainable Economic Welfare first designed by Daly and Cobb (1989). In contrast to GDP, where all economic activities are reflected positively in the value, activities which have a negative impact on welfare (for instance, the cost of crime, the value of lost wetlands and forests, the costs of pollution) factor negatively in the GPI. In addition to this, GPI includes the values of some goods and services which are not accounted for in the GDP but increase social welfare, for example the market value of unpaid household labor and parenting, the value of volunteer work, etc. (Talberth et al., 2007). Difficulties in applying the GPI method are connected with the reliability of statistical data and the complicated process of collecting information.

A sizeable body of literature is devoted to the sustainability assessment of a country based on calculations involving integral indices. Here we can mention such well-known indexes as the *Environmental Performance Index*, *Human Development Index and Better Life Index*.

The *Environmental Performance Index* (EPI) evaluates country sustainability in line with two dimensions: environmental health and ecosystem vitality (Hsu et al., 2014, p. 18). Each of these dimensions is, in turn, considered by means of some policy categories or issues (for example ecosystem vitality includes such directions as *climate* & *energy*, *water resources*, *biodiversity* & *habitat*, *forests*, etc.). Every issue is evaluated by specific indicators; for instance the category of *climate* & *energy* contains three indicators, i.e.: *trend in* CO^2 *emissions*, *change of trend in carbon intensity*, *trend in carbon intensity*. All of these indicators have weights determined based on expert judgments on 'the quality of the underlying dataset, as well as the relevance or fit of the indicator to assess the policy issue' (Hsu et al., 2014, p. 19). Using established high and low performance benchmarks, proximity-to-target methodology and assigned weightings at every level, EPI is constructed (Hsu et al., 2013, p. 55). This index has a very strong environmental direction of sustainability assessment, whereas economic and societal dimensions are estimated in an indirect form (e.g. such indicators as access to sanitation, child mortality, on the one hand, and SO_2 emissions per GDP on the other, can only partially be used as social and economic factors of sustainability, respectively).

The *Human Development Index* (HDI), designed by Mahbubul Haq and Amartya Sen in 1990, contains three components of well-being: *health*, *education*, and *living standards* (Human Development Report, 2013). The *health* dimension is evaluated by the index of life expectancy at birth, *education* is estimated by way of mean years of schooling and expected years of schooling indices, and *living standards* are expressed by the income (gross national income per capita) index. The HDI is quite a widespread indicator used for assessing social welfare, but at the same time it does not reflect the environmental dimension of sustainability explicitly, as only life expectancy can be considered an indirect result of the state of the environment.

The *Better Life Index* (BLI) designed by the Organization for Economic Cooperation and Development (OECD) is an attempt at assessing sustainability comprehensively. The BLI estimates individual well-being as a 'complex function of numerous variables' (Harris and Roach, 2013, p. 185). The index consists of 11 dimensions which can be divided into the three components of sustainability:

- economic (income);
- social (housing, jobs, community, education, health, civic engagement, life satisfaction, safety, work-life balance);
- environmental (How's life?, 2014).

Each dimension includes specific indicators which are calculated in different ways, including surveys and expert assessment. The amounts of all indicators are normalised across countries into a score ranging from 0 to 10 (http://data.worldbank.org/indicator/NY.ADJ.NNTY.KD, p. 186). The BLI is constructed taking all these dimensions into account. The basic approach implies using an equal weigh for each dimension. Despite seeming complete, the BLI method has obvious restrictions, mainly such as the difficulty or even impossibility of data collection (as few as a little over 35 countries, as OECD members, are available for comparison via data from the OECD database) and subjectivism of assessment (regarding the weights of dimensions or some indicators, e.g. people's satisfaction with their local environment, evaluation of overall health status).

The *Sustainable Value* (SV) approach was developed by Figge, Hahn, Liesen (Ding, 2005; Figge and Hahn, 2004a,c) and used widely on a corporate level (Barkemeyer et al., 2011; ADVANCE, 2006; Hahn et al., 2013, 2010). This approach implies the calculation and analysis of opportunity costs in terms of sustainable development, i.e. the approach 'assesses not just the use of economic capital but also environmental and social resources' (Barkemeyer et al., 2011, p. 6). The choice of factors depends on the availability of data, but in most studies applicants use such indicators for each dimension as: quantities of CO_2, NO_x, SO_x emissions, waste generation (environmental direction); number of employees and work accidents, absolute levels of voluntary and involuntary unemployment (social direction); or gross capital stock (economic direction) (Ang et al., 2011; Figge and Hahn, 2005c; ADVANCE, 2006). The approach is relative and allows the company's contribution to sustainability to be determined in comparison with the benchmark and other entities in monetary terms (Baumgartner, 2008, p. 3). According to Figge and Hahn (Figge and Hahn, 2004a,c; Figge and Hahn, 2004a), calculating sustainable value includes some stages, such as the assessment of resource efficiency for the considered companies and the benchmark, defining opportunity costs and value contributions, and determining sustainable value and benefit-cost ratios (e.g. Barkemeyer et al., 2011; ADVANCE, 2006). Sustainable value in absolute units shows how much value an entity creates (if the value of the indicator is more than 0) or destroys (if it is less than 0) in terms of sustainability. A detailed description of the method and the proposed directions of its development will be presented in the next section.

Specific features determined for comparative sustainability assessment in countries of the Baltic Sea Region are presented in Manzhynski et al. (2015). The methodology involves the following stages:

a Preparing for assessment (*choice of objects*, *choice of benchmark*, *defining resources*, *return figure and time scale under consideration*). In Manzhynski et al. (2015), the authors employ the following indicators of the use of natural, social and economic capital (according to existing comparable and available national statistical data):

– *environmental*:

CO2 emissions, thousands t,
SOx emissions, thousands t,
NOx emissions, thousands t,
Waste generation, thousands t,
Water use, millions m^3,
Non-methane volatile organic compound (NMVOC) emissions, thousands t;

– *social*:

Accidents at work by days lost, thousands of man-days,
Number of employed, thousands of people;

– *economic*:

Net capital stock at 2005 prices, billion euro.
As a benchmark regional average indicators were used.

- Data mining (to collect data on the use of resources for EU countries we use official internet statistical databases 'Eurostat' (http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home) and AMECO (AMECO, 2014) and official statistical data of the World Bank (http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.KD). For Belarus, the authors (Manzhynski et al., 2015) use the site of the National Statistical Committee of the Republic of Belarus (http://belstat.gov.by);
- Calculating sustainable value

The calculation process includes some steps.

(A) *Defining resource efficiencies for countries.* This can be calculated from the following formula:

$$e_{ij}^{t} = \frac{GDP_{j}^{t}}{u_{ij}^{t}}, \tag{3}$$

where e_{ij}^{t} – efficiency of resource i use in country j in the year t; GDP_j – GDP of country j in the year t; u_{ij}^{t} –resource i use in country j in the year t.

- *Determining benchmark resource efficiency*. Likewise, in Manzhynski et al. (2015) we use averages in the region as the benchmark efficiency of resource i use in the year t (eb_i^t) can be defined as:

$$eb_{i}^{t} = \sum_{j} \frac{GDP_{j}^{t}}{u_{ij}^{t}}. \tag{4}$$

- *Calculating opportunity costs*. Opportunity costs show how much return would be created if the resources were used not by the country's economy, but by the benchmark (ADVANCE, 2006, p. 17). So opportunity costs for resource i of country j in the year t (oc_{ij}^{t}) can be calculated as:

$$oc_{ij}^{t} = eb_{i}^{t} \times u_{ij}^{t}. \tag{5}$$

- *Determining value contributions*. On the base of opportunity costs and the GDP of each country, the contribution of each resource in SV in each year can be calculated as:

$$C_{ij}^{t} = GDP_{i}^{t} \times oc_{ij}^{t}, \tag{6}$$

where C_{ij}^{t} – the contribution of resource i in the sustainable value of country j in the year t.

- *Defining SV*. This indicator is calculated as an average of all contributions for a specific country:

$$SV_{j}^{t} = \frac{\sum_{i} C_{ij}^{t}}{n}, \tag{7}$$

where SV_j^t – sustainable value of country j in the year t, n – the quantity of considered resources.

Using the summary from Kuosmanen and Kuosmanen (2009), we can present another formula for calculating SV that will be used by us further in the paper, but which does not contradict the logic described above:

$$SV_{j}^{t} = \frac{1}{n} \sum_{i=1}^{n} \left(\left(\frac{GDP_{j}^{t}}{u_{ij}^{t}} - \frac{GDP_{b}^{t}}{u_{ib}^{t}} \right) u_{ij}^{t} \right) \tag{8}$$

where GDP_b^t – the return of the benchmark (in our case GDP of the benchmark), u_{ib}^{t} – resource i use of the benchmark in the year t. If the benchmark is an average level, then GDP_b^t and u_{ib}^{t} are defined as the average amount of GDP and resource i use in a region respectively.

- Taking economy size into account

SV, similarly to GDP, depends on the size of the economy. In order to compare different countries the size of the nation's economy should be taken into account (Baumgartner, 2008; Manzhynski et al., 2015). Thus we suggest using:

– *SV per capita*, which reflects the amount of SV created by one citizen of a country;

– *Benefit-cost ratios* which are determined by dividing the country's GDP by the opportunity costs of the each resource use:

$$bcr_{ij}^{t} = \frac{GDP_{j}^{t}}{oc_{ij}^{t}} \tag{9}$$

where bcr_{ij}^{t} – benefit-cost ratio for resource *i* in the year *t* for country *j*;

– the *Return to Cost Ratio* (RCR):

$$RCR_{j}^{t} = \frac{GDP_{j}^{t}}{GDP_{j}^{t} - SV_{j}^{t}} \tag{10}$$

where RCR_{j}^{t} – the RCR for country *j* in the year *t*.

Unfortunately, in the practical sustainability assessment of a specific object (the Baltic Sea countries) we had to exclude some of the described approaches which proved impossible to use due to a significant shortage or absence of relevant statistical data from further consideration. For example, the GPI method appears to be the most comprehensive and balanced in terms of adjusting components for GDP corrections (Center for Sustainable Economy, 2012), but currently there are huge gaps in statistics that make the actual calculations impossible. Nevertheless, this does not mean that these excluded approaches are not suitable in general, or cannot be applied in the future.

As a result of the above, methods of country sustainability performance such as: ANNI, ANS, EPI, HDI and SV were examined more thoroughly. Each of the mentioned methods allows different aspects of sustainable development to be compared due to the existence of available statistical data from reliable sources. Only the SV approach requires a separate clause because its use implies a self-dependent choice of sustainability factors, and thus the search for appropriate statistics. But as we demonstrate below, the SV method can be implemented successfully using selected data.

In Table 1, the comparative characteristics of the considered methods are outlined. The presented directions for comparisons were defined on the base of our understanding of the requirements for the practical sustainability assessment of countries.

First of all, an essential feature are the units used for assessment. In our opinion, monetary terms, which were factored in the ANNI and SV methods, are the most suitable as they are easy to understand for potential target groups: communities, governments and especially investors. Monetary units are also easier to apply in further research, e.g. modeling, forecasting.

The issue of the choice of units for input data (resources use) in sustainability assessment is valuable as well. However, due to the controversial monetary valuation of natural and social capital, the use of monetary units for input is not advisable; this could be considered an additional contradictory point and thus decrease the objectiveness of calculations. In this regard, the SV method trait involving the use of natural units is certainly of great advantage, whereas monetary units for natural capital use in ANNI and ANS can lead to reasonable doubts and criticism. The use of non-monetary units for natural and social capital applied in EPI and HDI enhances their confidence but, simultaneously, requires an aggregation procedure for index composition, where some traps and weaknesses are hidden.

Secondly, the assessment should include all sustainability dimensions without biases with respect to any of them, thus the balance of sustainability dimensions is a focus of our considerations. Among the considered approaches, some of them (ANNI, ANS, EPI) strongly favor the environmental dimension, whereas HDI, on the contrary, is directed at social welfare assessment. Due to the absence of a 'standard' form of the SV approach, the use and profile of this method depend on the user's choice and data availability.

Thirdly, the existence of available and reliable initial information is vital for operative and independent sustainability assessment. As we mentioned above, all methods presented in Table 1 have international statistical databases, which makes their practical application possible.

The Fourth important trait of the calculation procedure is the possibility of carrying out separate calculations for a specific country, though division into individual countries is not always desirable. On the one hand, the detached calculation of performance for a given country (in ANNI, ANS and HDI) allows preliminary research and provides advantages for decision makers (for example thanks to independence from data on other countries). On the other hand, mutual relative assessment realized in EPI and SV (e.g. if we use an average regional amount as the benchmark) allows the region to be considered as an organic whole, which better conforms to the concept of sustainable development, e.g. due to externalities.

Fifth is the possibility of reaching a final conclusion by answering the 'Yes/No question' (Figge and Hahn, 2004a): 'Does the country conform to the sustainable development trend?' An important advantage of the SV method is the opportunity to detect if the country improves or decreases sustainability (Figge and Hahn, 2004b). Theoretically, we can assign, for example, a minimum level to the value of the final indicator in other methods, but the prospects and conditions of such an assignment procedure are very vague, and its potential disputable. Therefore, in the case of all methods besides SV, we can only estimate the dynamics indicators in time or in comparison with other countries.

Another important element in developing a deep understanding of the ongoing processes of social, environmental and economic capital use is how we can examine alternative ways of development. The specific features of the EPI and especially SV approaches give opportunities to explore and compare alternatives for different ways of using the available resources (e.g. via opportunity costs in the SV method), and on the base of them, to detect directions for further improvements. In the case of ANNI and ANS, this is problematic due to only monetized valuations of natural capital depletion being openly available.

To eliminate biases, controversy and discrepancies in calculations and conclusions, the level of subjectivism in the method used should be minimized; thus bottlenecks stemming from subjectivism (during calculations) are considered. The distinguishing features of EPI and HDI, as composite index methods, are potential subjective weighting and aggregation procedures. As had been mentioned, ANNI and ANI have complex and ambiguous valuation processes regarding natural capital depletion. The SV approach can also be characterized by biases. Generally speaking, this method is built on the subjective view of the researcher who selects the resource use of capital indicators and the benchmark. The recommendation in this case is determining an average level or external international targets as the benchmark, thus the benchmark is defined independent of the researcher. To eliminate biases in input data we can use all available macro data appropriated for the assessment of sustainability dimensions with the exception of double account.

The short overview of the existing methods in the sphere of the sustainability assessment of a country shows that every method has its advantages and weaknesses and, so far, there is no single, universal and conventional approach. At the same time, the benefits and advantages of the SV approach revealed here encourage the implementation of this method in practice. The next sections aim to demonstrate and attempt to prove additional benefits that can be gained when using the SV approach.

Table 1
Comparative characteristics of different methods for the sustainability assessment of countries.

Characteristic	Method				
	Adjusted Net National Income	Adjusted Net Savings	Environmental Performance Index	Human Development Index	Sustainable Value
Units of the outcome indicator	Monetary terms	Non-monetary terms, but possible to express in monetary ones	Non-monetary terms (dimensionless parameter)	Non-monetary terms (dimensionless parameter)	Monetary terms
Units of environmental and social resource use	Monetary terms	Monetary terms	Non-monetary terms (in normalised units)	The use of environmental resources is not valuated in a direct way. The use of social resources is estimated via non-monetary terms	Physical terms (it allows information on the use of resources not to be distorted by controversial pricing assessment)
The balance of sustainability dimensions	Relies more heavily on environmental factors	Strong focus on environmental factors	Strong focus on environmental factors	Strong focus on social welfare (lack of environmental dimension of sustainability)	Depends on the choice of factors. There is a possibility of balanced measurements
Current data availability (the possibility of online calculation)	Available and easily accessible (from the official site of the World Bank)	Available and easily accessible (from the official site of the World Bank)	Available and easily accessible (from the official site of the approach)	Available and easily accessible (from the official site of the United Nations Development Programme)	Depends on the factors choice. It could use existing countries statistic database (e.g. Eurostat)
The possibility of detached calculation for an individual -country and then, cross-country comparisons	Possible	Possible	Impossible; the method implies relative ranging procedures	Possible	Possible if the benchmark does not depend on the performance of other; countries; otherwise impossible.
The possibility of a 'Yes/No' answer regarding sustainable development	No (we can assess dynamics in time or in comparison with other countries)	No (we can assess dynamics in time or in comparison with other countries)	No (we can assess dynamics in time or in comparison with other countries)	No (we can assess dynamics in time or in comparison with other countries)	Yes (we can detect if the country decreased or develops sustainability in a region)
The analysis of alternative ways of using resources	Very difficult to fulfill (in reality we can only determine the actual way resources are used)	Very difficult to fulfill (in reality we can only determine the actual way resources are used)	Partly (by way of the proximity-to-target methodology we can estimate the 'distance to target' for each resource separately, but we cannot estimate the alternative in monetary terms)	Very difficult to fulfill (in reality we can only determine the actual way resources are used)	Yes (we can define alternative or opportunity costs of the use)
Bottlenecks connected with subjectivism (during calculations)	Controversial monetary valuation of natural capital depletion and environmental damage	Controversial monetary valuation of natural capital depletion and environmental damage	Weighting and aggregation procedures; the choice of targets	Weighting and aggregation procedures	The choice of targets (benchmarks), resources (factors) and objects (countries)

3. Main results – the sustainability profile of countries in the baltic sea region

To estimate the sustainability performance of countries in the Baltic Sea Region we used all methods which enable such an analysis based on open statistic sources and described in Section 1 (see Table 1). The following sources were employed for the individual methods:

– for ANNI and ANS – database from the official website of the World Bank (http://data.worldbank.org/indicator/NY.ADJ.SVNG.GN.ZS; http://data.worldbank.org/indicator/NY.ADJ.NNTY.KD);
– for EPI – index statistics from the method site (http://epi.yale.edu/);
– for HDI – database from the official site of the United Nations Development Programme (https://data.undp.org/dataset/Human-Development-Index-HDI-value/8ruz-shxu).

Data collecting input information applied when using the SV approach was described in Section 1.

The dynamics of sustainability performance of countries in the Baltic Sea Region according to the ANNI, ANS, EPI, HDI and SV approaches in the years 2005–2010 and their respective rates of growth have been provided in Table 2. When accounting for the size of the economy, we present ANNI and SV per capita.

As we can see from Table 2, the best sustainability performance results based on the majority of methods were, as can be expected, noted for Germany, Finland and Scandinavian countries (Denmark and Sweden), while Belarus, Latvia and Lithuania ranked lowest. At the same time, there were some exceptions to this. For example, the leading position of Belarus was noted in the share of adjusted net savings. In 2005–2010 only Sweden was found to be comparable to Belarus regarding the magnitude of ANS. However, due to humble amounts of GNI (e.g. in comparison with Germany or Denmark) the relatively high percent of ANS in Belarus does translate to high absolute amounts of savings directed to development (even per capita). For all countries in the region, 2009 was a failed year in

Table 2
Sustainability performance dynamics of countries in the Baltic Sea Region in 2005–2010 (according to ANNI, ANS, EPI and HDI approaches).

year	Belarus		Denmark		Estonia		Finland		Germany		Latvia		Lithuania		Poland		Sweden	
	amount	growth rate, %	amount	growth rate, %	amount	growth rate, %	amount	growth rate, %	amount	growth rate, %	amount	growth rate, %	amount	growth rate, %	amount	growth rate, %	amount	growth rate, %
Adjusted Net National Income (ANNI) per capita, US $ in prices 2005																		
2005	2696	–	39 341	–	8 643	–	31 654	–	28 924	–	5 725	–	6 684	–	6 680	–	36 172	–
2006	3067	13.75	40 804	3.72	9 558	10.59	32 720	3.37	30 261	4.62	6 426	12.24	7 223	8.07	7 040	5.38	37 721	4.28
2007	3283	7.06	40 833	0.07	10 384	8.64	33 929	3.69	31 218	3.16	7 623	18.62	8 009	10.88	7 552	7.28	39 287	4.15
2008	3840	16.97	40 052	−1.91	9 920	−4.47	33 423	−1.49	31 084	−0.43	7 442	−2.37	8 521	6.39	8 058	6.70	38 925	−0.92
2009	3603	−6.18	37 639	−6.02	8 417	−15.15	30 697	−8.16	30 216	−2.79	6 444	−13.41	7 337	−13.89	8 245	2.32	35 708	−8.26
2010	3831	6.33	39 562	5.11	8 243	−2.07	31 541	2.75	31 284	3.54	6 155	−4.48	7 468	1.79	8 464	2.66	37 932	6.23
Adjusted Net Savings (ANS).% of GNI																		
2005	19.44	–	13.83	–	15.13	–	15.42	–	10.98	–	7.07	–	8.55	–	6.99	–	18.83	–
2006	18.36	−5.58	14.10	1.97	15.12	−0.03	15.82	2.60	13.34	21.50	4.03	−43.01	7.67	−10.34	7.11	1.74	20.08	6.66
2007	17.03	−7.21	13.19	−6.50	15.10	−0.11	16.99	7.38	15.52	16.32	7.99	98.22	8.57	11.74	9.20	29.33	21.67	7.90
2008	18.77	10.23	11.90	−9.77	13.07	−13.47	14.93	−12.11	14.10	−9.19	7.44	−6.95	5.79	−32.48	9.11	−1.04	21.13	−2.48
2009	13.70	−27.02	8.85	−25.61	10.97	−16.09	9.77	−34.57	10.71	−24.02	13.24	78.09	5.50	−4.98	9.17	0.66	15.62	−26.09
2010	14.23	3.86	12.11	36.78	10.96	−0.09	10.09	3.29	12.40	15.75	11.09	−16.23	9.30	69.14	8.67	−5.36	17.94	14.86
Environmental Performance Index (EPI)																		
2005	66.29	–	75.56	–	67.52	–	75.89	–	78.73	–	62.39	–	58.81	–	67.80	–	77.46	–
2006	65.74	−0.83	75.61	0.07	69.40	2.78	76.03	0.18	78.72	−0.01	62.30	−0.14	58.54	−0.46	67.80	0.00	77.48	0.03
2007	65.95	0.32	75.96	0.46	72.88	5.01	75.78	−0.33	79.06	0.43	62.33	0.05	58.85	0.53	68.12	0.47	77.47	−0.01
2008	67.14	1.80	76.53	0.75	73.12	0.33	75.81	0.04	80.41	1.71	62.93	0.96	60.27	2.41	69.32	1.76	77.69	0.28
2009	68.11	1.44	76.87	0.44	73.47	0.48	75.86	0.07	80.60	0.24	63.43	0.79	61.02	1.24	69.55	0.33	77.94	0.32
2010	67.58	−0.78	77.03	0.21	73.60	0.18	75.92	0.08	80.76	0.20	63.49	0.09	60.88	−0.23	69.70	0.22	77.93	−0.01
Human Development Index (HDI)																		
2005	0.730	–	0.893	–	0.830	–	0.882	–	0.901	–	0.792	–	0.802	–	0.798	–	0.905	–
2006	0.743	1.78	0.895	0.22	0.836	0.72	0.886	0.45	0.905	0.44	0.800	1.01	0.806	0.50	0.802	0.50	0.907	0.22
2007	0.756	1.75	0.898	0.34	0.841	0.60	0.890	0.45	0.907	0.22	0.808	1.00	0.810	0.50	0.806	0.50	0.909	0.22
2008	0.768	1.59	0.898	0.00	0.842	0.12	0.891	0.11	0.909	0.22	0.812	0.50	0.813	0.37	0.811	0.62	0.910	0.11
2009	0.780	1.56	0.897	−0.11	0.837	−0.59	0.886	−0.56	0.914	0.55	0.806	−0.74	0.809	−0.49	0.813	0.25	0.907	−0.33
2010	0.785	0.64	0.899	0.22	0.839	0.24	0.890	0.45	0.916	0.22	0.805	−0.12	0.810	0.12	0.817	0.49	0.913	0.66
Sustainable Value (SV) per capita. US $ in prices 2005																		
2005	−16145	–	3411	–	−25125	–	−6916	–	7210	–	−5202	–	−2190	–	−10466	–	3422	–
2006	−17298	7.14	3080	−9.72	−23188	−7.71	−8247	19.24	7461	3.48	−3951	−24.05	−1539	−29.75	−10648	1.74	3179	−7.10
2007	−17983	3.96	2258	−26.67	−28703	23.78	−8682	5.27	7522	0.82	−4590	16.17	−1016	−33.94	−10271	−3.53	3261	2.57
2008	−18167	1.02	3335	47.67	−29341	2.22	−8594	−1.01	7255	−3.54	−5001	8.95	288	−128.38	−9917	−3.45	3436	5.35
2009	−17715	−2.49	3541	6.20	−27212	−7.26	−10028	16.68	7040	−2.96	−6145	22.89	−1558	−640.31	−8767	−11.60	1601	−53.40
2010	−14398	−18.72	3520	−0.61	−33396	22.73	−11471	14.40	7419	5.38	−7384	20.15	−2451	57.30	−9826	12.09	1944	21.42

Table 3
Dynamics of the share of ANNI in NNI for countries in the Baltic Sea Region in 2005–2010.

Year	Belarus	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Sweden
2005	95.64	96.07	98.24	99.59	99.21	96.55	98.49	97.11	99.48
2006	96.07	96.16	98.45	99.53	99.23	96.51	98.55	96.87	99.40
2007	96.59	96.31	98.27	99.50	99.20	96.60	98.54	96.99	99.22
2008	96.76	95.42	98.19	99.55	99.17	97.42	98.78	96.59	99.26
2009	97.37	97.64	98.75	99.64	99.37	97.68	99.03	97.96	99.59
2010	97.09	97.47	97.72	99.54	99.40	97.34	98.80	97.50	99.26

Table 4
Dynamics of the Return to Cost Ratio (RCR) of countries in the Baltic Sea Region in 2005–2010 (according to the SV approach).

Year	Belarus	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Sweden
2005	0.349	1.115	0.397	0.816	1.302	0.720	0.869	0.568	1.117
2006	0.357	1.099	0.440	0.795	1.300	0.793	0.912	0.579	1.103
2007	0.368	1.070	0.406	0.794	1.291	0.786	0.946	0.604	1.103
2008	0.389	1.108	0.391	0.796	1.273	0.765	1.016	0.624	1.111
2009	0.396	1.124	0.373	0.752	1.280	0.688	0.911	0.656	1.052
2010	0.465	1.122	0.332	0.732	1.284	0.652	0.871	0.637	1.060

Table 5
Country sustainability profile of the Baltic Sea Region in 2005–2010 (ranking).

Year	Belarus	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Sweden
Adjusted Net National Income (ANNI) (based on ANNI per capita)									
2005	9	1	5	3	4	8	6	7	2
2006	9	1	5	3	4	8	6	7	2
2007	9	1	5	3	4	7	6	8	2
2008	9	1	5	3	4	8	6	7	2
2009	9	1	5	3	4	8	7	6	2
2010	9	1	6	3	4	8	7	5	2
Adjusted Net Savings (ANS)									
2005	1	5	4	3	6	8	7	9	2
2006	2	5	4	3	6	9	7	8	1
2007	2	6	5	3	4	9	8	7	1
2008	2	6	5	3	4	8	9	7	1
2009	2	8	4	6	5	3	9	7	1
2010	2	4	6	7	3	5	8	9	1
Environmental Performance Index (EPI)									
2005	7	4	6	3	1	8	9	5	2
2006	7	4	5	3	1	8	9	6	2
2007	7	3	5	4	1	8	9	6	2
2008	7	3	5	4	1	8	9	6	2
2009	7	3	5	4	1	8	9	6	2
2010	7	3	5	4	1	8	9	6	2
Human Development Index (HDI)									
2005	9	3	5	4	2	8	6	7	1
2006	9	3	5	4	2	8	6	7	1
2007	9	3	5	4	2	7	6	8	1
2008	9	3	5	4	2	7	6	8	1
2009	9	3	5	4	1	8	7	6	2
2010	9	3	5	4	1	8	7	6	2
Sustainable Value (SV) (based on RCR)									
2005	9	2	8	5	1	6	4	7	3
2006	9	2	8	5	1	6	4	7	3
2007	9	3	8	5	1	6	4	7	2
2008	9	2	8	5	1	6	4	7	3
2009	9	2	8	5	1	6	4	7	3
2010	8	2	9	5	1	6	4	7	3

terms of ANNI, ANS and partially HDI, which is easy to explain by the world economic crisis.

It is important to note that the amount of ANNI correlates with Net National Income (NNI) very strongly; moreover, when looking at data in Table 3, we can argue that ANNI is almost completely determined by NNI dynamics, which is explained by the insignificant magnitude of natural resource depletion estimates. The latter does not appear to be a very objective assessment of natural capital use and loss in line with the sustainable development concept.

All countries of the region increased their amounts of EPI and HDI in 2010 as compared to 2005, which indicates the enhancement of both social and environmental welfare in the region according to these approaches. Furthermore, taking into account the relativeness of EPI, we can assume increasing sustainability performance and attractiveness of the Baltic Sea Region in comparison to the 'rest of the world'.

This brings us to the results of applying the SV method. Based on the methodology presented above, we assessed the sustainability performance of countries in the Baltic Sea Region by means of the SV method indicators in 2005–2010. In Tables 2 and 4, the dynamics of sustainable value per capita (US dollars per capita) and RCR of each country of the Baltic Sea Region in 2005–2010 are presented. As we can see from the charts, only three countries in the region (Germany, Denmark and Sweden) displayed positive sustainable

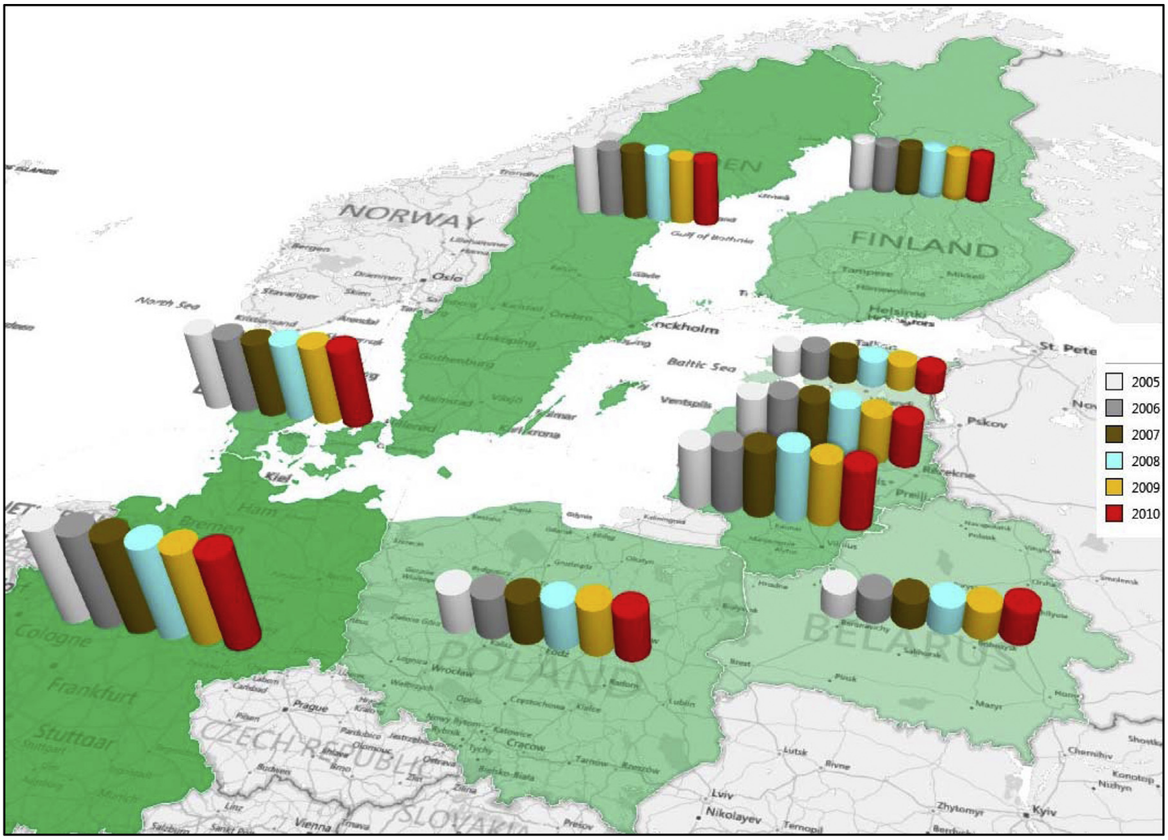

Fig. 1. Return to cost ratio for the Baltic region 2005–2010.

value in 2005–2010; other countries were characterized by a negative contribution to the relative sustainability of the region. Based on our calculations, Germany had the best relative sustainability performance, because of the highest RCR. Denmark and Sweden were also the drivers of sustainability.

According to relative sustainability performance indicators, the obvious laggards in the region are Belarus and Estonia. They have the worst positions among the analyzed countries, but vary in terms of development trends. While Estonia decreased sustainability performance continuously in 2006–2010, Belarus improved its sustainability indicators, though without leaving the 'negative' zone. It is important that these results be interpreted correctly. One should note, once again, that the 'threshold of sustainability' plays a vital role in the SV method (in order to conclude that sustainability improved, the value of SV must be more than 0, RCR – more than 1). So, for example, regardless of negative trends, Sweden and Denmark remain as sustainability-improvers of the region, due to a positive SV.

Fig. 1 illustrates dynamics of the RCR in the cartographic form, where height of columns and color intensity of countries' territories on the map present values of RCR.

To summarize the main results of sustainability assessment in the Baltic Sea Region according to the applied approaches we ranked the countries according to the values of sustainability performance indicators (Table 5). By doing so, we obtain a so-called sustainability profile of countries in the Baltic Sea Region. Based on the data in Table 5, we can compare the countries in terms of different aspects of sustainability performance. The results of the SV approach calculations reveal a similar ranking of the Baltic Sea countries (only ANS is odd to some extent, but we have tried to explain this fact above).

In general, such countries as Germany, Denmark and Sweden have the strongest positions on the path to sustainability, while Belarus, Estonia and Poland can be considered the outliers of the region. The leading countries should be the benchmarks for others. The described profile can certainly be supplemented by the results of other methods, and can be used as a generalized panel for sharing among all stakeholders: investors, governments, communities and others.

4. Conclusions and further studies

Comprehensive sustainability performance assessment of countries can be a powerful base generating incentives improving sustainable development. Objective and in-depth estimation allows the drivers and barriers of sustainability to be identified in the individual countries, and thus in the region as a whole, enabling the construction of a reasonable programme for further development. Unfortunately, some estimation methods that exist in theory cannot be used in practice for a specific region due to great gaps in statistics. Based on the performed comparative analysis of the estimation methods available when it comes to practical calculations, the main advantages and disadvantages of each approach were outlined. For an in-depth study of the main sustainability trends and the reasons behind them, we propose extending the implications of the Sustainable Value method based on factor analysis and allowing the cause-effect relations to be explored in detail.

Sustainability assessment of countries in the Baltic Sea Region by way of *Adjusted Net National Income*, *Adjusted Net Savings*, the *Environmental Performance Index*, the *Human Development Index*, and *Sustainable Value* approaches was applied and considered. Generally speaking, the results obtained by means of implementing different methods show a similar situation. Germany, Sweden and Denmark were the sustainability drivers of the region in 2005–2010, while Belarus, Lithuania and Latvia lagged behind on the path towards sustainability. As a final point, we can highlight some prospects for practical use based on our study:

– drawing up a panel of data on sustainability for comprehensive analysis;
– increasing awareness regarding sustainable development in a region;
– detecting the strengths and weaknesses of a country in terms of sustainability;
– providing substantiation of national and regional sustainable development strategies;
– carrying out investment attractiveness analyses of different countries in a region.

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