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Corporate Sustainability Measurement and Assessment of Czech Manufacturing Companies using a Composite Indicator

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This paper discusses the measurement and assessment of corporate sustainability by a composite indicator. The aim of the paper is a construction of a composite indicator "Index corporate sustainability" (I_{CS}). A tool for measuring and assessing corporate sustainability is an appropriately designed model called the "Sustainable Environmental, Social, Governance and Economic Model (SEESG Model)". The composite indicator ***I*****CS** *integrates 5 financial (economic) and 14 non-financial, environmental, social and corporate governance (ESG) performance indicators Iji, which are determined in a stepwise fashion from a basic set of performance indicators using the principal component analysis (PCA) modelling. The composite indicator* ***I*****CS** *is one of the possible ways to create a tool for measuring and assessing corporate sustainability that allows for the assessment of companies by a set of financial and non-financial indicators in various areas of their performance, thus enabling a detailed analysis and determination of the impact of various performance areas and factors in complex corporate performance. An important characteristic of the composite indicator is the possibility to easily make comparisons and rankings of companies in a particular sector, and estimate whether they are heading towards sustainability. The use of benchmarking for company-to-company comparisons makes it possible to interpret summary information and to quantify differences in the performance of individual companies using graphic visualization. For this reason,* ***I*****CS** *can be offered as a consistent and flexible benchmarking for owners, managers and investors. Using this indicator, they can incorporate sustainability into their decision-making processes, and achieve economic growth and ensure protection of the environment and social values.*

Keywords: *Corporate Sustainability, Composite Indicator, Performance Indicators, Modelling, Sustainable Environmental, Social, Governance and Economic Model, the Principal Component Analysis.*

Introduction

Corporate sustainability can be viewed as a business approach which focuses on creating long-term value for company owners by exploiting opportunities and managing risks deriving from economic, social and environmental development. In a situation where companies are under pressure from economic, environmental and social legislation, codes of ethics and conditions of customers and suppliers, profit maximization ceases to be the sole criterion and owners and managers are forced to introduce voluntary approaches into their companies (ISO 14000, EMAS, Cleaner Production, LCA, etc.) as well as voluntary concepts (CSR, ISO 26000, OHSAS, Safe Company, etc.) related to sustainability, and their aim is to achieve a balanced relationship between environmental, economic and social pillars, i.e. to ensure the sustainable management at the corporate level. Companies seek to achieve long-term benefits by integrating activities connected with sustainability into the core of the business strategy (Gajowiak, 2013; Chabowski *et al*., 2011; Cruz *et al*., 2006). Generally it can be said that companies incorporate sustainability practices because they feel bound to do so, they want it themselves or are forced to do it (Van Marrewijk, 2003). Corporate sustainability is inconceivable without a balance in the environmental, social and economic area. If we want to measure and assess corporate sustainability, in addition to standard financial indicators it is also necessary to include relevant non-financial indicators, which ultimately means depicting a link between economic, environmental and social performance. Measurement and assessment of performance only by financial indicators has virtually no relevant information value for stakeholders. Corporate sustainability can be defined as an integration of financial (economic) and non-financial indicators. By being included into sustainable corporate performance, corporate governance indicators may also globally characterize problems investors take into consideration in connection with corporate behaviour. Another reason why corporate governance should be included in sustainable performance is that it significantly contributes to the process of corporate management control; it takes into account the interest of stakeholders within the company and that of other parties; it focuses on a company guaranteeing responsible behaviour. By applying internationally recognized principles, corporate governance facilitates communication of the company with foreign partners both in the ordinary course of trade and in the event

of mergers and acquisitions; it creates conditions for improving corporate culture. Its main objective is to achieve the maximum level of performance and profitability of the company. The area of the company's corporate governance is important not just for the operation of the company's economy as a whole; it affects all the stakeholders of the company as well. The level of respecting the principles of corporate governance constitutes an important piece of information for investors.

The aim of the paper is the construction of composite indicator Index corporate sustainability (I_{CS}) for sustainability measuring and assessing of manufacturing companies. The Sustainable Environmental, Social, Governance and Economics Model (*SEESG Model*) is presented in the methodology. The model is based on the financial performance indicators I_{Ecoi} and non-financial indicators I_{ESGi}.

The structure of the *SEESG Model* involves four important stages: 1. the basic conceptual framework for manufacturing industry companies for economic, environmental, social and corporate governance groups *j = {Eco, En, Soc, Cg}; 2.* the determination of financial (economic) and non-financial ESG performance indicators I_{ji}; *3.* the determination of performance sub-indices I_{Sj}, sustainable performance indicators I_{Dj} *j = {Eco, En, Soc, Cg}*, and the composite indicator "*Index corporate sustainability (I_{CS})"; 4.* the assessment of corporate sustainability and benchmarking. The construction of the composite indicator I_{CS} is based on financial and non-financial data of Czech manufacturing companies for the period 2010–2013. Selected companies have implemented environmental management system - ISO 14001 or EMAS. The reduction of the number of indicators was done by Principal Component Analysis. The set of indicators was reduced by 43 % and weights were assigned to the reduced set of indicators. Composite indicator I_{CS} is a sum of indicators I_{Dj}. The companies are ranked based on the I_{CS}. The best company is used as a benchmark. Using AMOEBA diagram the users can assess the economic, environmental, social and corporate governance performance and if the company is inclined to sustainability. Evaluation using financial indicators practically does not have a relevant information value for investors, and for this reason the composite indicator I_{CS} can help them in their decision-making.

The relationship between economy and sustainability is the subject of many theoretical and empirical studies. Kirchhoff (2000); Feddersen and Gilligan (2001) state that companies with high sustainability achieve economic benefits by using brands and advertisements informing of the sustainability of the products, by which they support product differentiation. Greening and Turban (2001) show that high sustainability enables the companies to hire more innovative and motivated employees, which, in turn, reflects in their economic results. In contrast, there is a neoclassical argument that the companies have only one social responsibility - to increase their profits. Sustainability reduces economic performance because sustainability-increasing activities are expensive (Friedman, 1962; Becchetti *et al*., 2005). Orlitzky and Benjamin (2001) demonstrated a link between social responsibility and financial risk of the given entity. Park, Lee and Kim (2014) examine internal factors between social responsibility and corporate reputation by considering a wider range of corporate social responsibility (CSR) initiatives.

Generally, it is very difficult to measure and assess sustainability of a company on the basis of a large number of indicators, so the integration of financial and non-financial indicators into one composite indicator (overall index) is very convenient for measuring and assessing corporate sustainability, and primarily for decision-making of stakeholders.

The environmental, social and corporate governance (ESG) integration and economic performance indicators are probably the best ways to measure sustainable performance based on the concept of sustainable financial value (based on the integration of ESG issues within the standard financial framework) (Kocmanova & Šimberova, 2014; Pavlakova Docekalova & Kocmanova, 2016). Research into the measurement and evaluation of the sustainability in the Czech manufacturing industry is being performed by a research unit at the Faculty of Business and Management at Brno University of Technology which, within the framework of the grant project "Measuring Corporate Sustainability in Selected Sectors", has proposed the predictive model Corporate Sustainability Index (CSI_{MDA}) using Multiple Discriminant Analysis. This predictive model has already been published by Kocmanova *et al*. (2015). Theoretical background needed for the design of the methodology can be found in the works of Meluzín and Zinecker (2014a, b).

The Conceptual Framework

Sustainability of a company can be seen as a strategic approach that focuses - in addition to effectiveness and efficiency - on comprehensive performance of the company, on the creation of value for owners/shareholders, and may be gauged on the environmental, economic and social dimension; currently it also includes corporate governance. A number of authors deal with the issue of sustainability at the company level and its link to the company performance (Elkington, 2008; Carol *et al*., 2008; Schaltegger *et al*., 2009; Schaltegger & Wagner, 2006).

With regard to the fact that sustainability cannot be measured by a simple indicator, it is convenient to use composite indicators. Composite indicators affect sustainability by aggregating several simple indicators; they have advantages as well as disadvantages. A major advantage is the possibility of a comprehensive summary of the problem and simple interpretation; composite indicators also provide a benchmark. The disadvantage of composite indicators is especially the subjectivity in their construction. Another problem is the use of composite indicators in relation to the need of the objective determination of the weight of each indicator (Saltelli *et al*., 2005). To remedy this deficiency, it is advisable to make a sensitivity analysis for each composite indicator, and to use composite indicators together with appropriate individual sub-indices. The transparency is a priority in the construction of composite indicators, especially with respect to the choice of the methodology and data base. A number of authors deal with the topic of composite indicators (Nardo *et al*., 2005; Mederly *et al*., 2004). The methodological approach to determine composite indicators can be according to statistical and analytical methods and statistical and descriptive methods (Saisana & Tarantola, 2002; Mederly *et al*., 2004).

Composite indicators are flexible because they are a model; changes in methodology (selection of indicators, standardization, system of weights, aggregation) can easily be taken into account, but it is at the expense of comparability (Booysen, 2002). However, the indicator can be recalculated back to the new methodology. Krajnc and Glavic (2005) have developed a Combined Sustainable Development Index (CSDI) using the concept of the Analytical Hierarchy Process (AHP) model. This CSDI index monitors the information of economic, environmental and social performance over time. For the construction of the Composite Sustainability Index, Singh *et al*. (2012) use also the AHP model for steel companies.

Research Methodology

The Sustainable Economic, Environmental, Social and Corporate Governance Model *(SEESG Model)*

Unsustainability of companies is the result of imbalance between social and economic aspects and environmental impacts. Measurement and assessment of sustainability plays an important role for representation of sustainable corporate development and for best practices of sustainability. Due to the lack of existing methods for measuring and assessing corporate sustainability, the *SEESG Model* is designed pro measuring and assessing corporate sustainability.

The structure of the *SEESG Model* involves four important stages: *1. the basic conceptual framework for manufacturing industry companies for economic, environmental, social and corporate governance groups j = {Eco, En, Soc, Cg}; 2. the determination of financial (economic) and non-financial (environmental, social and corporate governance) performance indicators* $\boldsymbol{I_{ji}}$*; 3. the determination of performance sub-indices* $\boldsymbol{I_{Sj}}$*, sustainable performance indicators* $\boldsymbol{I_{Dj}}$ *j = {Eco, En, Soc, Cg}, and of the composite indicator "Index corporate sustainability (*$\boldsymbol{I_{CS}}$*)"; 4. the assessment of corporate sustainability and benchmarking*, see (Appendix I).

The *SEESG Model* of a company must meet certain criteria:

- Integrate financial (economic) and non-financial performance indicators;
- Include indicators that meet basic criteria, namely significance, representativeness, measurability and availability of data, comparability of data, information value and simplicity of calculation;
- Be constructed separately for each sector and reflect specifics of the sector in which the company operates;
- Easy interpretation of the model; i.e. a mathematically constructed overall index (composite indicator) for measuring and assessing corporate sustainability ($\boldsymbol{I_{CS}}$) is a part of the model;
- Include principles of benchmarking.

The *SEESG Model* uses four phases: (plan - collect data - analyse - implement good practice). The result of the *SEESG Model* is the determination of *financial (economic) and non-financial performance indicators* and *the construction of the composite indicator "Index corporate sustainability*" ($\boldsymbol{I_{CS}}$) for measuring and assessing manufacturing industry corporate sustainability.

Empirical Analysis of Measurement and Assessment of Corporate Sustainability

For empirical analysis of measurement and assessment of corporate sustainability, it was crucial to choose those relevant economic, environmental, social and corporate governance performance indicators of the *SEESG Model* that relate to sustainability and meet the conditions for Czech manufacturing industry companies.

Financial (economic) performance indicators in relation to sustainability are analyzed from the reporting framework Global Reporting Initiative (G3, 2006; G3.1, 2011, 2012, 2013; IFAC, 2012), and the economic indicators reported by the Czech Statistical Office. To determine *environmental performance indicators*, the following international sources have been used: Global Reporting Initiative, EMAS III, Sustainable Framework 2.0, DVFA, 2008 and the indicators of the Czech Statistical Office. For social performance, both financial and non-financial indicators have been used. To determine *social performance indicators*, the following international sources have been analysed: Global Reporting Initiative, the ISO 26000 standards, Sustainable Framework 2.0, and the indicators of the Czech Statistical Office. To determine *corporate governance performance indicators*, (OECD Principles of Corporate Governance, 2004; Green Paper − the EU corporate governance Framework, 2011), and International Federation of Accountants have been used as a basis.

Based on the empirical analysis of these international documents and sources, a questionnaire has been compiled and experts addressed from individual four groups *j* = {*Eco, En, Soc, Cg*}. Survey has been conducted in 79 manufacturing industry companies with more than 250 employees and with an implemented environmental system - ISO 14001 or EMAS. Based on the questionnaire survey, responses of experts and conditions imposed on the indicators, such as *significance, measurability, comparability, reliability, usability, ease of traceability and the information value*, *measurable areas and financial (economic) and non-financial performance indicators* including their scale have been designed; 45 performance indicators have been proposed, see (Appendix II).

For measuring and assessing corporate sustainability, indicators are not used in their absolute expression. These indicators for intercompany comparison are not suitable, because their value can be greatly affected within the particular sector by a specific product, by the company manufacturing means, etc.

For this reason, company performance is evaluated on the basis of relative (ratio) scales, which are relevant for comparing companies of the particular industry focus; the EMAS access is mainly used (in the case of manufacturing companies, it is the total annual gross value added), but in some cases it was not possible to use this construction and other variables were used: specifically economic, corporate governance and some social performance indicators. Especially non-financial performance indicators are partly of a qualitative nature (e.g. social, corporate governance indicators) and their assessment is largely based on subjective assessment, which inevitable includes different types of knowledge. Including these qualitative indicators to the assessment of sustainable performance may significantly affect the final assessment of the direction to

corporate sustainability. Proposed financial (economic) and non-financial performance indicators correspond with international sources IFAC, EFFAS-DVFA, ASSET4, etc., which are engaged in designing sustainability indicators. Furthermore, these performance indicators were also compared with the indicators of the reporting framework, Global Reporting Initiative[1].

Determination of Corporate Sustainability Sub-indices and of a Composite Indicator

The proposal of the *composite indicator* I_{CS} for measuring and assessing corporate sustainability is based on the determination of *sub-indices* $\boldsymbol{I_{Sj}}$, $j = \{Eco, En, Soc, Cg\}$. For the construction of the composite indicator $\boldsymbol{I_{CS}}$, factor analysis and the method of principal components have been used with the goal of reducing data, i.e. reducing the large number 45 performance indicators $\boldsymbol{I_{ji}}$, and identifying indicators that are correlated and grouped into factors.

The construction of the composite indicator I_{CS} is built on the data of financial indicators, which were obtained from the AMADEUS database and from annual reports of companies; non-financial indicators are acquired from the Czech Statistical Office (the environmental data and a part of social data); other data (social and corporate governance) have been supplemented by experts from manufacturing industry companies. From the financial and non-financial areas, the data have been collated for the period of 2010-2013. Manufacturing companies are selected from the CENIA database; it was a selective sample of 88 manufacturing companies with more than 250 employees, who possess EMS certification according to the CSN EN ISO 14001 standard.

The general model of factor analysis can be expressed to the Eq.1 (Morrison, 2005):

$$Z_j = y_{j1}F_1 + y_{j2}F_2 + \cdots + y_{jR}F_R + \varepsilon_j \quad (1)$$

where $\varepsilon_1, \varepsilon_2, \ldots\ldots \varepsilon_p$ is p random (error) components; constants γ_{j1}, γ_{j2} are called 'factor loadings' with values between -1 and +1; they can be interpreted as correlation coefficients between variables and factors observed.

The standard method of principal components assesses mutual linear relationships between the variables observed. The algorithm is designed so that the first latent variable explains as much as possible of the original variability. (Morrison, 2005). The supporting initial database for the construction of the composite indicator $\boldsymbol{I_{CS}}$ consists of indicators $\boldsymbol{I_{ji}}$, on which factors influencing corporate sustainability are identified. Analyses were performed on the 2013 data. Indicators $\boldsymbol{I_{ji}}$, which are analysed, are listed in (Appendix II); (fourteen economic performance indicators $\boldsymbol{I_{Ecoi}}$, eleven environmental performance indicators $\boldsymbol{I_{Eni}}$, nine social performance indicators $\boldsymbol{I_{Soci}}$, eleven corporate governance performance indicators $\boldsymbol{I_{Cgi}}$) using the principal component method.

The initial value of $\boldsymbol{I_{ji}}$ indicators was adjusted by including a positive/negative impact. Performance indicators were divided into indicators $\boldsymbol{I_{ji}^+}$, whose increasing value had a positive impact on corporate sustainability, and indicators $\boldsymbol{I_{ji}^-}$, whose increasing value had a negative impact on corporate sustainability. A positive/negative impact of indicators on corporate sustainability:

$I_{Nji}^+ = I_{Soc1}, I_{Soc3}, I_{Soc4}, I_{Soc7}, I_{Soc8}, I_{Soc9}, I_{Cg1}, I_{Cg2}, I_{Cg3}, I_{Cg4}, I_{Cg5}, I_{Cg6}, I_{Cg7}, I_{Cg8}, I_{Cg9}, I_{Eko1}, I_{Eco2}, I_{Eco3}, I_{Eco4}, I_{Eco5}, I_{Eco6}, I_{Eco7}, I_{Eco8}, I_{Eco9}, I_{Eco10}, I_{Eco11}, I_{Eco12}, I_{Eco13}, I_{Eco14}.$

$I_{ji}^- = I_{En1}, I_{En2}, I_{En3}, I_{En4}, I_{En5}, I_{En6}, I_{En7}, I_{En8}, I_{En9}, I_{En10}, I_{En11}, I_{Soc2}, I_{Soc5}, I_{Soc6}, I_{Cg10}, I_{Cg11}.$

The basic set of standardized financial (economic) and non-financial performance indicators $\boldsymbol{I_{Nji}}$, was reduced by Principal Component Analysis by 43 %. The reduced set consists of 19 indicators, Table 1.

For the construction of the composite indicator $\boldsymbol{I_{CS}}$, an important step is the determination of weights, i.e. the selection of an appropriate method, because the weights most affect the final proposal of the composite indicator $\boldsymbol{I_{CS}}$. It is thus necessary to assign a weight to each $\boldsymbol{I_{Nji}}$ indicator due to higher preference of the indicator importance. An appropriate way of determining the weights of the $\boldsymbol{I_{Nji}}$ indicators of the composite indicator $\boldsymbol{I_{CS}}$ is an exact procedure because of the statistical significance in contrast to the subjective approach (evaluation of experts). For an exact assessment of weights, the analysis of principal components is convenient, which focuses on the comprehensive explanation of the original variance.

Part of the composite indicator $\boldsymbol{I_{CS}}$ is the determination of sub-indices $\boldsymbol{I_{Sj}}$ of sustainability of the *SEESG Model* (economic sub-index $\boldsymbol{I_{SEcoi}}$; environmental sub-index $\boldsymbol{I_{SEnvi}}$; social sub-index $\boldsymbol{I_{SSoci}}$; and corporate governance sub-index $\boldsymbol{I_{SCgi}}$); these are determined according to the Eq.2:

$$I_{Sj} = \sum_{j=1}^{p} w_{ir}\, I_{Nji} \quad (2)$$

where: I_{Nji} ... standardized value of the indicator for the *j-th* group $j = \{Eco, En, Soc, Cg\}$ and the *i-th* indicator, $i = 1, \ldots. p$; p ... number of indicators in the group j, w_{ir} ... the component score to the *i-th* indicator is calculated from standardized variables, I_{Sj} ... sub-indices of sustainable performance.

Standardized numbers of financial and non-financial indicators $\boldsymbol{I_{Nji}}$ are included into the resultant composite indicator $\boldsymbol{I_{CS}}$ using the method of principal components; indicators $\boldsymbol{I_{Nji}}$ are assigned weights w_{ir} on the basis of the component score, and from them, sub-indices $\boldsymbol{I_{Sj}}$ of the group $j = \{Eco, En, Soc, Cg\}$ are determined, to which weights w_{ji} are assigned (the significance of the sub-index importance); the sub-index weight is determined on the basis of the % of variability, and the sum of sub-indices equals to one (it is a proportion of variability explained by the sub-index in the total variability explained (by all sub-indices)).

The composite indicator $\boldsymbol{I_{CS}}$ is constructed from resultant indicators of sustainable performance $\boldsymbol{I_{Dj}}$, which includes the *indicator of economic performance* $\boldsymbol{I_{DEco}}$, *indicator of environmental performance* $\boldsymbol{I_{DEn}}$, *indicator of social performance* $\boldsymbol{I_{DSoc}}$, and the *indicator of corporate governance performance* $\boldsymbol{I_{DCg}}$; the scheme of the proposal of the composite indicator $\boldsymbol{I_{CS}}$, see (Figure 1).

[1]GRI *Reporting Principles and Standard Disclosures.* Retrieved 1 July, 2014, from: https://www.globalreporting.org/resourcelibrary/GRIG4-Part1-Reporting-Principles-and-Standard-Disclosures.pdf.

Table 1

Reduced Standardized Financial (Economic) and Non-Financial Performance Indicators of the *SEESG Model*

S.no.	*Economic group (j=Eco)*	*Environmental group (j=Envi)*	*Social group (j=Soc)*	*Corporate governance group (j=Cg)*
	I_{Ecoi} - Economic indicators	**I_{NEni} - Environmental indicators**	**I_{NSoci} - Social indicators**	**I_{NCgi} - Corporate governance indicators**
1	I_{NEco1} - ROE = EAT / Equity.	I_{NEn2} - Non-investment expenditures for the protection of the Environment /Added value.	I_{NSoc1} - Total number of women / Total number of employees in given to period.	I_{NCg1} - Inform about financial results. [yes = 0,98; no = 0,02]
2	I_{NEco2} - ROA = EBIT /Assets.	I_{NEn3} - Total emissions to air / Added value [t/CZK]	I_{NSoc6} - Number of terminated employments / Total number of employees in given to period.	I_{NCg5} - Collective agreement. [yes = 0,51; no = 0,49]
3	I_{NEco3} - ROS = EAT/ Revenues.	I_{NEn5} - Total consumption of renewable energy /Added value. [GJ/CZK]	I_{NSoc7} - Education and training expenditures / Added value.	I_{NCg4} - Reports from environmental and social areas. [yes = 0,63; no = 0,37]
4	I_{NEco4} - ROCE = EBIT/ Equity + Long-term liabilities.	I_{NEn9} - Total annual consumption of water / Added value. [m^3/rok/CZK]	I_{NSoc9} - Added value / Wage costs.	I_{NCg6} - Code of ethics. [yes = 0,72; no = 0,28]
5	I_{NEco11}- Cash flow / Assets.	I_{NEn10} - Total annual production of waste / Added value. [t/CZK]		
6		I_{NEn11} - Total annual production of hazardous waste / Added value. [t/CZK]		

Author's own source

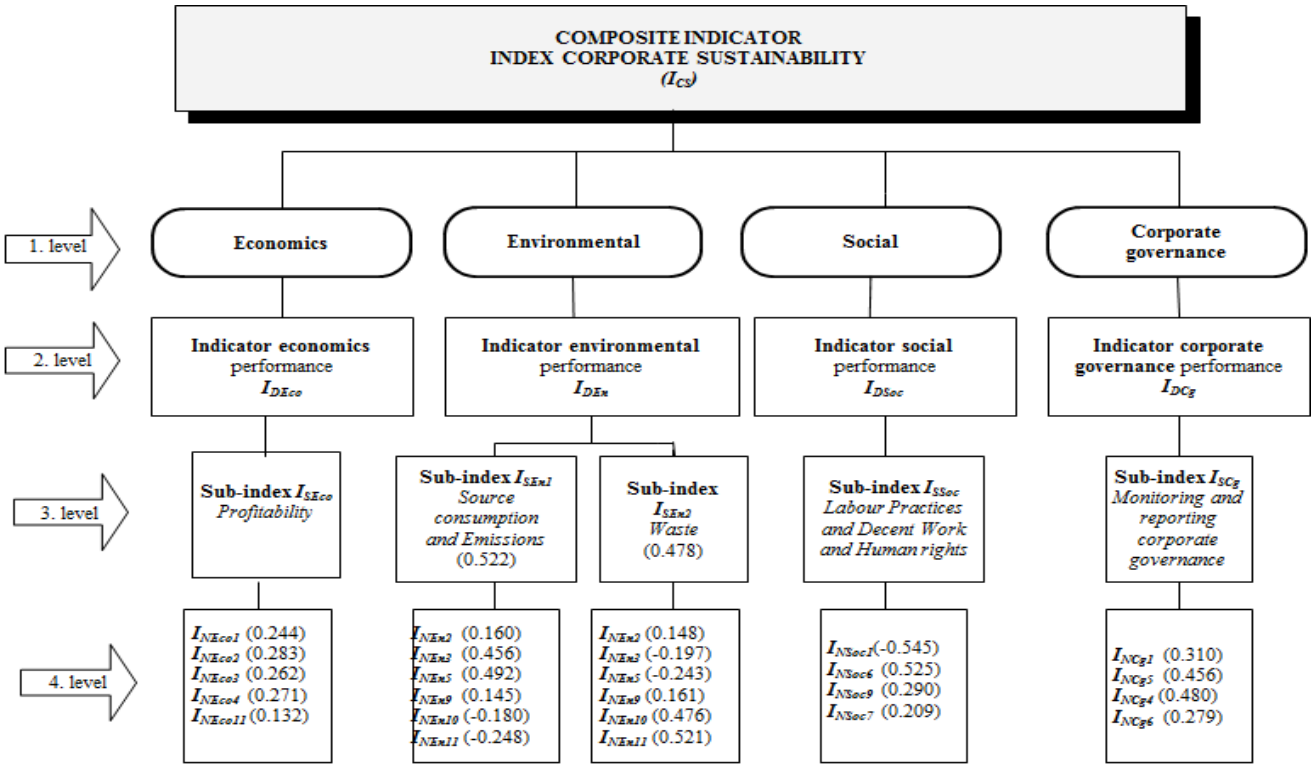

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Figure 1. Diagram of I_{CS} Composite Indicator Determination

Economic performance is influenced by the sub-index I_{SEco} - *Profitability*. Determined weights of I_{NEcoi} indicators range from 0.132 to 0.283; higher preferences are those of the following indicators: I_{NEco2}, I_{NEco4}, I_{NEco3}, I_{NEco1} *and* I_{NEco11}.

Environmental performance is influenced by two sub-indices: sub-index I_{SEn1} - *Source consumption* and *Emissions* (weight 0.522), and sub-index I_{SEn2} - *Waste* (weight 0.478), Determined weights of indicators I_{NEni} in sub-index I_{SEn1} range between the values of -0.248 to 0.492; higher preferences are those of the following indicators: I_{NEn5}, I_{NEn3}, I_{NEn2} and $I_{NEn9.}$ Determined weights of indicators I_{NEni} in sub-index I_{SEn2} range between the values of -0.243 to 0.521; higher preferences are those of the following indicators: I_{NEn11}, I_{NEn10} and I_{NEn9}. These environmental indicators can be used to assess the relationship to environmental protection.

Social performance is influenced by the sub-index I_{SSoc} - *Labour practices and Decent Work and Human rights*. Determined weights of indicators I_{NSoci} range between the values of -0.545 to 0.525; higher preferences are those of the following indicators: I_{NSoc6}, I_{NSoc9} and I_{NSoc7}.

Corporate governance performance is influenced by sub-index I_{SCg} - *Monitoring and reporting corporate governance*. Determined weights of indicators I_{NCgi} in sub-index I_{SCg} range between the values of 0.279 to 0.480; higher preferences are those of the following indicators: $I_{NCg4,}$ $I_{NCg5,}$ $I_{NCg1,}$ and $I_{NCg6.}$

Results and Discussion

Using an appropriate aggregation method, the position of a company can be assessed by the composite indicator $\boldsymbol{I_{CS}}$. The assessment of the composite indicator $\boldsymbol{I_{CS}}$ is based on a general to the Eq.3:

$$I_{CS} = \sum_{J=1}^{p} I_{Dj} \qquad (3)$$

where $j = 1,\ldots. p$; p ... number of indicators of sustainable performance I_{Dj} in the group j; I_{Dj}... includes the economic performance indicator I_{DEco}, environmental performance indicator I_{DEn}, social performance indicator I_{DSoc}, and the corporate governance performance indicator I_{DCg} for the *j-th* group j = {*Eco, En, Soc, Cg*}.

The resulting composite indicator $\boldsymbol{I_{CS}}$ to the Eq.4:

$$I_{CS} = I_{SEko} + 0{,}522I_{SEn1} + 0{,}478I_{SEn2} + I_{SSoc} + I_{SCg} \qquad (4)$$

where I_{Sj} ….. sub-indices of sustainable performance of the group j = {*Eco, En, Soc, Cg*}. I_{SEco} – *Profitability*; I_{SEn1} – *Source consumption and Emissions*; I_{SEn2} – *Waste*; I_{SSoc} – *Labour practices and Decent Work and Human rights;* I_{SCg} – *Monitoring and reporting corporate governance.*

On the basis of calculation according to the Eq.4, an order of companies is determined from the best (benchmark) to the worst manufacturing industry company. If companies are assessed according to the order, then the best assessment will be assigned to those companies who have the highest value of the composite indicator $\boldsymbol{I_{CS}}$ *(heading towards sustainability*) and the lowest value of the composite indicator $\boldsymbol{I_{CS}}$ will be assigned to companies who have the worst assessment (*not heading towards sustainability*). Determination of the benchmark is important for assessing the sustainability of a company; we may use some of the following as the benchmark: The best company in the group; the best practice, industry, etc.; or even target values from the Data Envelopment Analysis. In the following (Figure 2), results of the composite indicator $\boldsymbol{I_{CS}}$ of the *SEESG Model* are interpreted of the best and worst companies and of some average companies of manufacturing industry in the group, as well as their heading towards sustainability.

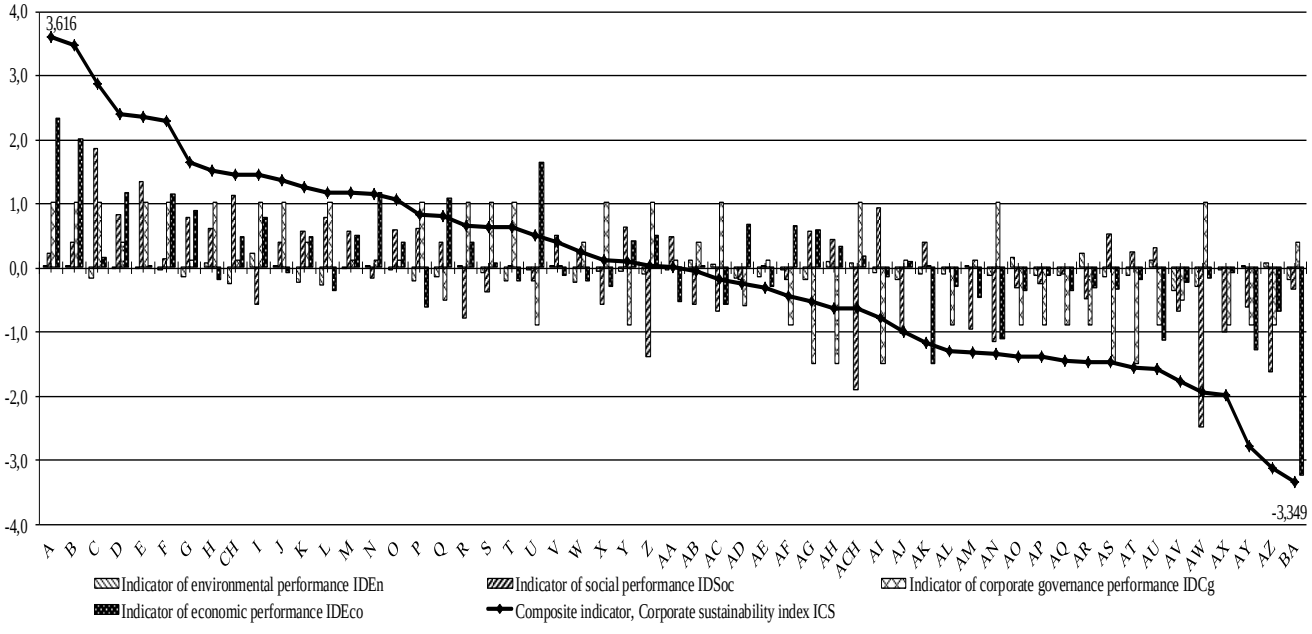

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Figure 2. Representation of Composite Indicator I_{CS} and Indicators I_{Dj} of Manufacturing Companies

The higher the value of the composite indicator $\boldsymbol{I_{CS}}$, the higher the probability that the company is heading towards sustainability. The same applies to indicators of sustainable performance $\boldsymbol{I_{Dj}}$ of the company. The relatively high value of the composite indicator $\boldsymbol{I_{CS}}$ may also mean, as a measure of relative probability, that the company will be able to maintain favourable sustainable conditions. Graphic representation (Figure 2) shows that the best assessment was

achieved by the company A (25-manufacture of fabricated metal products, except machinery and equipment); the value of the composite indicator is I_{CS} = 3.616. This (A) company is heading towards sustainability. The worst results are shown by the company BA (24-manufacture of basic metals, metallurgical processing of metals), which showed a negative value of the composite indicator I_{CS} = - 3.349. The company is not heading towards sustainability.

Based on the results of these two companies, the best one in the company (A) and the worst one in the company (BA), we can use graphic visualization to easily draw conclusions that can serve for owners, managers and investors. A convenient tool to illustrate corporate sustainability is graphic visualization using AMOEBA diagrams. By means of these AMOEBA diagrams, standardized values of levels 2 to 4 (Figure 1) of the composite indicator $\boldsymbol{I_{CS}}$ of both companies and their heading towards sustainability are shown. In our case, we consider the best company (A) as a benchmark.

Graphic representation using the AMOEBA diagram of the second level of the composite indicator $\boldsymbol{I_{CS}}$ presents sustainable performance indicators $\boldsymbol{I_{Dj}}$, i.e. the economic performance indicator $\boldsymbol{I_{DEco}}$, the environmental performance indicator $\boldsymbol{I_{DEn}}$, the social performance indicator $\boldsymbol{I_{DSoc}}$ and the corporate governance performance indicator $\boldsymbol{I_{DCg}}$, (Figure 3). From the principle of calculation of the chosen method of aggregation, it is clear that if $\boldsymbol{I_{Dj}}$ is *0*, the development of the company can be assessed as *average*. Values higher than 1 mean that the company achieves *above-average* results in terms of the $\boldsymbol{I_{Dj}}$ assessed. Conversely, when the $\boldsymbol{I_{Dj}}$ value is less than *0*, the company can be assessed as *below average*. Each indicator of sustainability is represented by one arm; resulting values of $\boldsymbol{I_{Dj}}$ are compared to the benchmark. The greater the amoeba curve, the more sustainable the company is - and vice versa. The probability of development increases by nearing the standardized value to point 1. Curves represent quantitative differences between the best and worst companies in the group for the year 2013.

By benchmarking companies, the owner/manager clearly sees the difference that heads to sustainability from $\boldsymbol{I_{Dj}}$, or conversely does not reach minimum levels of sustainability. From (Figure 3) it is clear that sustainability of the company (A) is positively influenced by the economic performance indicator (2.330) and by the corporate governance performance indicator (1.021). The social performance indicator of the company is 0.230, and the environmental performance indicator has a low value, 0.034. Social and environmental performance indicators reduce the value of the composite indicator $\boldsymbol{I_{CS}}$; it is not the highest in the group of companies, yet the company (A) is *above average* in the assessment of sustainable performance. The low level of the composite indicator $\boldsymbol{I_{CS}}$ of the company (BA) is influenced by negative values of the indicators of economic (-3.247), environmental (-0.179) and social (-0.326) performance, i.e. that the company has serious problems in economic, environmental and social performance. The corporate governance indicator reaches a lower value (0.402). The company (BA) in the assessment of sustainable performance is *below average*, and so far there is no assumption about its heading to sustainability. It is clear from graphic visualization of both companies that the economic performance indicator greatly affects the overall sustainability of the company.

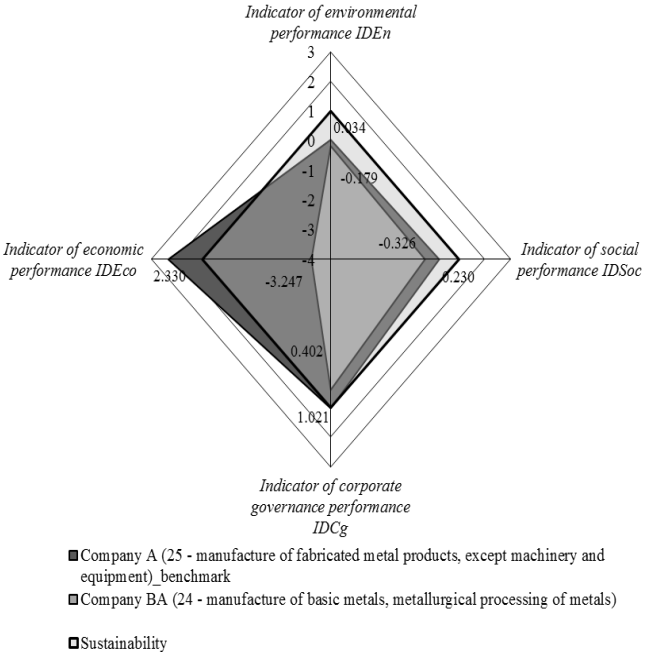

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Figure 3. Indicators of Sustainable Corporate Performance of Company A (Benchmark) and Company BA

From graphical visualization of (Figure 4), by benchmarking the company (BA) with the benchmark of the company A, it is clear that the heading of companies to sustainability is greatly influenced by economic performance; there is a visible difference between companies in the Profitability sub-index, which reaches a negative value (-3.247). The sub-index Labour relationships and Human rights (-0.326) also has a great impact on sustainability of the company (BA); the same applies to low values of the sub-index Resource consumption and Emissions (-0.062), and the sub-index Waste (-0.117). The sub-index Monitoring corporate governance (0.402) basically reaches a positive, but low value: 0.402.

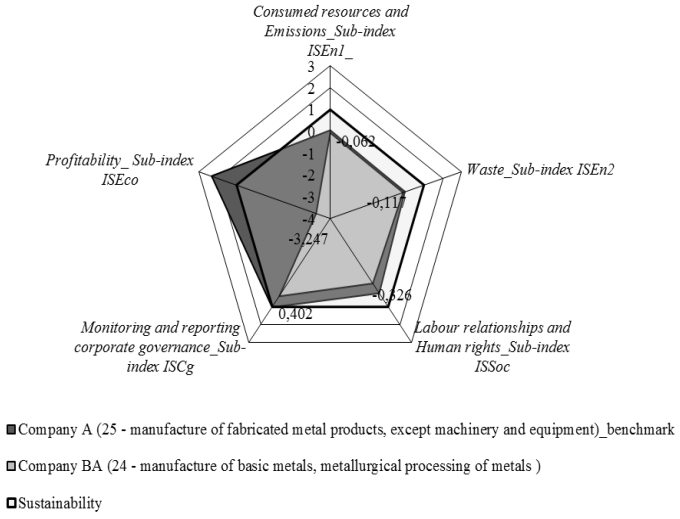

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Figure 4. Sub-Indices of Companies A and BA

What performance indicators most influence individual sub-indices and cause a negative impact on overall sustainable performance can be seen from the fourth level of the composite indicator $\boldsymbol{I_{CS}}$, (Figure 5).

In case of the assessment of the (BA) company, it is clear that the economic performance ranges in negative values; the worst values are reached by indicators of the Profitability sub-index (ROE, ROA, ROCE, ROS, CF/A). Also indicators of social performance have a negative impact on sustainable performance: work productivity from added value I_{Soc9} (-0.920), which captures performance of the company in relation to the cost of wages of employees, the employee turnover indicator I_{Soc6} (-1.465), the indicator of equal opportunities I_{Soc1} (-1.367), and the monetary support to local community indicator I_{Soc3} (-0.168). The corporate governance performance in the case of the (BA) company is at a good level; the company provides its stakeholders with transparent information about financial results I_{Cg1} and about reporting from environmental or social areas I_{Cg4}; it also behaves responsibly towards employees by issuing a collective report I_{Cg5}. Only the code of ethics indicator I_{Cg6} reduces the corporate governance performance; the company does not have the code of ethics implemented. In environmental performance indicators, it reaches low negative values in almost all indicators I_{En2}, I_{En3} I_{En5} I_{En9} I_{En10} except indicator I_{En11}, which achieves a positive value.

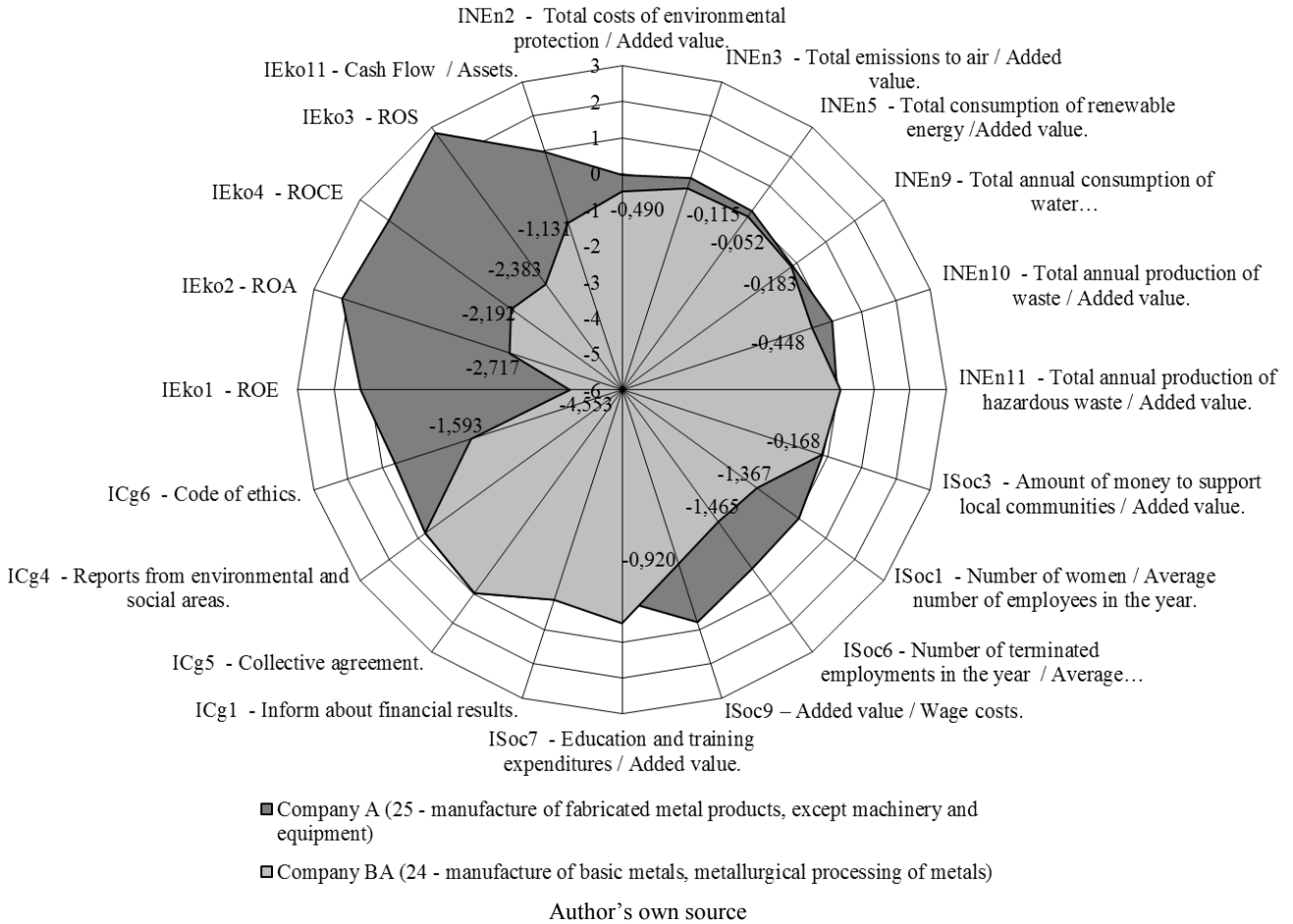

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Figure 5. Performance of Companies in Each Indicator of Companies A (Benchmark) and BA

From the results of the breakdown of individual levels of the composite indicator $\boldsymbol{I_{CS}}$ it can be concluded that progress towards sustainability is achieved in the case when the company reaches the $\boldsymbol{I_{CS}}$ value with the benchmark (in our case it is the best company A in the group), i.e. the value (if the benchmark does not reach this value).

The composite indicator $\boldsymbol{I_{CS}}$ thus provides a comparison criterion, the so-called *benchmark*. The composite indicator I_{CS} in the *SEESG Model* enables companies of manufacturing industry to identify opportunities for improvement, and can be also used for further comparative analyses and be part of Integrated Reporting, as well as in accordance with guidelines of the Global Reporting Initiative (GRI), IFAC and CFA, etc. From the above graphical outputs, owners, managers and investors can be acquainted with sustainable performance of the company on the basis of the breakdown of composite indicators, and this can help them to make decisions in the economic, environmental, social and corporate governance areas and to lead the company to sustainability. The *SEESG Model* thus allows owners and managers to uncover weaknesses in company performances, to quantify and lead to the elimination of these weaknesses, improving thereby the sustainability of the company; it could also help in the development of standards for external benchmarking and monitor the progress of the company in terms of time.

Conclusions

The *SEESG Model* includes financial (economic) and non-financial ESG performance indicators I_{ji}, sub-indices I_{Sji}, groups $j = \{Eco, En, Soc, Cg\}$, the economic indicator I_{DEco}, the environmental indicator I_{DEn}, the social indicator I_{DSoc}, and the corporate governance performance indicator I_{DCg}, and the composite indicator I_{CS}; they will be used to assess sustainable performance of companies. By using the composite indicator it can be also explained why companies that have good economic results may not be sustainable.

The composite indicator I_{CS} is one of the ways to create a tool for measuring and assessing sustainability of the company, which enables us to assess the company as to whether it is heading to sustainability or not.

Composite indicators are often subjected to criticism especially because of their subjectivity - despite the relative objectivity of the methods used in their construction. In our opinion, transparency and comprehensibility must stay in the first place in the creation of the composite indicator I_{CS}. When analysing the composite indicator I_{CS}, important findings were made that can be summarized as follows. The composite indicator I_{CS}, which is composed of financial and non-financial indicators, will summarize complex phenomena which lead to simplified decision-making; it also allows aggregation of individual parameters in different units into one composite (overall) indicator; by this, it may be more easily interpreted than a set of many indicators and its results can serve as a basis for decision-making of stakeholders and also as an initial composite indicator of Integrated Reporting. An important feature of the composite indicator is the possibility of simple benchmarking and ranking of companies in a particular sector. For this reason, I_{CS} can be offered as a consistent and flexible benchmarking for private and institutional investors. The composite indicator can be used for different sectors of CZ-NACE by the selection of suitable performance indicators (in administration, in the public sector, for university ranking, in business activities, etc.); it formulates a uniform methodology for assessing the direction to sustainability; its transparency of the indicator algorithm provides unambiguous results. The main advantage of using the composite indicator is transparency and reproducibility.

However, the composite indicator also has some disadvantages. If inappropriately constructed, the composite indicator I_{CS} may lead to wrong conclusions; if poorly constructed and interpreted, it may lead to simplified conclusions that need to be supplemented with other analyses; there may be a need to analyses the model at a lower level or to examine the relationships between indicators. Because it is strongly influenced by the choice of indicators used and weights assigned to them, it may lead to an attempt to influence purely statistical procedures; to determine weights, exact and objective methods should be recommended rather than an expert approach. The basis for determining the composite indicator is formed by the values of all indicators that need to be included in their calculation; missing and remote data reduce the quality of the calculation.

Despite these advantages and disadvantages, it can be summarized that it is possible to get to know the issue examined of sustainable performance of a company, because it will determine for us the quality of the solution on the basis of justified financial (economic) and non-financial ESG performance indicators with defined contents, and their weights. The same applies also to the composite indicator I_{CS} of the *SEESG Model* for manufacturing industry companies, to their factual interpretation. Algorithms can be then used, such as advanced quantitative methods, determination of weights, aggregation, and last but not least, the visual presentation of the results.

The *SEESG Model* for assessing corporate sustainability has been developed for quantified evaluation of manufacturing companies; at the same time, it formulates a uniform methodology for assessing the direction to sustainability using a composite indicator I_{CS}. It is based on existing approaches and recommendations of international organizations, such as GRI, IFAC, etc., and also relies on the OECD methodology. The *SEESG Model* is exceptional by including financial and non-financial performance indicators; it includes corporate governance performance into non-financial indicators, which is not done by any other model; and it primarily focuses on the company. Most composite indicators are used in international comparisons of individual countries, e.g. in areas such as the assessment of competitiveness, globalization, or the ability to create innovations. The proposed methodology of the composite indicator I_{CS} of the *SEESG Model* is universal and not limited to a sector; it can be applied also to other sectors.

Evaluation using financial indicators practically does not have a relevant information value for investors, and for this reason, the composite indicator I_{CS} can help them in their decision-making. It can inform them - with sufficient information value - about the economic, environmental, social and corporate governance performance of the company. Even the recent financial crisis has brought renewed attention of investors to focusing on non-financial indicators of companies in investment analyses, such as social and environmental conditions.

The outcome of the assessment of the company performance is reporting; in the financial area, the outcome comprises financial statements and annual reports. These proposed financial and non-financial indicators, including the composite indicator, may be included in the unified reporting, the so-called Integrated Reporting, and serve for a broader group of stakeholders for long-term decision-making. An integrated approach is thus created, in which there is a broader spectrum of reported data in a clear, concise, interconnected and comparable format for easier management of companies in the short as well as long term. Integrated Reporting is essentially a new approach to corporate reporting, which may bring greater consistency to the reports of companies and generally contribute to the harmonization of reporting.

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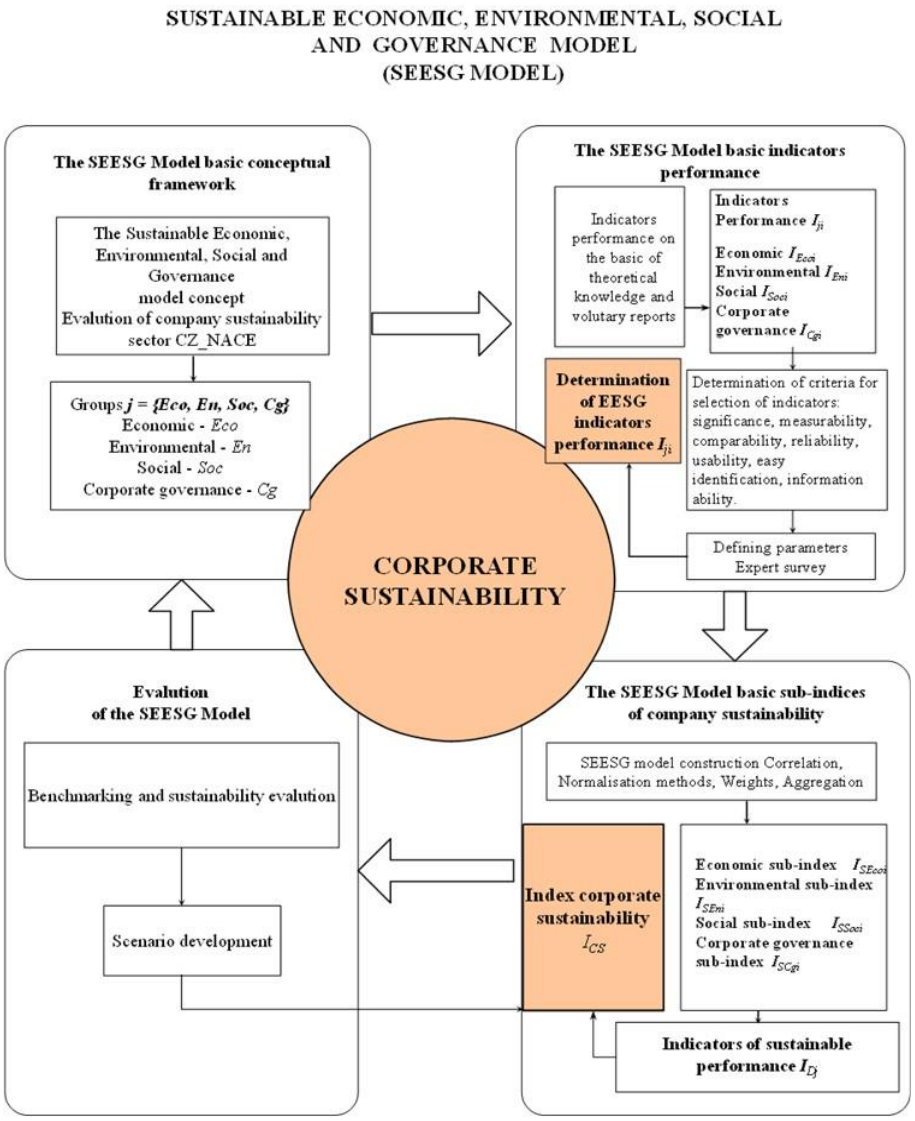
Appendix I. The *SEESG Model* structure



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Appendix II. Financial (Economic) and Non-Financial Environmental, Social, Corporate Governance (ESG) Performance Indicators

Measurement Area	Indicators	Measure (Unit)
Economic indicators		
Profitability	Indicators profitability	I_{Eco1} - ROE = EAT / Equity. I_{Eco2} - ROA = EBIT /Assets. I_{Eco3} - ROS = EAT/ Revenues. I_{Eco4} - ROCE = ROCE = EBIT/ Equity + Long-term liabilities.
Financial stability	Liquidity	I_{Eco5} - Current assets / Short-term liabilities.
	Debt	I_{Eco6} - Assets / Liabilities.
	Assets coverage by long-term capital	I_{Eco7} - Equity + Long-term sources / Assets.
	Asset turnover	I_{Eco8} - Sales / Fixed Assets.
Operation	Productivity	I_{Eco9} - Added value/ Sales of own products and services + Revenues from sale of goods.
Cash Flow	Cash flow based indicators	I_{Eco10} - Return on equity of Cash flow: Cash flow / Equity.
		I_{Eco11} - Return on assets of Cash flow: Cash flow / Assets.
Market position	Approaches to recruit employees from the region	I_{Eco12} - Number of employees from the region / Average recorded number of employees in the year (in persons).
	Financial contributions from the state	I_{Eco13} - Amount of money (e.g. subsidies, investment grants, grants for research and development, relief from fees, tax reliefs, financial incentives, awards and rewards) / Added value.
	Policies and approaches to suppliers from the region	I_{Eco14} - Amount of money for the purchase of material and services from local suppliers / Total amount for the purchase of material and services from all suppliers.

Environmental indicators		
Environmental Investment	Acquired investments for environmental protection	I_{En1} - Total investments for environmental protection / Added value.
	Environmental non-investment expenditures	I_{En2} - Non-investment expenditures for the protection of the Environment /Added value.
Emissions	Total annual emissions	I_{En3} - Total emissions to air / Added value [t/CZK] (solid particulate matter, SO_2, NO_x, NH_3, PM without CO)
	Total annual emission of greenhouse gases	I_{En4} - Total greenhouse gas emissions / Added value. [t/Kc] (CO_2,CH_4 , N_2O, HFCs, PFCs, SF6)
Measurement Area	**Indicators**	**Measure (Unit)**
Economic indicators		
Source consumption	Total annual energy consumption	I_{En5} - Total consumption of renewable energy /Added value. [GJ/CZK]
	Total consumption of renewable energy	I_{En6} - Total of renewable energy / Total energy sources.
	Annual mass flow of different used materials (in addition to the carriers of energy and water)	I_{En7} - Total consumption of materials / Added value. [t/CZK]
	Recycled materials use Proportion of the recycled input materials	I_{En8} - Percentage content of used recycled materials from total consumption materials. [%]
	Total annual consumption of water	I_{En9} - Total annual consumption of water / Added value. [m³/rok/CZK]
Waste	Total annual production of waste	I_{En10} - Total annual production of waste / Added value. [t/CZK]
	Production of hazardous waste	I_{En11} - Total annual production of hazardous waste / Added value. [t/CZK]
Social indicators		
Human rights	Equivalent opportunities	I_{Soc1} - Total number of women / Total number of employees in given to period.
	Discrimination	I_{Soc2} - Total number of final convictions for discrimination / Total number of employees in given to period.
Society	Allowances to municipalities	I_{Soc3} - Total amount of money for gifts / Added value.
	Community	I_{Soc4} - Total amount of money of charitable work in support of local communities / Added value.
	Customers' safety and health protection	I_{Soc5} - Total amount of money for non-compliance of regulations related to customers' safety and health protection / Added value.
Labour Practices and Decent Work	The rate of staff turnover	I_{Soc6} - Number of terminated employments / Total number of employees in given to period.
	Expenditure on education and training	I_{Soc7} - Education and training expenditures / Added value.
	Labour productivity from value added	I_{Soc8} - Wage costs / Added value I_{Soc9} - Added value / Wage costs. I_{Soc10} - Wage costs / Average number of employees .
Corporate governance indicators		
Monitoring and reporting	Inform about the company	I_{Cg1} - Inform about financial results. [yes = 0,98; no = 0,02]
		I_{Cg2} - Inform about company goals and strategy. [yes = 0,56; no = 0,44]
		I_{Cg3} - Informat ion from control activities. [yes = 0,61; no = 0,39]
	Reporting of voluntary reports	I_{Cg4} - Reports from environmental and social areas. [yes = 0,63; no = 0,37]
Effectiveness corporate governance	Responsibility corporate governance.	I_{Cg5} - Collective agreement. [yes = 0,51; no = 0,49]
	Ethical behaviour	I_{Cg6} - Code of ethics. [yes = 0,72; no = 0,28]
Structure Corporate governance	Remuneration of corporate governance	I_{Cg7} - Total financial value of remunerations to Board of Directors and Supervisory Board* 100 / Added value. [%]
	Effective composition of corporate governance	I_{Cg8} - Number of independent Cg members * 100 / Number of TOP management members. [%]
	Equal opportunities: Ratio of women /men in corporate governance.	I_{Cg9} - Share of Cg women * 100 / Total members Cg. [%]
Compliance	Corruption	I_{Cg10} - Share of final judgements for corruption * 100 / Total members Cg. [%]
	Observance of legal standard.	I_{Cg11} - Cash value of more significant fines and the total number of non-monetary penalties for non -compliance with laws and regulations* 100 / Total members Cg. [%]

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