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Measuring Corporate Sustainability and Environmental, Social, and Corporate Governance Value Added

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Abstract: The aim of the paper is to propose a model for measuring sustainable value which would complexly assess environmental, social, and corporate governance contribution to value creation. In the paper the concept of the Sustainable Environmental, Social and Corporate Governance Value Added is presented. The Sustainable Environmental, Social and Corporate Governance Value Added is based on the Sustainable Value Added model and combines weighted environmental, social, and corporate governance indicators with their benchmarks determined by Data Envelopment Analysis. Benchmark values of indicators were set for each company separately and determine the optimal combination of environmental, social, and corporate governance inputs to economic outcomes. The Sustainable Environmental, Social and Corporate Governance Value Added methodology is applied on real-life corporate data and presented through a case study. The value added of most of the selected companies was negative, even though economic indicators of all of them are positive. The Sustainable Environmental, Social and Corporate Governance Value Added is intended to help owners, investors, and other stakeholders in their decision-making and sustainability assessment. The use of environmental, social, and corporate governance factors helps identify the company's strengths and weaknesses, and provides a more sophisticated insight into it than the one-dimensional methods based on economic performance alone.

Keywords: corporate sustainability; environmental, social, corporate governance indicators; value added; factor analysis; confirmatory factor analysis; Data Envelopment Analysis

1. Introduction

The concept of sustainable development was first discussed in the second half of the 20th century; it was defined in 1987 and gradually implemented at the macroeconomic level in response to global problems (e.g., global warming, soil degradation, poverty) that cannot be addressed at the local level [1]. However, during the implementation of sustainable development policies, there was a shift from the macro to the micro level because the actual power to enforce changes rests with economic entities, namely companies. Many studies assessed current consumption and production patterns as unsustainable in the long term. The influence of various stakeholder groups began to grow and it is becoming obvious that the traditional attitude to evaluating and reporting the economic performance of a company is no longer sufficient [2,3]. The authors [4] note that environmental, social, and corporate governance (ESG) indicators are also important in terms of corporate strategy. It became apparent that non-financial ESG indicators needed to be included in the management of corporate value. The Sustainable Value Added (SVA) model is a relatively new method which takes into consideration the sustainable value (SV) of the company. The SVA model was first published in Sustainable Value Added—Measuring Corporate Performance Beyond Sustainable Eco-Efficiency [5]. The SVA model includes only indicators relating to environmental issues (e.g., waste, emissions, and energy) and social aspects (e.g., accidents); these are, however, only minimizing indicators—the model does not consider maximizing indicators at all (such as the community, investment into employee education and training, etc.). The aim of this paper is to present a model of the Sustainable Environmental, Social and Corporate Governance Value Added ($SESG_{VA}$) that is based on the strengths of the original SVA but overcomes its weaknesses. The goal of empirical research is to focus on measuring and managing sustainability of the manufacturing industry in terms of $SESG_{VA}$ model and, based on empirical research and data from 2009–2013, to propose a $SESG_{VA}$ model for manufacturing companies. Focus on the manufacturing industry is due to the fact that the industry constitutes an important sector of the Czech economy and has a significant impact on the environment and in the field of sustainable development it plays an important role. The manufacturing industry is one of the most important sources for gross domestic product (GDP) in the Czech Republic.

2. The Conceptual Framework

The question of how to determine a company's SVA was raised by Figge and Hahn [6], who also devised the method of SVA. Figge and Hahn [6] published their first SVA model based on comparing earned value of a company with a benchmark entity, assuming the same impact of both the company and the benchmark entity on the environment. The latter may be, e.g., another company, a sector, a national economy, or an international fixed target quantity value of economic and environmental variables [6].

From an economic point of view, value can be viewed through the prism of utilized resources, which represents a holistic approach to value creation and is based on the interaction of resources. Porter and Kramer [7] came up with a concept of value as something beneficial for both the company and the society. They point out that the internal economic costs approach needs to be extended to include social costs and benefits that contribute to long-term sustainability. We can look at environmental resources as eco-efficiency [6]. Eco-efficiency describes the degree to which the company makes use of the environmental resources in reverse proportion to its economic output (e.g., CZK/tonnes of CO_2). Social-efficiency can be calculated as the ratio of the added value to the social impact of the company (e.g., CZK/work injury). Environmental and social (added) value increases or decreases the SVA, in proportion to the quantity of environmental or social resources used compared to the benchmark [6].

2.1. The Sustainable Value Approach

The Sustainable Value (SV) model is based on the concept defined by Figge and Hahn [5,6,8], and is based in the theory of capital and opportunity costs. Given that there are n different forms of capital, the sustainable value created by the company can be calculated as follows (see Equation (1)). [8]:

$$SV = \frac{1}{n}\sum\nolimits_{i=1}^{n} \left(\frac{y}{x_i} - \frac{y^*}{x_i^*}\right) x_i, \tag{1}$$

where: $\frac{y}{x_i} - \frac{y^*}{x_i^*}$ is *value spread*; $\left(\frac{y}{x_i} - \frac{y^*}{x_i^*}\right) x_i$ is *value contribution*.

SV	sustainable value of the company
n	number of forms of capital considered
y	value added (output) of the company
y^*	value added (output) of the benchmark
x_i	amount of capital i used by the company
x_i^*	amount of capital i used of benchmark
y^*/x_i^*	opportunity cost

Figge and Hahn [8] used the following as x_i indicators: CO_2 emissions [t], CH_4 emissions [t], SO_2 emissions [t], NO_x emissions [t], CO emissions [t], PM_{10} [t], and work accidents [number].

Value spread refers to the value per unit of capital *i*, which is how much higher or lower the value created by the company is, for which the benchmark is of fundamental importance (the authors chose national economy indicators and environmental and social indicators as output and input indicators, respectively). Such a choice can significantly affect the resulting sustainable value. The value contribution is calculated as the value spread of capital *i* multiplied by the amount of capital *i* used by the company. The overall sustainable value created by the company is the sum of the value contributions. Each form of capital is divided by *n* resources considered in the calculation of the sustainable value. SV indicates "whether the value added created by a firm exceeds the costs of its capital use" [8]. Sustainable efficiency of capital use is determined by relating the value added created by the firm to the opportunity cost of all forms of capital used (see Equation (2)). The opportunity cost of this capital (SE) is calculated as the difference between the value added created by the company and its sustainable value [8]:

$$\mathrm{SE} = \frac{y}{y - \mathrm{SV}}, \quad (2)$$

where: SV is the sustainable value of the company; and y is value added (output) of the company.

Sustainable efficiency greater than one implies that the value added created by the company is greater than the opportunity cost of its capital (the efficiency of the benchmark). Even the authors themselves recognize that this model of SV measurement is imperfect and does not say whether the company is sustainable; it only indicates that it uses its resources in a more sustainable way than the benchmark. The SV model has its opponents [9–11] who criticize it for using an arbitrary benchmark to determine eco-efficiency of a firm and for being based on a simple average of added values.

2.2. The Economic Value Added

A suitable solution appears to include the Economic Value Added (EVA) into the $SESG_{VA}$ model. The EVA is a method of calculating the actual economic profit of the company. The point of departure for determining the EVA will be a model used by the Ministry of Industry and Trade of the Czech Republic. This model was created by authors [12]. The EVA on the basis of economic profit can be calculated as follows (see Equation (3)):

$$\mathrm{EVA} = (ROE - r_e) \times C, \quad (3)$$

where: C is invested capital, ROE is return on capital, r_e is equity capital costs.

In response to critical remarks it was deemed necessary to create an integrating model for the measurement and management of corporate sustainability that uses the synergistic effects of selected SV and EVA models with the benchmarking support which can become an effective tool for the measurement and management of Czech manufacturing companies.

The link between SV and EVA provides a huge potential for synergy. In addition to opportunity costs, SV also takes into account the environmental, social and economic dimensions of corporate sustainability and is a much more comprehensive tool for corporate performance measurement.

3. Materials and Methods

The methodology is based on two main pillars, i.e., the SV model, environmental, social, and corporate governance performance indicators (I_{ESGi}), and the Data Envelopment Analysis (DEA) model. As we have already stated, the current models (e.g., EVA, SV) have shortcomings: they only have a limited number of factors, they do not respect intricate interdependencies between indicators, and they do not always reflect reality. The currently prevailing investment strategy as well as a tool of the future cash flows is the integration of ESG indicators. ESG integration and economic performance indicators are probably the best ways to measure sustainable performance based on the concept of sustainable value.

The methodology of research for determining $SESG_{VA}$ model of manufacturing companies includes: selection and reduction of ESG indicators through factor analysis, assigning weights to a reduced set of ESG indicators, setting a benchmark through the additive DEA model and verification of the $SESG_{VA}$ model on selected Czech manufacturing companies. The basis of the $SESG_{VA}$ model is the selection of appropriate environmental, social and corporate governance (I_{ESGi}) performance indicators. The methodology is described in detail in articles [13–17]. International resources are used to define the environmental performance indicators, in particular the Global Reporting Initiative, EMAS III, the International Federation of Accountants, and indicators of the Czech Statistical Office. Resources, such as the Global Reporting Initiative [18,19], ISO 26000, and the International Federation of Accountants [20], are used to determine the social performance indicators. The OECD documents Principles of Corporate Governance [21], Green Paper—The EU Corporate Governance Framework [22], and the International Federation of Accountants [20], are the points of reference for the determination of corporate governance performance indicators. The basic selection of I_{ESGi} performance indicators is shown in Appendix A.

Exploratory factor analysis (EFA) is used to reduce the large number of I_{ESGi} performance indicators to a smaller number of latent factors [23]. EFA is a statistical method for investigating common, but unobserved, sources of influence in a set of variables [24]. The factor analysis model shows the relationship between the vector of manifest (measured) variables Z ($Z_1, \ldots, Z_R$) and one or more latent factors F ($F_1, \ldots, F_R$), which act as variables explaining the correlation of Z: $F \rightarrow Z$. F factors are not known and the task of the method is to identify them and to make measurements that would support their interpretation. The Z vector enters the model as a vector of standardized components (Z-scores) because the method is usually based on the correlation matrix of Z components (the correlation disregards the shift in the start of the measurement scale and the units of the used scale). The general factor analysis model (see Equation (4)) can be expressed as follows [25,26]:

$$Z_j = \gamma_{j1} F_1 + \gamma_{j2} F_2 + \ldots + \gamma_{jR} F_R + \varepsilon_j, \quad (4)$$

where: $\varepsilon_1, \varepsilon_2, \ldots, \varepsilon_p$ is p of random (error) components; γ_{j1}, γ_{j2} constants are called factor loadings. Z measured, manifest variables; F unknown, unmeasured, latent causes/factors together affecting Z in the way expressed by equations.

To reduce the number of indicators, the standard Principal Component Analysis (PCA) is used, which assesses the mutual linear relationship between the observed variables. The latent variable (see Equation (5))—the first principal component—is expressed by the equation [27]:

$$Z_j = \omega_1^T (x), \quad (5)$$

where: ω_1 is determined by maximizing the variance of component Z_1 across all vectors ω_1 so as to fulfill the normalization condition $\omega_1^T \omega_1 = 1$. The second principal component is defined in the same way.

The verification of variables determined from the EFA is possible using a confirmatory factor analysis. Confirmatory factor analysis (CFA) is a form of structural equation modeling that specifically deals with measurement models. Exploratory factor analysis is used to find an appropriate number of factors for the original variables that will describe them in sufficient detail, and then to determine those factors. In CFA, on the other hand, the number and nature of factors are already known and the aim is to determine whether they describe the original data with sufficient precision. When we have sufficient theoretical insight into our data and links between them, CFA can be used to investigate, e.g., which variables should be grouped into one factor or how many factors we need to express the given data [23]. The results of CFA include estimates of factor variance and covariance, loadings of the indicators on their respective factors and the amount of measurement error for each indicator.

All indicators specified to measure a common factor have relatively high standardized factor loadings on the factor >0.70 and estimated correlations between the factors are not excessively high <0.90 in absolute value [28].

The basis of the $SESG_{VA}$ model is to determine the benchmark that fits the value spread of the company. An analysis of the SV model consists essentially in measuring the efficiency of units, naturally using the opportunity costs. What is the efficiency of units, and how can that be applied into the $SESG_{VA}$ model? The production unit is engaged in the production of what can be referred to as output. To produce a certain number of outputs, it consumes a certain number of inputs. The aim is to achieve a positive result, i.e., to achieve the highest possible value of the output [29]. As for inputs, the aim is to minimize them. Efficiency can be defined as the ratio of the weighted output to weighted input. This ratio indicator enables us to easily compare a large number of homogeneous production units, i.e., those with identical inputs and outputs. In their paper, Charnes, Cooper, and Rhodes [30] (CCR) presented the first model for measuring the efficiency of such production units—the Data Envelopment Analysis. Basic DEA models differ in assumptions of returns to scale. The CCR model assumes constant returns to scale [30]. Banker, Charnes, Cooper model (BCC model) assumes variable returns to scale [31].

In the design of the $SESG_{VA}$ model, the essence of efficiency is used. The additive Slack-Based Measure (SBM) model is applied that measures the efficiency directly through the values of auxiliary variables, si^+ and si^- and it is, therefore, not necessary to distinguish between the input and the output orientation when formulating it [32,33]. Units that are identified as ineffective in this model can achieve efficiency by simultaneously reducing inputs (x_q) and increasing outputs (y_q) to the level of their virtual units. Values of the variable λ identify the peer group for any inefficient unit. A mathematical model which assumes constant returns to scale:

$$\max e^T s^+ \ + e^T s^-, \tag{6}$$

$$\text{under the conditions}: \ X\lambda + s^+ = x_q, \tag{7}$$

$$Y\lambda - s^+ = y_q, \tag{8}$$

$$e^T \lambda < \ = >1, \tag{9}$$

$$\lambda, \ s^+, \ s^- \ \geq 0, \tag{10}$$

In this model, efficient units are those whose value of the objective function equals 1. Inefficient are units whose e^T value is less than 1. The main advantage of this model is that there cannot be a case where the unit achieves an efficiency rating of 1 but in fact is inefficient because one of its auxiliary variables $\boldsymbol{s_j}^{+*}$ or $\boldsymbol{s_i}^{-*}$ does not equal zero.

4. Results and Discussion

The empirical research is based on the hypothesis that the corporate performance and sustainability are influenced by the integrating effects of environmental, social, and corporate governance performance indicators I_{ESGi}. To determine the $SESG_{VA}$ model for measuring the sustainability of the manufacturing companies, 25 I_{ESGi} indicators and their data were determined (Appendix A). Data were obtained between 2009 and 2013 according to CZ_NACE from 211 companies with over 250 employees that have EMS certification according to DIN EN ISO 14001. Data of I_{ESGi} indicators were from the following companies: 10-manufacture of food products (3.3%); 11-manufacture of beverages (5.2%); 13-manufacture of textiles (2.8%); 20-manufacture of chemicals and chemical products (7.6%); 22-manufacture of rubber and plastic products (3.3%); 24-manufacture of basic metals (8.1%); 25-manufacture of fabricated metal products, except machinery and equipment (26.1%); 26-manufacture of computer, electronic, and optical products 12.3%); 27-manufacture of electrical equipment (12.8%); and 28-manufacture of machinery and equipment (18.5%). Data were initially analysed using descriptive statistics, which served for the description and identification of basic information contained in the data. The I_{ESGi} indicators were evaluated by means of the correlation analysis of Spearman's coefficient.

The basic set of 25 I_{ESGi} performance indicators (Appendix A) was reduced using statistical methods, in particular the EFA and PCA to a total of 13 I_{ESGi} performance indicators, see Table 1. Before EFA and PCA scales of I_{ESGi} were modified so that higher values mean better results. In terms of the appropriateness of using factor analysis, individual variables were tested using the Kaiser-Meyer-Olkin rate (KMO) [34,35]. KMO values for environmental, social, and corporate governance variables exceed 0.6. The structure of relationships between variables was identified using the factor analysis with an estimate of factors using the method of principal components and the rotation of factors using the varimax method. The EFA was performed in the IBM SPSS 23 (Armonk, NY, USA) statistical program. The next step was to determine the weight of the *i*-th I_{ESGi} indicator, the reason being a higher preference in terms of the indicator's importance. The method of principal components is suitable for the exact assessment of weights where the I_{ESGi} indicators are assigned weights w_i on the basis of the component score.

Table 1. Reduced I_{ESGi} performance indicators using the exploratory factor analysis.

I_{Eni}—Environmental Indicators	I_{Soci}—Social Indicators	I_{Cgi}—CG Indicators
I_{En2}—Non-investment expenditures for the protection of the Environment ['000 CZK]	I_{Soc1}—Total amount of money for charitable work in support of local communities ['000 CZK]	I_{Cg1}—Information about financial results [yes = 0.98; no = 0.02]
I_{En6}—Total annual consumption of water [m^3]	I_{Soc2}—Total amount of money for gifts ['000 CZK]	I_{Cg5}—Collective agreement [yes = 0.53; no = 0.47]
I_{En7}—Total annual production of waste [t]	I_{Soc6}—Number of employees terminated [number]	I_{Cg4}—Reports from environmental and social areas [yes = 0.60; no = 0.40]
I_{En8}—Total annual production of hazardouswaste [t]	I_{Soc5}—Total number of employees [number] I_{Soc9}—Education and training expenditures ['000 CZK]	I_{Cg6}—Code of ethics [yes = 0.70; no = 0.30]

The CFA model of sustainable value is shown in Figure 1. The structure of the model is derived from EFA results. Sustainable value is based on integration of environmental indicators I_{Eni}, social indicators I_{Soci} and CG indicators I_{Cgi}. These groups of indicators create the environmental factor F_{En}, social factor F_{Soc}, and a corporate governance factor F_{Cg}. Based on the results of the EFA, four variables were removed from the environmental area. F_{En} factor is filled with four variables. In the social area, four variables were removed due to their low factor load relative to the other variables, F_{Soc} factor is filled with five variables. F_{Cg} factor is filled with four variables. Factor structure accuracy was further verified through the CFA in the IBM SPSS AMOS (Armonk, NY, USA) program, particularly for the accuracy of the factor structure. Thirteen I_{ESGi} performance indicators entered the CFA, see Table 1. To achieve acceptable levels of the indices, it was necessary to modify the model and leave out I_{Soc2}—Total amount of money for gifts. The quality of the model increased as a result of the removal of redundant variables and the addition of the required covariance between the variables and the indices attained the desired values. Although direct correlation between F_{En} and F_{Soc} is insignificant, the environmental area of sustainable value is influenced not only environmental indicators I_{Eni}, but also by the number of employees I_{Soc5}, and charitable work in support of local communities I_{Soc1} also relates to environmental concerns. The social area is influenced by production of waste I_{En7}.

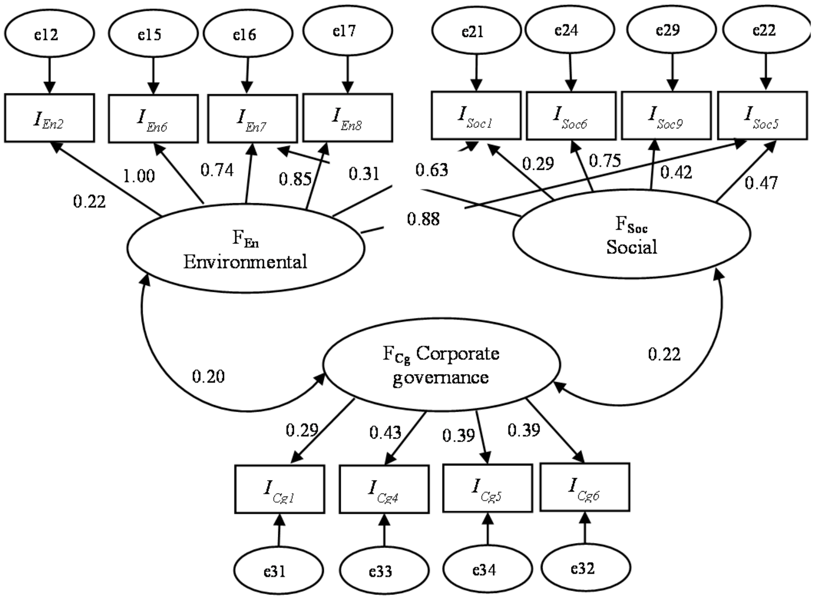

Figure 1. CFA model of sustainable value.

The process of balancing the model follows the recommended methodology [23]. The balancing of the model is assessed by the goodness of fit index (GFI), root mean square error of approximation (RMSE), normed fit index (NFI), Tucker Lewis index (TLI), comparative fit index (CFI) and incremental fix index (IFI), see Table 2.

Table 2. Goodness-of-fit statistics for the CFA model of sustainable performance measurements.

Model	Chi-Square (χ^2)	df	Chi-Square (χ^2)/df	Probability (p-Value)	CFI	RMSEA	NFI	TLI	GFI	IFI
Criterion	Preferably small	-	$\leq$3	$\geq$0.05	$\geq$0.9	$\leq$0.08	$\geq$0.9	$\geq$0.9	$\geq$0.9	$\geq$0.9
Results	43.868	40	1.097	0.311	0.996	0.021	0.961	0.994	0.938	0.996

The testing using CFA proved that the model was appropriate because data analysis showed that chi-squared $(\chi^2)/\text{df} = 1.097$ and chi-squared $(\chi^2)/\text{df} \leq 3$, see Table 2. Based on CFA results, a modified factor structure was proposed. No factor structure changes were made in the environmental factor F_{En} and corporate governance factor F_{Cg} based on the results of the exploratory factor analysis. One variable (I_{Soc2}) was discarded from the social factor F_{Soc} due to its low factor loading.

I_{ESGi} performance indicators from EFA and CFA are used for the calculation of the SESG_{VA} model, i.e., twelve I_{ESGi} performance indicators and their weights w_i, which give priority to I_{ESGi} indicators, see Tables 3 and 4. These I_{ESGi} performance indicators are included as input (resource) indicators. The I_{Soc1} —Total amount of money for charitable work in support of local communities and I_{Soc9}—Education and training expenditures are maximizing indicators and this is why they are used in the transformed form in the SESG_{VA} model. I_{Soc1} and I_{Soc9} were transformed to minimizing indicators. This step is presented as a "saving" compared to the worst scenario. For the same reason, I_{Cgi} must be transformed. I_{Cgi} enters the model as negatively defined, and e.g., I_{Cg1} in the SESG_{VA} model calculation is used as non-information about financial results with values [yes = 0.02; no = 0.98]. Thus, modified indicators can then be treated as minimization indicators, while the information provided by the indicator remains preserved.

Table 3. I_{ESGi} performance indicators and their weights w_i in the SESG$_{VA}$ model.

I_{ESGi}—Input Indicators		
I_{Eni}—Environmental Indicators	**I_{Soci}—Social Indicators**	**I_{Cgi}—CG Indicators**
I_{En2}—Non-investment expenditures for the protection of the environment ['000 CZK]	I_{Soc1}—Total amount of money for charitable work in support of local communities ['000 CZK]	I_{Cg1}—Information about financial results [yes = 0.98; no = 0.02]
I_{En6}—Total annual consumption of water [m^3]	I_{Soc6}—Number of terminated employees [number]	I_{Cg5}—Collective agreement. [yes = 0.53; no = 0.47]
I_{En7}—Total annual production of waste [t]	I_{Soc5}—Total number of employees [number]	I_{Cg4}—Reports from environmental and social areas [yes = 0.60; no = 0.40]
I_{En8}—Total annual production of hazardous waste [t]	I_{Soc9}—Education and training expenditures ['000 CZK]	I_{Cg6}—Code of ethics [yes = 0.70; no = 0.30]

Weights determined by factor analysis are standardized in order to satisfy the condition: $\sum_{r=1}^{R} w_i = 1$, for i = 1, 2, . . . , k. The standardized weights w_{Ni} are shown in Table 4.

Table 4. Standardized weights w_{Ni} of indicators I_{ESGi} in the SESG$_{VA}$ model.

Indicators	I_{En2}	I_{En6}	I_{En7}	I_{En8}	I_{Soc1}	I_{Soc6}	I_{Soc5}	I_{Soc9}	I_{Cg1}	I_{Cg5}	I_{Cg4}	I_{Cg6}
w_i	0.115	0.363	0.336	0.361	0.405	0.307	0.427	0.273	0.394	0.386	0.477	0.415
w_{Ni}	0.027	0.085	0.079	0.085	0.095	0.072	0.100	0.064	0.093	0.091	0.112	0.097

Economic indicators EBIT, EAT, and EVA are gradually included in the SESG$_{VA}$ model as output indicators, see Table 5.

Table 5. Economic output indicators in the SESG$_{VA}$ model.

I_{Ecoi}—Economic Indicators		
Output 1—Model A$_{EBIT}$	**Output 2—Model B$_{EAT}$**	**Output 3—Model C$_{EVA}$**
I_{Eco1}—Earnings before Interest and Taxes (EBIT) ['000 CZK]	I_{Eco2}—Earnings after Taxes (EAT) ['000 CZK]	I_{Eco3}—Economic Value Added (EVA) ['000 CZK]

Modified SVA model based on [18] for the calculation of SESG$_{VA}$ model:

$$SESG_{VA} = En_{VA} + Soc_{VA} + Cg_{VA}, \tag{11}$$

$$En_{VA} = \sum_{r=1}^{R} w_{Ni} \left(\frac{I_{Ecoi}}{I_{Eni}} - \frac{I^*_{Ecoi}}{I^*_{Eni}} \right) I_{Eni}, \tag{12}$$

$$Soc_{VA} = \sum_{r=1}^{R} w_{Ni} \left(\frac{I_{Ecoi}}{I_{Soci}} - \frac{I^*_{Ecoi}}{I^*_{Soci}} \right) I_{Soci}, \tag{13}$$

$$Cg_{VA} = \sum_{r=1}^{R} w_{Ni} \left(\frac{I_{Ecoi}}{I_{Cgi}} - \frac{I^*_{Ecoi}}{I^*_{Cgi}} \right) I_{Cgi}, \tag{14}$$

$$\text{on condition}: \ f(x) = \begin{cases} x, & x \neq 0 \\ I_{Ecoi}, & x = 0 \end{cases}, \text{where } x = \left(\frac{I_{Ecoi}}{I_{ESGi}} - \frac{I^*_{Ecoi}}{I^*_{ESGi}} \right) I_{ESGi}. \tag{15}$$

$$\text{Then } SESG_{VA} = \sum_{r=1}^{R} w_{Ni} x \tag{16}$$

where

En_{VA}	Environmental value of the company
Soc_{VA}	Social value of the company
Cg_{VA}	Corporate value of the company
R	Total amount of resources considered
w_{Ni}	standardized weight of i-th indicator I_{ij}
I_{Ecoi}	Economic output of the company
I^*_{Ecoi}	Economic output of benchmark
I_{Eni}	Environmental resources of the company
I^*_{Eni}	Benchmark value of environmental resources
I_{Soci}	Benchmark value of social resources
I^*_{Soci}	Social output of benchmark
I_{Cgi}	Corporate governance resources of company
I^*_{Cgi}	Benchmark value of corporate governance indicator

Individual economic indicators I_{Ecoi} were, in turn, used in the $SESG_{VA}$ model calculations, and the model was applied to data from 42 large companies with positive economic indicators I_{Ecoi} selected from a sample of Czech manufacturing companies. The average $SESG_{VA}$ model in the selected companies was negative even though economic indicators of all of the companies were positive. On average, the corporate governance indicators contributed to the added value the most. Most companies report that they publish their financial results and have a code of ethics. Indicators with the lowest value—and, thus, causing the greatest decrease in $SESG_{VA}$—were social indicators, in particular community donations (I_{Soc1}) and expenditure on education (I_{Soc9}). Even though they are large corporations, they spend relatively small amounts on employee education and community donations. According to the descriptive characteristics of individual models shown in Table 6 it is obvious that Model A_{Ebit} shows the most deviated values. Model A_{Ebit} identified 21% of companies with a positive $SESG_{VA}$ model, while Model B_{EAT} reflected 17%, and Model C_{EVA} reflected only 12% of such companies; this is obviously due to the robustness of applied output indicators.

Table 6. Descriptive characteristics of $SESG_{VA}$ models.

Model	SESG$_{VA}$ Descriptives					
	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Model A_{EBIT}	42	−3,302,703.78	15,088,236.69	2,328,165.47	−98,118,216.77	1,074,447.48
Model B_{EAT}	42	−2,307,604.61	8,713,279.21	1,344,488.17	−56,424,267.84	1,094,196.71
Model C_{EVA}	42	−1,286,197.61	4,111,942.70	634,486.53	−26,549,905.76	464,628.07

Table 7 shows the calculation of a $SESG_{VA}$ model for a company "A". This case study demonstrates how different the results may be depending on the concept of the company value that takes into account ESG factors. The company in the case study generates positive EBIT, EAT, and EVA, but its $SESG_{VA}$ becomes negative in all of the models. The additive CCR model in DEA was used to determine the benchmarks for environmental, social and economic indicators. Benchmarks for the corporate governance indicators were set to prioritize companies that publish reports and information about their activities and have a code of ethics, i.e., the benchmark was defined as a "*yes*". The lowest $SESG_{VA}$ was found in the A_{EBIT} model. The water consumption indicator (I_{En5}) caused the greatest decrease in the total $SESG_{VA}$.

Models A_{EBIT} and C_{EVA} propose to maintain the level of economic output and to reduce only the input indicators I_{ESGi} allowing the company to create value in indicators I_{Cg1}, I_{Cg4} and I_{Cg6}. In the B_{EAT} model, the values of both input and output economic indicators are adjusted and therefore the company "A" does not generate any positive added value for any I_{ESGi} indicator. Apparently there is a large gap between the actual values and indicator benchmarks. The company could achieve the values of the best companies in the group if it significantly reduced the value of all environmental and social indicators.

Table 7. Calculation the $SESG_{VA}$ model for the company in the case study.

Indicators	Company A	Benchmark Values of Indicators			Value Added by Indicators I_{ESGi} ['000 CZK]		
		Model A_{EBIT}	*Model* B_{EAT}	*Model* C_{EVA}	*Model* A_{EBIT}	*Model* B_{EAT}	*Model* C_{EVA}
I_{En2}—Non-investment expenditures for the protection of the Environment ['000 CZK]	2047	418	269	324	−15,576	−12,162	−12,319
I_{En6}—Total annual consumption of water [m^3]	7199	785	589	710	−102,710	−64,515	−66,626
I_{En7}—Total annual production of waste [t]	849	108	332	400	−80,533	−8810	−7618
I_{En8}—Total annual production of hazardous waste [t]	85	14	62	74	−64,701	−2759	−1062
I_{Soc1}—Total amount of money for charitable work in support of local communities ['000 CZK]	8348	1032	1127	6083	−99,616	−41,451	−3033
I_{Soc6}—Number of terminated employees [number]	56	10	6	8	−51,060	−37,373	−38,095
I_{Soc5}—Total number of employees [number]	295	99	130	157	−29,279	−9199	−7570
I_{Soc9}—Education and training expenditures ['000 CZK]	54,972	11,194	7422	19,645	−37,014	−27,925	−9868
$nonI_{Cg1}$—Information about financial results [yes = 0.02; no = 0.98]	0.02	0.02	0.02	0.02	13,754	−646	7974
$nonI_{Cg5}$—Collective agreement [yes = 0.47; no = 0.53]	0.53	0.47	0.47	0.47	−1718	−1411	−996
$nonI_{Cg4}$—Reports from environmental and social areas [yes = 0.40; no = 0.60]	0.40	0.40	0.40	0.40	16,564	−778	9603
$nonI_{Cg6}$—Code of ethics [yes = 0.30; no = 0.70]	0.30	0.30	0.30	0.30	14,345	−674	8317
I_{Eco1}—EBIT ['000 CZK]	147,889	147,889					
I_{Eco2}—EAT ['000 CZK]	60,078		67,026				
I_{Eco3}—EVA ['000 CZK]	85,744			85,744			
	$SESG_{VA}$ according to *Model* A_{EBIT} ['000 CZK]				**−437,544**		
	$SESG_{VA}$ according to *Model* B_{EAT} ['000 CZK]					**−207,703**	
	$SESG_{VA}$ according to *Model* C_{EVA} ['000 CZK]						**−121,293**

5. Conclusions

The economic concept of company value reflects a single aspect of the corporate sustainability, while all other sources are being neglected. Today's corporate stakeholders are not interested only in economic performance, they are increasingly interested in the company's impact on the environment and society. The $SESG_{VA}$ model makes it possible to express the company value in financial units, as any other conventional financial method for determining the company value, but on top of that it assesses the company's environmental and social inputs and the effects of corporate governance. Such a concept of values is in line with the idea of sustainable development. The above concept of the $SESG_{VA}$ model is based on SVA developed by Figge and Hahn [5,6]. The opportunity costs, however, are determined individually for each company. The benchmark is calculated using DEA, which determines the benchmark relatively to the best and most efficient companies in the group. DEA identifies the best practices, and for each inefficient company it quantifies the progress that must be achieved if the company is to reach its optimum ratio of ESG inputs to their economic outputs, and, thus, maximize the $SESG_{VA}$ model. The weakness of this method for determining benchmarks is its demands placed on data and the sensitivity of the result to what companies are selected for the sample.

The $SESG_{VA}$ model concept is based on the assumption that not all ESG indicators have the same impact on sustainability and this is why weights are allocated to individual indicators. The $SESG_{VA}$ model is intended for owners, investors, and other stakeholders to support their decision-making and sustainability assessment. The inclusion of ESG factors means that strengths and weaknesses of companies can be more readily identified, and permits a broader view of the company than the one-dimensional methods based only on their economic performance.

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Appendix A

Table A1. Environmental, social, corporate governance (I_{ESGi}) performance indicators.

Measurement Area	Indicators	Measure (Unit)
Environmental Indicators		
Environmental Investment	Investments for environmental protection	$I_{En}1$—Total investments for environmental protection ['000 CZK]
	Environmental non-investment expenditures	$I_{En}2$—Non-investment expenditures for the protection of the Environment ['000 CZK]
Emissions	Total annual emissions	$I_{En}3$—Total emissions to air [t] (solid particulate matter, SO_2, NO_x, NH_3, PM without CO)
	Total annual emission of greenhouse gases	$I_{En}4$—Total greenhouse gas emissions [t] (CO_2, CH_4, N_2O, HFCs, PFCs, SF6)
Consumption resources	Total annual energy consumption	$I_{En}5$—Total consumption of renewable energy [GJ]
	Total annual consumption of water	$I_{En}6$—Total annual consumption of water [m^3]
Waste	Total annual production of waste	$I_{En}7$—Total annual production of waste [t]
	Production of hazardous waste	$I_{En}8$—Total annual production of hazardous waste [t]
Social Indicators		
Society	Community	$I_{Soc}1$—Total amount of money of charitable work in support of local communities ['000 CZK]
	Donations to municipalities	$I_{Soc}2$—Total amount of money for gifts ['000 CZK]
	Customers' safety and health protection	$I_{Soc}3$—Total amount of money for non-compliance of regulations related to customer's safety and health protection
Human rights	Equal opportunities	$I_{Soc}4$—Total number of women [number] $I_{Soc}5$—Total number of employees [number]
Labour Practices and Decent Work	The rate of staff turnover	$I_{Soc}6$—Number of terminated employees [number]
	Labour productivity from value added	$I_{Soc}7$—Wage costs/Added value $I_{Soc}8$—Wage costs/Average number of Employees [CZK/number employees]
	Expenditure on education and training	$I_{Soc}9$—Education and training expenditures [000 CZK]
Corporate Governance Indicators		
Monitoring and reporting	Information about the company	$I_{Cg}1$—Information about financial results [yes = 0.98; no = 0.02] $I_{Cg}2$—Information about company goals and strategy [yes = 0.56; no = 0.44] $I_{Cg}3$—Information from control activities [yes = 0.61; no = 0.39]
	Reporting of voluntary reports	$I_{Cg}4$—Reports from environmental and social areas [yes = 0.60; no = 0.40]
Effectiveness corporate governance	Responsibile corporate governance	$I_{Cg}5$—Collective agreement [yes = 0.53; no = 0.47]
	Ethical behaviour	$I_{Cg}6$—Code of ethics [yes = 0.72; no = 0.28]
Structure corporate governance	Remuneration of corporate governance	$I_{Cg}7$—Total financial value of remunerations to Board of Directors and Supervisory Board [%]
	Effective composition of corporate governance	$I_{Cg}8$—Number of independent corporate governance members [%]

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