AI IN
ESG
INVESTING

Contents

1.Introduction

In the past decade, forms of sustainable finance have grown substantially due to an increasing demand by institutional and retail investors to better reflect sustainability issues in their investment choices. In particular, the use of environmental, social and governance (ESG) investment approaches has been driven by increased investor demand to make better use of non-financial information to guide asset allocation decisions to improve long-term value, while also better aligning portfolios with societal values. In this respect, growing concerns over the impact of climate change and the consequences of pandemics have drawn greater attention to environmental and social risks, combined with policy signals that the financial sector should be a driving force in advancing global sustainability.

ESG investing can be defined as any investment process that uses environmental, social, and/or governance criteria to evaluate investments or to access the societal and environmental impact of investments. Its focus is long-term, taking into consideration a broad spectrum of society and the environment[1].

The original motives for ESG investing were moral or ethical, based on third-party effects rather than investment returns. ESG investing finds its roots in the socially responsible investing (SRI) movement that came to the fore in the 1980s as part of a divestment campaign aimed at South Africa's apartheid regime[2]. Other familiar labels for the practice include ethical investing, economically targeted investing, sustainable or responsible investing, value-based investing, thematic investment, green investment, and impact investing. So, ESG investing can be used as an umbrella term that includes all of the previously mentioned labels.

In the late 1990s and early 2000s, proponents of SRI rebranded the concept as ESG by adding corporate governance factors (the G in ESG)[3]. Moreover, some asserted that ESG investing could improve risk-adjusted returns, thereby providing a direct benefit to investors. For example, instead of avoiding the fossil fuel industry to achieve collateral benefits from reduced pollution, ESG proponents argued that the fossil fuel industry should be avoided because financial markets underestimate its litigation and regulatory risks, and therefore divestment would improve risk-adjusted return. In this view, ESG investing can be a kind of profit-seeking, active investing strategy.

The underlying principle behind ESG-based investing lies in identifying and quantifying the intangible value possessed by socially responsible, environment-friendly firms with robust governance policies in place. These firms are believed to exhibit better risk management measures on ESG parameters, which in turn create

---

[1] Karishma K Dalal , Nimit Thaker, *ESG and Corporate Financial Performance: A Panel Study of Indian Companies*, Journal of Corporate Governance
[2] Max M. Schanzenbach, Robert H. Sitkoff, *ESG Investing: Theory, Evidence, and Fiduciary Principles*, Journal of Financial Planning, October 2020
[3] *Ibidem*

value for investors with long lasting sustainable business models. These ESG parameters represent the non-financial performance of an organization and are numerous and ever shifting[4].

The ESG factors listed subsequently are not exhaustive. What constitutes an acceptable set of ESG criteria is subjective, so it is important for investors and investment firms to do their own research to identify investments that match their own values. **Environmental** criteria (table 1) address how a company performs as a steward of the natural environment. **Social** criteria examine how a company manages relationships with its employees, suppliers, customers and the communities where it operates. **Governance** deals with a company's leadership, executive pay, audits and internal controls, and shareholder rights. See other examples of ESG factors along with proposed KPIs and Measurements in Appendix 1, tables A.1. and A.2.

Table 1. Alternative data categories

Issues	Alternative data categories
Environmental issues	Event detection
Climate change and carbon emissions	Satellite & weather
Air and water pollution	Trade
Biodiversity	Internet of Things
Deforestation	B2B
Energy efficiency	
Waste management	
Water scarcity	
Social issues	Reviews & ratings
Customer satisfaction	Employment data
Data protection and privacy	Event detection
Gender and diversity	Sentiment
Employee engagement	Social media
Community relations	
Human rights	

---

[4] *Ibidem*

Labor standards	
Governance issues	Employment data
Board composition	Web crawled
Audit committee structure	Sentiment
Bribery and corruption	Expert views
Executive compensation	
Lobbying	
Political contributions	
Whistleblower schemes	

Source: Eagle Alpha, Alternative Data Use Cases Edition 6

2. Different methods to use ESG factors

Asset managers during analysis use ESG data in order to evaluate risk and investment returns. Moreover, ESG factors enable them to recognize possible risks quickly. Environmental, social and governance factors let them also identify factors which are responsible not only for sustainable development, but also for stimulating economic growth. We can classify medical treatment and the educational system as these factors.
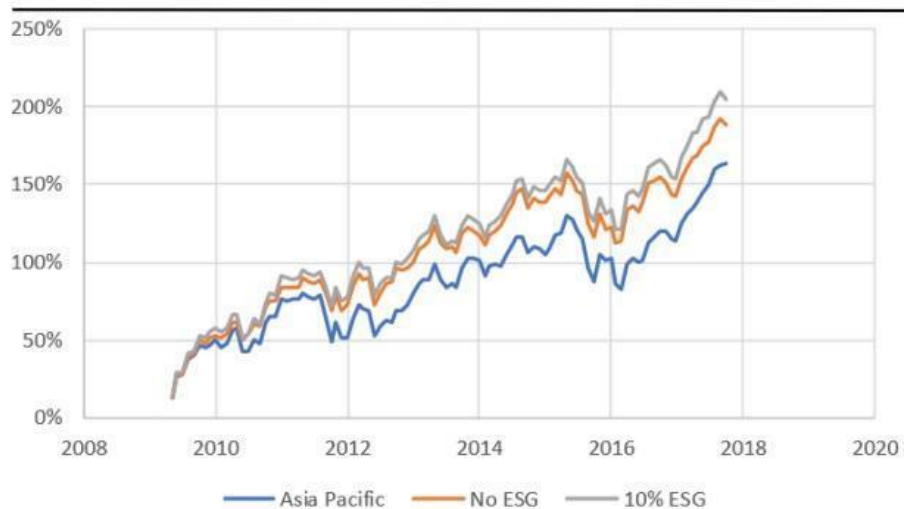
As a response to many questions and concerns about employment of alternative data, Eagle Alpha presented, in the sixth edition of its report, various case studies concerning usage of this data. Alternative data in cases was used specifically to invest. Case studies help understand better usage of alternative data which has become popular among investors. In this chapter we will look at chosen investments with ESG usage.

Case 1

Backtesting proves that a portfolio which was optimised with ESG usage had better results than benchmarks and portfolios based only on standard factors.

Data was developed with ESG rating from above 20 thousand companies. Each KPI in the database can achieve a score from 0 to 100. Such aggregated data can be used in various investment strategies. As a result of one of them, it turned out that usage of ESG data was profitable considering investment returns and shape ratios. Maximum drawdown was also lower than maximum drawdown from benchmarks. Detailed results are presented on figure 1 and table 2.

Chart 1. Investment with ESG usage.

Table 2. Investment returns.

	Asia Pacific	No ESG	10% ESG
Realized return (% Ann)	12,09%	13,30%	14,02%
Realized risk (% Ann)	14,98%	13,38%	14,04%
Sharpe ratio	0,81	0,99	1,00
Realized Active Return (% Ann)		1,21%	1,93%
Realized Active Risk (% Ann)		4,49%	3,97%
Information Ratio		0,27	0,49
Realized Beta	1,00	0,85	0,90
MaxDrawDown	20,7%	17,6%	16,8%

Case 2

Backtesting proves that ESG factors provide better results than many standard quantitative factors. ESG factors are also additive in regard of multicausal investment analysis.
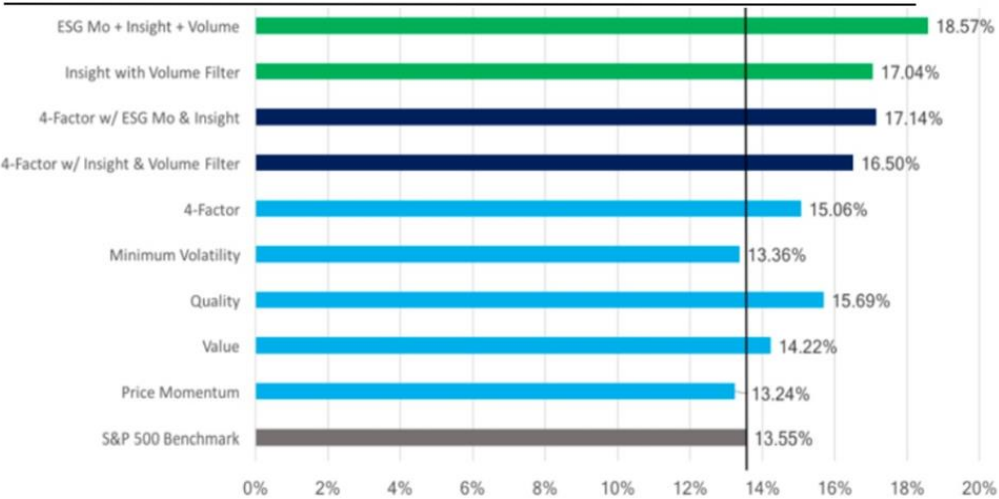
In presented case artificial intelligence was used to collect ESG data from various asset classes. Using AI to analyse unstructured text, the company gains access to values and risk factors which haven't been available. The Sustainability Accounting Standards Board (SASB) framework was used in order to use this data. Figure 2 displays cumulative investment results.

Chart 2. Cumulative investment returns.

Source: Eagle Alpha, Alternative Data Use Cases Edition 6

Chart 3. Comparison between various investment strategies.

Source: Eagle Alpha, Alternative Data Use Cases Edition 6

3. The most popular and recognised ESG databases

Profits from ESG usage were presented in the previous chapter. However, the number of ESG databases is still increasing. It is worth analyzing the most popular and recognised ESG databases among professional investors.

Table 3. Databases comparison

Database	Reputation, recognition	Companies which use database
Bloomberg ESG Data Service	12 200 ESG clients in 2016	
Corporate Knights Global 100	Among top 10 best companies in the Global 100 ranking 40% of them published information about results in the media	
DowJones Sustainability Index (DJSI)	Among 10 leaders in industry in 2016 all of them published information in the media	RobecoSAM
ISS	One of the leaders in collecting ESG data	
MSCI ESG Research	One of the leaders in collecting ESG data. Company's data is used in many top banks and financial institutions around the world	BlackRock Inc., PIMCO, Allianz Group, BMO Global Asset Management, Environment Agency Pension Fund, Kempen Capital Management, Legal and General Investment Management
RepRisk	UN partner in creating rules concerning responsible investing	Advent International, Amundi, APG ASN Bank, Baillie Gifford, Boston Common, Calvert Investments, Comgest, EDG, Emmond de Roschild, First State, Henderson, Just Capital, KKR
Sustainalytics Company ESG Reports	Cooperation with many companies and government institutions across the globe	BNY Mellon Investment Management, Prudential Financial, Columbia Threadneedle, Norwegian

		Government Pension Fund, City of London Investment Management (CLIM)
Thomson Reuters ESG Research Data	First agency which shares raw data to investors.	

Source: Based on *ESG Reports and Ratings: What They Are, Why They Matter, Harvard*

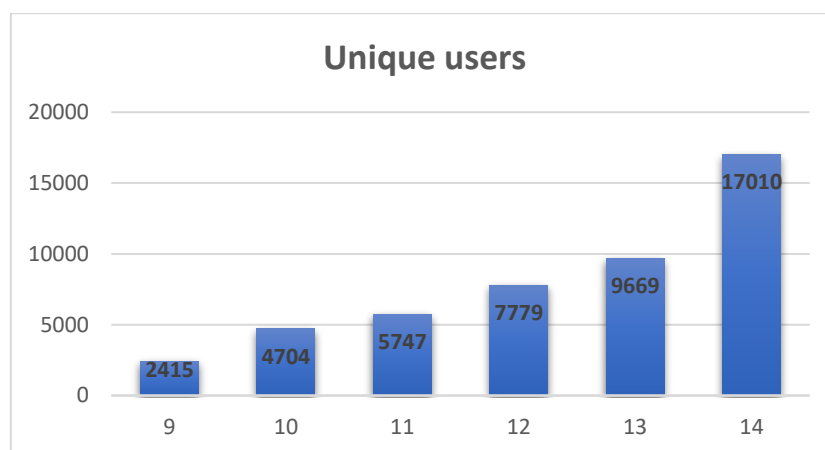# 4. Process of creating ESG index - Bloomberg ESG Data

It is crucial to understand what the ESG index is and how it is created before investing with ESG data. Nowadays, there are a lot of databases which differ in methodology and companies' results in them. In this chapter attention will be drawn to one of the most popular ESG databases - Bloomberg ESG Data. Figure 4 presents a rising number of Bloomberg unique users which confirms keen demand on Bloomberg's data among asset managers.

Table 4. Bloomberg ESG Data

Basic information	Methodology	Number of factors that is used in index
Scale: 0/100. Additionally, Bloomberg analyzes ratings from different companies which also make ratings.	Rating is based on annual companies' reports concerning CSR or sustainable development. Bloomberg also analyzes the reports made by public institutions, materials available on the Internet and interviews with a company. Collected data is checked and standardised.	Bloomberg ESG Data covers 120 ESG factors such as carbon dioxide emission, pollution, human rights, renewable energy and waste management. Companies' transparency and sharing data are very important. **Bloomberg penalizes companies which do not share all of the data.**

Source: *ESG Reports and Ratings: What They Are, Why They Matter, Harvard*

Chart 4. Unique Bloomberg database's users from 2009 to 2014.

Unique users

Source: *Environmental, social, and governance issues in investing, CFA Institute*

5.Influence ESG factors on investment returns[5]

Holding companies, which specialize in securities trading, use ESG data to predict the financial condition of enterprises. Financial models and financial statements don't cover all the information. Therefore, ESG data and factors are appreciated by quantitative analysts. ESG data also allows to look beyond financial analysis or investment horizon in the macroeconomic context.

For instance, low ESG index might implicate a fact that a company is organized worse than its competitors. Investors analyze the ESG index and consider different reasons for its level. Low level also indicates that companies should change their approach to organization in order to fulfil obligation after government's restriction or even modernise the manufactures. Because of that, drawing attention to ESG factors can be seen as beneficial.

Experts list three main risks related to environmental changes. Physical risk which concerns necessity to adapt to the new weather conditions due to climate change. Professionals point out also risk connected with giving compensation to the climate change victims. Third risk is a risk of policy changes. As a result of political changes, enterprises might be forced to change their business models. Undoubtedly, all of the risks have a positive impact on ESG factors' popularity and recognition, because asset managers and quantitative researchers tend to understand their importance and influence on financial results.

---

[5] Based on Investment governance and the integration of environmental, social and governance factors. OECD

6. Calculating ESG index. S&P DJI ESG case[6]

S&P Dow Jones Indices cooperates with SAM in order to create annual questionnaires. **S&P DJI ESG** index is based on results from these questionnaires. The list contains more than 3400 enterprises which are ranked in order of their size, region and country. Each indicator is created individually and is grounded on assigning wages to sustainable development's factors. Weights are differentiated regarding industry. Sum of the weights is 1. In this index, ESG factors are assigned to specific industries. If factor applies to industry, factor is used by experts. Otherwise, the wage of that factor is considered as 0.

$$T_{it} = \sum_{j=1}^{N} w_{I(i)jt} \bar{c}_{ijt} \qquad (1)$$

where:

i=1,2,…,N	- the companies in the anchor universe
t=1,2,…,N	- the assessment years
j=1,2,…,N	- the question level indicators
$\bar{c}_{ijt}$	- the adjusted indicator j for company i and for year t, the adjustment is grounded on the question level indicators $\bar{c}_{ijt}$
c_{ijt}	- the indicator j at question level for company i, for example S&P Global ESG Score from the SAM CSA

$$\sum_{j=1}^{N} w_{I(i)jt} = 1, \forall\, i, t \qquad (2)$$

$w_{I(i)jt}$ - the weight of indicator j for company i on assessment year t, where the sum of all weights for a specific company in a specific year is one

$I_{(i)} \in \{1, …, 61\}$ - the industry of company i

S&P Dow Jones Indices and SAM define two kinds of questions in questionnaire – obligatory and additional. Non-answer for additional question is not counted, whereas non-answer for obligatory question is equivalent to 0 points for that question and it is counted to overall score. In this case, statute implies punishment for omitting important issues and encourages companies to share sensitive data, which is crucial for investors.

Authors use normalization in order to obtain more reliable data. It's very important, because often some data is missing or industry has specific feature. In these cases, results' comparison will be nonquantifiable and risky. Normalization enable to point companies which have relatively high or low scores. Results is the sum of normalized factors with adjusted weights. Then results are also normalized, because score might be influenced by the type of industry. In some industries it is relatively easy to get better or worse results than in the others.

---

[6] *S&P DJI ESG Score Methodology.*

$$\tilde{c}_{ijt} = \Sigma \left(\frac{c_{ijt} - \bar{c}_{I(i)jt}}{\sigma_{I(i)jt}} \right) \tag{3}$$

where:

$\bar{c}_{I(i)jt}$ - the average for indicator c_{ijt} within the peer group $I_{(i)}$

$\sigma_{I(i)jt}$ - the corresponding standard deviation

$\Sigma(x) = \frac{2}{1+e^{-x}} - 1$ - the sigmoid function, which smooths the final indicator in the range (-1,1)

$$\tilde{T}_{it} = \frac{T_{it} - \bar{T}_{I(i)t}}{\sigma_{I(i)t}} \tag{4}$$

where:

$\bar{T}_{I(i)t}$ - the average of the total scores for industry I to which company i belongs and assessment year t

$\sigma_{I(i)t}$ - the corresponding standard deviation

Total score is the risk-adjusted score. The probability score is defined as the normal cumulative density function. Regarding probability let understand what percentage of an infinitely large population each company would be better than. Then the total score is multiplied by 100. Result is the final score.

$$P_{it} = F_t(\tilde{T}_{it}) \tag{5}$$

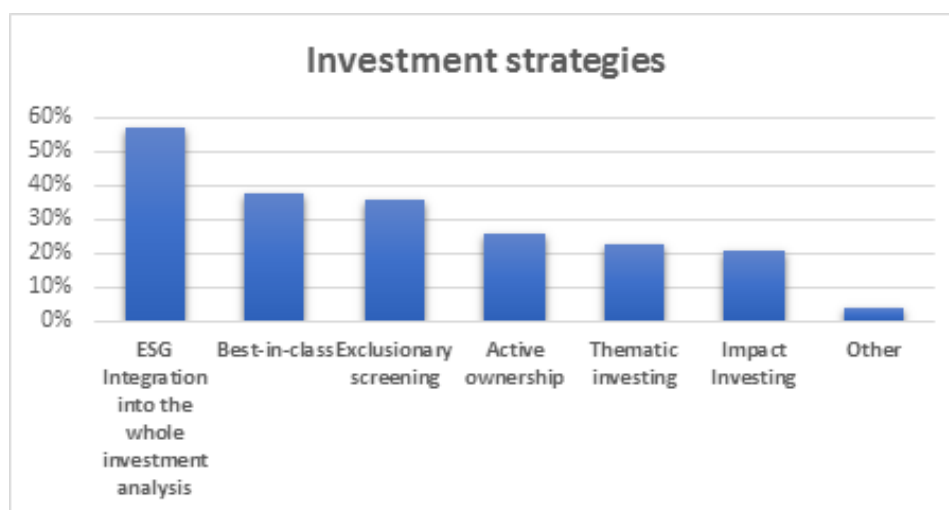# 7. Investment strategies with ESG usage[7]

There are many investment strategies which use environmental, social and governance data (ESG). The list presented below covers only the most popular approaches among investors. Investment strategy depends on individual risk inclination and preferred industry.

- **Exclusionary screening -** making a blacklist with companies and industries based on one or two ESG factors
- **General ESG integration -** including risks related to ESG in investment analysis
- **Best-in-class (inclusionary screening)** - creating a portfolio with best companies according to ESG index
- **Thematic investment - creating a portfolio of stocks which are connected with environmental, social and governance aspects**
- **Divestment -** approach opposed to thematic investment, investors stop investing money and sell stocks which come from companies related to ESG issues and risks, e.g. coal yield

---

[7] Based on Investment governance and the integration of environmental, social and governance factors. OECD

- **Engagement (active ownership)** - investment which is alternative to divestment, investors who are in the enterprises' management try to have impact on companies' decision and start discussion about sustainable development and ESG factors

Chart 5. The most popular investment strategies regarding ESG data

The three important stages in developing a financial model with ESG factors are collecting data, modelling data and estimation.

Table 5. Factors in developing a financial model with ESG factors.

Data	Investment analysis depends on the amount of data and its quality. ESG data sometimes might be unavailable because access is dependent on companies' policies. Moreover, data must be assessed in an appropriate economic context such as relevant industry. For example, fast food chains have different physical risk from oil companies and it is very difficult to compare them.
Modelling	ESG indicators usually are not used in the same way as standard data. The indicators don't have an impact on analysis in a short period. Another difficulty is to predict values of ESG indicators in the future. We are not able to do this based on historical data. Therefore, many models are developed in order to estimate risks connected with ESG issues.
Estimation	Investors take account of future cash flows and environmental, social, governance risks to determine discount rates.

8.Summary

Technological advances have caused an increasing demand on alternative data in recent years. Environmental, social and governance data are one of the most interesting among them. Trend to set up businesses with sustainable development policies is the reason why it is happening. Money stopped being the only aim. Owners want to treat workers as well as the environment. As a consequence, many investment strategies based on ESG factors have occurred. ESG data is appreciated by investors, because it presents data which wasn't available and measurable before. Nowadays, it is relatively easy to find ESG database and estimate various risks related to ESG issues.

Our research drew attention that ESG investment strategies have potential, although its use is not as easy as it might initially seem. The ESG ratings published in the databases such as Thomson Reuters Eikon show regularities in relation to the stock prices. Currently, for about ten years, a trend has been observed in which companies with higher ESG grades allow investors to achieve higher rates of return than the companies rated low in the rankings. It is worth pointing, that at the beginning of the 2000s the trend was reversed. Among the components of the weighted ESG index, the highest positive correlation between price increases and ESG grades is observed on the factor known as Social, while in terms of rates of return, the Environmental and Governance factors still favor low-rated enterprises.

Appendix I

Table A.1. Examples of ESG factors defined by international organizations, provided by banks and common areas suggested

Provided by	Environmental	Social	Governance
INTERNATIONAL FRAMEWORKS AND INITIATIVES*	Energy use and efficiency Greenhouse gas emissions Air pollutants Water use Waste management (water, solid, hazardous) Use of ecosystem services – impact and dependence Innovation in environment-friendly products and services	Workforce Workplace health and safety Customer health and safety Diversity and equal opportunity Poverty and community impact Supply chain management Training and education Customer privacy	Codes of conduct and business principles Accountability Transparency and disclosure Executive pay Board diversity and structure Bribery and corruption Stakeholder engagement Shareholder rights
PROVIDED BY BANKS	Consumption of materials, energy and water Production of greenhouse gas emissions, other emissions to air and water Production and management of waste and waste water Protection of biodiversity	Quality and innovation in customer relations, rights of the customers to gain information about environmental issues (e.g., climate and social consequences of global warming with which they can make responsible decisions) Human rights Labour practices: human resource management and	Set of rules or principles defining rights, responsibilities and expectations between different stakeholders in the governance of the bank Values that determine the definition of governance: executive pay, Board of Directors independence, composition and structure, shareholder rights, internal audit,

Source: A. Kocmanová, Z. Karpíšek, M. Klímková, *The construction of environmental indicators for determination of performance of ESG indicators to support decision-making of investors*, Business: theory and practice, Faculty of Business and Management, Brno University of Technology, Brno, 2012

Table A.2. Key indicators of environmental performance

Indicator	KPI	Measurement
EN1 - Energy	Energy use Total annual energy consumption [MWh/CZK] (indicator EN3 in GRI)	Total direct (produced internally) and indirect (delivered) energy consumption in megawatt divided by net sales. (Total direct energy consumption = Electricity/heat produced by the company)
	Renewable energy use Total consumption of renewable energy [%] (indicator EN3)	Total of renewable energy sources in MWh x 100 divided by total energy sources.
EN2 - Materials	Material use Annual mass flow of different used materials (in addition to the carriers of energy and water) [t/CZK] (indicator EN1)	Total consumption of materials in tons divided by total operation costs.
	Recycled materials use Proportion of the recycled input materials [%] (indicator EN2)	Percentage content of used recycled materials out of total consumption materials.
EN3 - Waste	Production of waste Total annual production of waste [t/CZK] (indicator EN22)	Total waste use in tons divided by net sales.
	Production of hazardous waste Total annual production of hazardous waste [t/CZK]	Total hazardous waste use in tons divided by net sales
EN4 - Water	Water Use Total annual consumption of water [m3/CZK] (indicator EN8)	Total water use in cubic meters divided by net sales.

EN5 -Emissions	Total annual emissions [t/CZK](indicator EN20)	Total emissions (solid particulate matter, SO2, NOx, NH3, PM without CO) in tones divided by net sales.
EN6 -Investment	Environmental protection investment [t/CZK] (indicator EN30)	Total investments in environmental protection in CZK divided by net sales.
Additional indicators		
EN7 - Compliance with the rules on the protection of environment	Environmental laws and regulations [number] (indicator EN28)	Number of voluntary agreements.
	Fines and penalties [CZK] (indicator EN28)	Monetary value of significant fines and total number of non-monetary sanctions for non-compliance with environmental legislation and regulations. The total monetary value of significant fines; number of non-monetary sanctions.
EN8 - Significant environmental impacts	Transport [t/km] (Indicator EN29 in GRI)	Greenhouse gas emissions Total direct (produced internally) emissions of CO2 equivalents in tones divided by number of covered kilometers in company.
EN9 - Biodiversity	Land use [%] of built-up surface (partial indicator EN11)	Total amount of land owned, leased, or managed for production activities or extractive use in square meters x 100 divided by the area of SCIs in hectare (according to Natura 2000 Sites).

Source: A. Kocmanová, Z. Karpíšek, M. Klímková, *The construction of environmental indicators for determination of performance of ESG indicators to support decision-making of investors*, Business: theory and practice, Faculty of Business and Management, Brno University of Technology, Brno, 2012