SILESIAN UNIVERSITY OF TECHNOLOGY PUBLISHING HOUSE

SCIENTIFIC PAPERS OF SILESIAN UNIVERSITY OF TECHNOLOGY 2023
ORGANIZATION AND MANAGEMENT SERIES NO. 176

# MACROECONOMIC CONDITIONS OF SUSTAINABLE DEVELOPMENT OF TRANSPORT ENTERPRISES – THE CASE OF FRANCE, GERMANY AND POLAND

Anna MISZTAL

University of Lodz, Faculty of Economics and Sociology; anna.misztal@uni.lodz.pl,
ORCID: 0000-0002-7455-5290

**Purpose:** The paper's primary purpose is to assess macroeconomic conditions' impact on the sustainable development of transport companies in France, Germany and Poland from 2008 to 2020. The study is important for the stable development of the transport sector and for ensuring a balance between socioeconomic and environmental development.
**Design/methodology/approach**: The research goal was achieved thanks to creating sustainable development indicators using the normalization method of variables; additionally, econometric models were developed using the Ordinary Least Square (OLS) and the Seemingly Unrelated Regression (SUR) methods.
**Findings:** The analysis results indicate that in France, Germany and Poland, there is a positive trend in the sustainable development of transport companies. What is more, its high rates also remain at the time of the outbreak of the Covid-19 pandemic. Economic growth is an essential macroeconomic condition which positively affects sustainable development and its pillars.
**Research limitations/implications**: The research limitations are related to data availability at the level of sectors, the selected research period, the selection of variables, and the normalization method. Moreover, the econometric methods were selected for estimating equations.
**Practical implications:** The empirical implications include that the research results can help those in power (formulation of specific legal regulations and conditions for sustainable development of enterprises). Furthermore, those managing enterprises should focus not only on the company's internal situation but also on analyzing macroeconomic factors continuously.
**Social implications:** Social development is crucial for the sustainable development of enterprises. Therefore it is necessary to take measures to develop human capital.
**Originality/value:** The study's novelty is the comparative assessment of the sustainable development of the transport sector in France, Germany and Poland. In addition, it should be noted that modern statistical methods were used for the analyses.

**Keywords:** sustainable development, transport enterprises, macroeconomic conditions.

**Category of the paper:** research paper.

## 1. Introduction

Sustainable development of enterprises (SD) occurs in three economic, social and environmental pillars. Its basis is improving business entities' financial and property situation, developing human and intellectual capital and reducing the negative impact on the natural environment. Undertaking synchronized actions in these three pillars is part of the general economic development strategy and is important for the current and future generations (Pieloch et al., 2021; Christensen et al., 2022).

SD of the transport sector is particularly important due to its role in the country's stable socio-economic development. It should be noted that this sector is one of the largest polluters of the environment due to the high emissivity of harmful substances (Aminzadegan et al., 2022).

Researchers emphasize that the SD of transport companies has recently shown positive dynamics due to changes in laws and regulations in the field of environmental protection, technological progress, and the introduction of eco-innovations, including electric vehicles (Nundy et al., 2021; Comporek et al., 2022; Guo et al., 2022).

There has yet to be a consensus on the consequence of individual macroeconomic indicators on the direction of transport sector development. Some scientists emphasize that economic growth can negatively impact the natural environment and positively affect social development (Comporek et al., 2021; Koengkan, Fuinhas, 2022).

The paper aims to assess the impact of macroeconomic conditions, including GDP per capita, exports and imports of goods and services, wages and salaries, unemployment rate, and inflation (HICP), on the sustainable development of transport companies in France, Germany and Poland in 2008-2020. The research covers the period from the financial crisis to the Covid-19 pandemic.

The main research hypothesis follows: "The GDP growth is the most significantly important indicator for the sustainable development of transport enterprises in France, Germany and Poland from 2008 to 2020".

The article supplements the literature on the topic significantly from the economic theory and practice perspective. A novelty is an attempt to assess the situation in the sustainable development of transport companies in the period of gradual recovery from the financial crisis. The analyzed countries differ in socio-economic development and conditions for the development of the transport sector. The paper shows how the transport sector in Poland fares compared to the best-developed economies of the European Union.

The manuscript includes an introduction, theoretical background, research methodology, results, discussion and conclusions. The paper uses Polish and foreign literature on the subject, collected based on the Web of Science and Scopus databases and statistical data from the Eurostat database. To verify the research hypotheses, the author created the synthetic indicators of sustainable development of transport enterprises based on the standard method of

standardization and unitarization and used the ordinary least square method (OLS) and seemingly unrelated regression (SUR) to assess the relationship between sustainable development and macroeconomic indicators.

## 2. Theoretical background

Sustainable development is a model for harmonizing social, economic and environmental systems (Kryk, 2003; Misztal, 2022). The goal of SD is to use and influence natural resources and to organize social life in such a way as to maintain a high quality of life (Borys, 2005; Costa, 2022; Sun et al., 2023). The concept concerns many aspects of human activity and its relationship with the environment, and its implementation requires cooperation between states, institutions, enterprises and ordinary people.

SD entails the need to use natural resources rationally, following the standards and principles of environmental protection. The concept requires the development of innovations, including environmental innovations, information technology and new techniques for products and services (Duran, 2015; Lazaretti et al., 2020).

Sustainable enterprise development is adopting business strategies and actions that meet the enterprise's and its stakeholders' needs today while protecting, maintaining and increasing the human and natural resources needed in the future (International Institute for Sustainable Development 1992). It is based on three economic, social and environmental pillars and entails implementing innovations and modern technologies (Hilson, Murcka, 2000; Singh et al., 2008; Ozturen, Ozgit, 2022). It means that the company is on the path to sustainable development (Dvořáková, Zborková, 2013).

SD of the enterprise is a concept that considers the interests of the current and future stakeholders of the enterprise (Grudzewski et al., 2010; Zhang et al., 2022). The implementation of the concept of sustainable development should be considered holistically, and it requires thinking not only in terms of life cycle costs and individual processes but also performed activities (Eckert, Giacona, 2023).

The company's sustainable development is next to corporate social responsibility, corporate ecological responsibility, and green development. Due to this and the scope and approach to its implementation, tasks, goals and principles, there are many different definitions of the term in the literature (Table 1).

According to many researchers, the practical implementation of the principles of sustainable development allows for gaining a competitive advantage and increasing market share (Grabara et al., 2015). It is necessary to meet the following postulates: determining the impact of the enterprise on its environment, building the image based on a positive impact on the environment and society, achieving the best possible financial results, multidimensional management, testing

different business models and scenarios, implementation of continuous learning processes organization, searching for and mitigating threats in the area of achieving sustainable goals development (Burchell, 2008; Albloushi et al., 2023).

**Table 1.**
*Selected definitions of sustainable development of enterprises*

| Author | Definition of "sustainable development of enterprise" |
|---|---|
| J. Elkington (1998) | Focus not only on maximizing profits, but equally on environmental and social issues. |
| M.E. Porter, M.R. Kramer (2002) | Sustainable development includes activities that aim to increase environmental performance and health and safety performance. |
| T. Dyllick, K. Hockerts (2002) | Sustainability is meeting the needs of current stakeholders without compromising the needs of future stakeholders. |
| C. Laszlo (2008) | A sustainable company becomes restorative – putting back on balance more than it takes from the Earth, and doing good for society. |
| E. Majewski (2008) | It includes everyone and everything, and its implementation requires the cooperation of people and institutions representing different professions, starting points and visions of the future. |
| D. Kiełczewski (2010) | It means socio-economic development in harmony with the protection of the natural environment. |
| W.M. Grudzewski (2010) | A sustainable enterprise is the concept of the company of 'tomorrow,' flexibly adapting to the constant turbulent changes in the environment and able to function in chaos and crisis. |
| L. Zu (2013) | Sustainable enterprise incorporates principles of sustainability into each of its business decisions, it supplies environmentally friendly products or services that replaces demand for nongreen products and/or services, it is greener than traditional competition, and has made an enduring commitment to environmental principles in its business operations. |
| T. Trojanowski (2015) | Sustainable development is a way to reduce the destructive economic activity of enterprises. |
| A. Pabian (2017) | A sustainable enterprise operates on the basis of sustainable resources. These resources include people, infrastructure, durable and non-durable assets, as well as any outgoing goods. |
| S. Singh (2018) | It requires that the triple bottom lines of long-term economic prosperity, social equity, and environmental responsibility be included in the business practice and management of enterprises |
| F. Hou (2019) | The sustainable development of an enterprise should not only consider the maximization of short-term shareholder wealth but also consider the importance of capital demand to the sustainable operation and investment of the enterprise from a strategic perspective |
| A.J. Costa (2022) | The concept of sustainable development should apply to the external environment of the organization, in other words to a certain region [country, state] in a certain period of time. |
| H. Sun et al. (2023) | Sustainable development capability is also a part of enterprise values and business methods. |

Source: own elaboration based on the literature of the subject.

Sustainable transport means effective public, domestic and international transport that is economically beneficial and minimizes the harmful impact of vehicles on the environment. It focuses on both the control of harmful exhaust emissions and the promotion of means of transport using renewable energy. Sustainable transport also assumes limiting the destruction of urban space due to the dominance of individual car transport. Sustainable transport is achieved by limiting car traffic and developing a network of bicycle routes and public transport (Kuc-Czarnecka et al., 2023; Mohamad Taghvaee et al., 2023).

A large responsibility is on the transport companies, which should strive to reduce pollutant emissions; this is what the transition to the electrification of transport leads to, turning to greener solutions for shipping and storing goods. Moreover, it is necessary to develop environmentally friendly means of transport, such as rail and river transport, which are alternatives to traditional means of transport (Hussain et al., 2023).

Researchers emphasize that in many aspects, the sustainable development of the transport sector takes place (Kharlamova et al., 2022). Companies take active steps to reduce emissions. The economic, social and environmental indicators of transport companies in the European Union countries are improving.

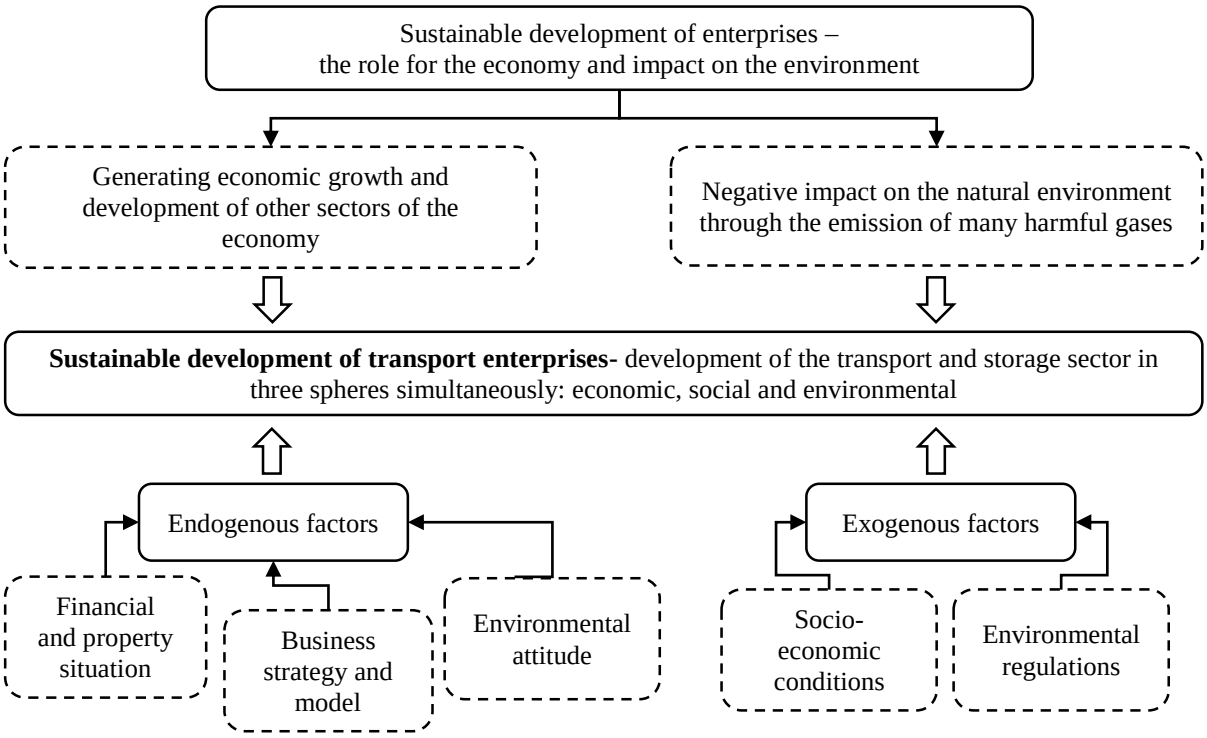



**Figure 1.** Sustainable development of transport enterprises and its determinants.

Source: own elaboration.

There needs to be a consensus on the impact of individual factors determining the sustainable development of transport (Pieloch et al., 2021; Comporek et al., 2022). It is emphasized that several external and internal factors condition this development. External factors include issues related to the socio-economic development of countries, legal regulations in the field of environmental protection, transport regulations, and customer expectations. Internal factors include enterprises' financial and property situation, development models and strategies, internal possibilities and capabilities in implementing innovative solutions.

## 3. Research methodology

The study's main aim is to assess the impact of selected socio-economic conditions on the sustainable development of Polish transport companies from 2008-2020. The Author chose three countries called the Weimer group, France, Germany and Poland as a research sample. The selection of such a research group results from the desire to compare the Polish economy with the two most developed countries of the European Union.

The research period covers the period from 2008 to 2020, i.e. the time from the financial crisis to the Covid-19 pandemic, which will allow us to notice the situation of sustainable development and its three pillars of economic, social and environmental transport companies.

The data for the analysis were taken from the Eurostat database, and they are annual data; the availability of economic, social and environmental data conditions their collection.

In connection with this research goal, the following research hypothesis is as follows "The GDP growth is the most important indicator for the sustainable development of transport enterprises in France, Germany and Poland from 2008 to 2020". Such a hypothesis results from economic growth being crucial for the transport sector's development. Moreover, its level has a special impact on the sector of transport enterprises, as its financial and property situation is significantly correlated with the situation in other sectors of the economy.

Moreover, the following sub-hypotheses were put forward:

- The dynamics of the ecological development of transport enterprises is higher than the social and economic development in the analyzed countries in the years 2008-2020.
- The beginning of the Covid-19 pandemic did not significantly affect the level of sustainable development indicators and the economic, social and environmental pillars.
- There is a strong diversification as to the impact of individual macroeconomic indicators on individual pillars of sustainable development of transport companies.

The study was conducted in the following stages:

- Stage 1: Creation of synthetic indicators of economic, social and environmental development, and based on them, the indicator of sustainable development of transport enterprises. These indicators are based on the following diagnostic variables:
  - economic development (E), based on stimulants: Enterprises - number Turnover or gross premiums were written - million euros Production value - million euros Gross operating surplus - million euros Total purchases of goods and services - million euros;
  - social development (S), based on stimulants: Wages and Salaries - million euro Social security costs - million euro Gross investment in tangible goods - million euro Employees - number Apparent labour productivity (Gross value added per person employed) - thousand euro Investment per person employed - thousands of euros and destimulants: Personnel costs - one million euros;
  - environmental development (Env): destimulants: greenhouse gas emissions.

Normalization of diagnostic variables was based on the following formulas:

- for the stimulants:

$$z_{ij} = \frac{x_{ij}}{\max\limits_{i}\{x_{ij}\}},\ z_{ij} \in [0;1]; \tag{1}$$

- for the destimulants:

$$z_{ij} = \frac{\min\limits_{i}\{x_{ij}\}}{x_{ij}},\ z_{ij} \in [0;1] \tag{2}$$

where:

$z_{ij}$ stands for the normalized value of the *j*-th variable in the *i*-th year;

$x_{ij}$ is the value of the *j*-th variable in the *i*-thyear;

$\min\limits_{i}\{x_{ij}\}$ is the lowest value of the *j*-th variable in the *i*-th year;

$\max\limits_{i}\{x_{ij}\}$ is the highest value of the *j*-th variable in the *i*-th year.

- To calculate the indicator of SD, E, S, and Env I assume the same impact of different indices on the aggregate measure and use the following formula:

$$SI_i = \frac{1}{n}\sum_{j=1}^{n} z_{ij},\ (i = 1,2,\dots,\ n) \tag{3}$$

where:

$SI_i$ stands for the indicator in the *i*-year;

*n* is the number of metrics;

others as above.

- Stage 2: I created a model for assessing the impact of selected macroeconomic variables on the sustainable development of transport companies:

$$\widehat{SD_\iota} = \beta_0 + \beta_1 \cdot \widehat{GDP_\iota}\mathrm{i} + \beta_2 \cdot \widehat{Exp_\iota}\mathrm{i} + \beta_3 \cdot \widehat{Imp_\iota}\mathrm{i} + \beta_4 \cdot \widehat{W_\iota}\mathrm{i} + \beta_5 \cdot \widehat{Un_\iota}\mathrm{i} + \beta_6 \cdot \widehat{HICP_\iota}\mathrm{i} + \varepsilon_\mathrm{i} \tag{4}$$

- Stage 3: A model of interdependent equations was created, which I estimated using the Seemingly Unrelated Regression (SUR) method, based on the formula:

$$\begin{cases} \widehat{E_\iota} = \beta_0 + \beta 1 \cdot \widehat{GDP_\iota}\mathrm{i} + \beta 2 \cdot \widehat{Exp_\iota}\mathrm{i} + \beta 3 \cdot \widehat{Imp_\iota}\mathrm{i} + \beta 4 \cdot \widehat{W_\iota}\mathrm{i} + \beta 5 \cdot \widehat{Un_\iota}\mathrm{i} + \beta 6 \cdot \widehat{HICP_\iota}\mathrm{i} + \\ \qquad \beta_7 \cdot \hat{S}\mathrm{i} + \beta_8 \cdot \widehat{Env_\iota}\mathrm{i} + \varepsilon_i \\ \widehat{S_\iota} = \beta_0 + \beta 1 \cdot \widehat{GDP_\iota}\mathrm{i} + \beta 2 \cdot \widehat{Exp_\iota}\mathrm{i} + \beta 3 \cdot \widehat{Imp_\iota}\mathrm{i} + \beta 4 \cdot \widehat{W_\iota}\mathrm{i} + \beta 5 \cdot \widehat{Un_\iota}\mathrm{i} + \beta 6 \cdot \widehat{HICP_\iota}\mathrm{i} + \\ \qquad \beta_7 \cdot \hat{E}\mathrm{i} + \beta_8 \cdot \widehat{Env_\iota}\mathrm{i} + \varepsilon_i \\ \widehat{Env_\iota} = \beta_0 + \beta 1 \cdot \widehat{GDP_\iota}\mathrm{i} + \beta 2 \cdot \widehat{Exp_\iota}\mathrm{i} + \beta 3 \cdot \widehat{Imp_\iota}\mathrm{i} + \beta 4 \cdot \widehat{W_\iota}\mathrm{i} + \beta 5 \cdot \widehat{Un_\iota}\mathrm{i} + \beta 6 \cdot \widehat{HICP_\iota}\mathrm{i} + \\ \qquad \beta_7 \cdot \hat{E}\mathrm{i} + \beta_8 \cdot \hat{S_\iota}\mathrm{i} + \varepsilon_i \end{cases} \tag{5}$$

where:

GDP - gross domestic product (mln euro);

Ex - exports of goods and services;

Im - Imports of goods and services;

W - wages and salaries;
Un - unemployment rate;
HICP - harmonized price index.

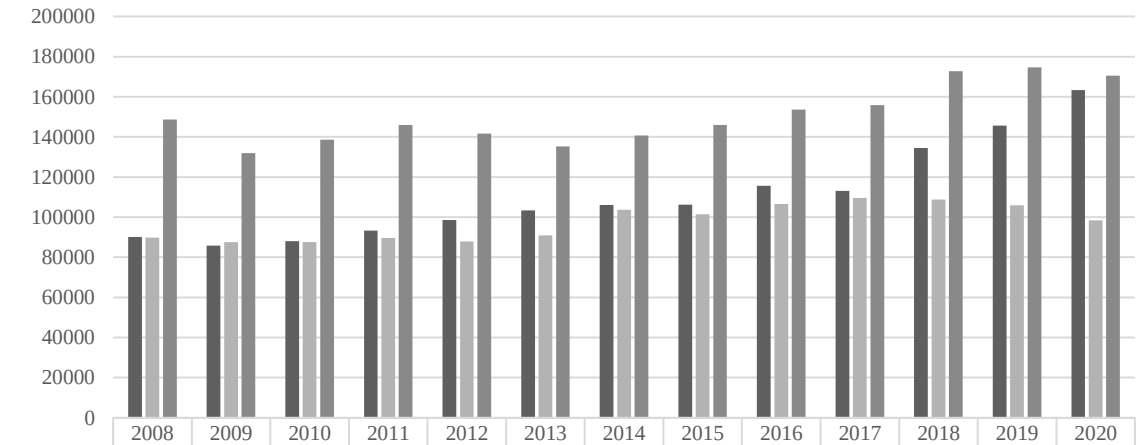
The formula for the SUR estimator is as follows:

$$\sqrt{R}\cdot(\hat{\beta}-\beta)\xrightarrow{d} N(0,(\frac{1}{R}\cdot X^{T}\cdot\left(\sum -1\otimes I_{R}\right)\cdot X)^{-1} \quad (6)$$

where:
R - the number of observations,
$\Omega$ - covariance matrix,
X - equations,
IR - the R-dimensional identity matrix;
$\otimes$ denotes the matrix Kronecker product;
$\hat{\sum}$ - the matrix;
y - vector.

## 4. Research results

Figure 1 presents the number of transport companies in France, Germany and Poland from 2008 to 2020. Throughout the period, the largest number of enterprises is registered in Poland, followed by France, and the smallest in Germany. It should be noted that the number of transport companies is increasing in all three countries.




| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| France | 90073 | 85773 | 88059 | 93230 | 98574 | 103315 | 106036 | 106298 | 115627 | 113151 | 134457 | 145696 | 163436 |
| Germany | 89734 | 87489 | 87535 | 89704 | 87819 | 90871 | 103727 | 101415 | 106559 | 109660 | 108834 | 105903 | 98486 |
| Poland | 148756 | 131974 | 138649 | 145939 | 141739 | 135210 | 140736 | 145993 | 153586 | 155910 | 172850 | 174666 | 170508 |

**Figure 1.** The number of transport enterprises (research sample) from 2008 to 2020.
Source: Source: https://ec.europa.eu/eurostat/databrowser/, 20.06.2023.

The indicators of economic, social and environmental development and selected descriptive statistics are presented in Table 1. In France, the highest median level is for the social indicator and the lowest for the environmental indicator; in Germany for the economic indicator and the lowest for the environmental indicator. In Poland, the values of the indicators are lower than in the other two countries, with the highest median for the social indicator and the lowest for the environmental one.

In the discussed period, all pillars show a positive trend, which should be assessed positively, as the economic, social and environmental situation of enterprises is improving, which is the result of an improvement in the financial situation in the sector and changes in legal regulations in the field of environmental protection.

**Table 1.**
*Economic, social, environmental and sustainable development of transport enterprises from 2008 to 2020 and its descriptive statistics*

| Years | France | | | | Germany | | | | Poland | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **E** | **S** | **Env** | **SD** | **E** | **S** | **Env** | **SD** | **E** | **S** | **Env** | **SD** |
| 2008 | 0,77 | 0,84 | 0,58 | **0,73** | 0,82 | 0,79 | 0,73 | **0,78** | 0,64 | 0,68 | 0,60 | **0,64** |
| 2009 | 0,72 | 0,84 | 0,62 | **0,73** | 0,73 | 0,77 | 0,80 | **0,77** | 0,53 | 0,60 | 0,59 | **0,57** |
| 2010 | 0,78 | 0,86 | 0,62 | **0,75** | 0,78 | 0,80 | 0,78 | **0,79** | 0,59 | 0,64 | 0,56 | **0,59** |
| 2011 | 0,81 | 0,88 | 0,61 | **0,77** | 0,81 | 0,80 | 0,82 | **0,81** | 0,64 | 0,70 | 0,55 | **0,63** |
| 2012 | 0,84 | 0,86 | 0,63 | **0,78** | 0,81 | 0,78 | 0,72 | **0,77** | 0,64 | 0,70 | 0,55 | **0,63** |
| 2013 | 0,85 | 0,89 | 0,65 | **0,79** | 0,84 | 0,78 | 0,71 | **0,78** | 0,65 | 0,71 | 0,58 | **0,65** |
| 2014 | 0,86 | 0,86 | 0,68 | **0,80** | 0,89 | 0,81 | 0,80 | **0,84** | 0,69 | 0,76 | 0,56 | **0,67** |
| 2015 | 0,89 | 0,90 | 0,68 | **0,82** | 0,91 | 0,85 | 0,70 | **0,82** | 0,72 | 0,80 | 0,54 | **0,68** |
| 2016 | 0,89 | 0,88 | 0,69 | **0,82** | 0,91 | 0,84 | 0,73 | **0,83** | 0,76 | 0,69 | 0,47 | **0,64** |
| 2017 | 0,91 | 0,92 | 0,70 | **0,84** | 0,96 | 0,89 | 0,69 | **0,85** | 0,82 | 0,75 | 0,42 | **0,66** |
| 2018 | 0,92 | 0,91 | 0,72 | **0,85** | 0,97 | 0,91 | 0,67 | **0,85** | 0,97 | 0,88 | 0,41 | **0,75** |
| 2019 | 0,98 | 0,96 | 0,70 | **0,88** | 0,97 | 0,95 | 0,72 | **0,88** | 0,99 | 0,90 | 0,92 | **0,94** |
| 2020 | 0,81 | 0,88 | 1,00 | **0,89** | 0,87 | 0,90 | 1,00 | **0,92** | 0,98 | 0,92 | 1,00 | **0,97** |
| **Max** | 0,98 | 0,96 | 1,00 | 0,89 | 0,97 | 0,95 | 1,00 | 0,92 | 0,99 | 0,92 | 1,00 | 0,97 |
| **Min** | 0,72 | 0,84 | 0,58 | 0,73 | 0,73 | 0,77 | 0,67 | 0,77 | 0,53 | 0,60 | 0,41 | 0,57 |
| **Mean** | 0,85 | 0,88 | 0,68 | 0,80 | 0,87 | 0,84 | 0,76 | 0,82 | 0,74 | 0,75 | 0,60 | 0,69 |
| **Mediana** | 0,85 | 0,88 | 0,68 | 0,80 | 0,87 | 0,81 | 0,73 | 0,82 | 0,69 | 0,71 | 0,56 | 0,65 |
| **St.d.** | 0,07 | 0,03 | 0,10 | 0,05 | 0,07 | 0,05 | 0,08 | 0,04 | 0,15 | 0,10 | 0,17 | 0,12 |

Source: https://ec.europa.eu/eurostat/databrowser/, 20.06.2023.

Figure 2 shows the sustainable development of transport companies from 2008 to 2020. The results of the study indicate that there is a positive SD trend in France, Germany and Poland. Interestingly, in 2020, i.e. in the year of the Covid-10 pandemic, this indicator did not deteriorate, and in the case of Poland, it even increased. To a large extent, this is due to the reduction in the emission of harmful substances into the natural environment due to restrictions on conducting business activities and temporary lockdowns.

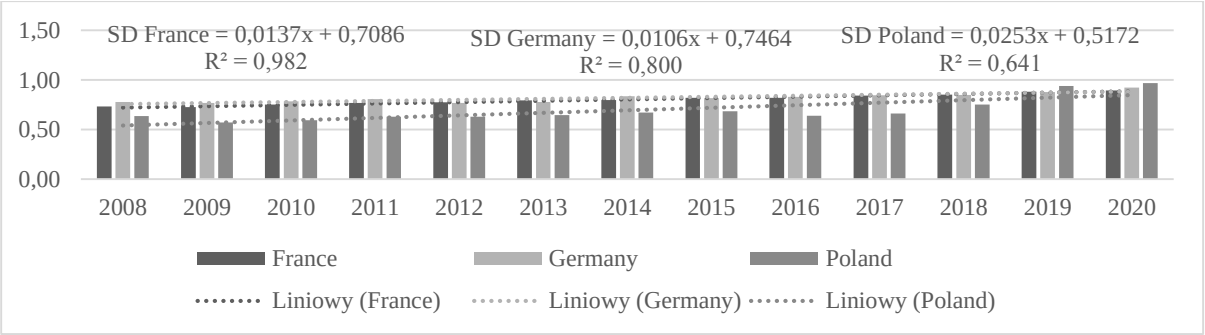



**Figure 2.** Sustainable development of transport enterprises from 2008 to 2020.

Source: Source: https://ec.europa.eu/eurostat/databrowser/, 20.06.2023.

The results of the OLS estimation are presented in Table 2. A clear, statistically significant impact of GDP on the sustainable development of transport enterprises in France, Germany and Poland was recorded in each analyzed country. In addition, in the case of France, a negative impact of exports on the SD value of transport enterprises was noted, while in Poland, sustainable development also depends on the value of this indicator in the previous period, which indicates the continuity of processes related to the sustainable development of the transport sector taking place in this country.

**Table 2.**
*The OLS estimation*

| Country | | *Coefficient* | *Std. Dev.* | *p-value* |
|---|---|---|---|---|
| **France** | const | −0,110683 | 0,0720993 | 0,1558 |
| | GDP | 5,42438e-07 | 6,47090e-08 | <0,0001 |
| | Exp | −4,10844e-07 | 1,20725e-07 | 0,0067 |
| | $R^2$=0,964470 | | | |
| | LM = 7,60104; p = P(Chi-kwadrat(5) > 7,60104) = 0,179637 | | | |
| | Chi-kwadrat(2) = 0,125789; p = 0,939042 | | | |
| | LMF = 0,739604; p = P(F(1, 9) > 0,739604) = 0,41211 | | | |
| **Germany** | const | 0,476896 | 0,0547967 | <0,0001 |
| | GDP | 1,16400e-07 | 1,84275e-08 | <0,0001 |
| | $R^2$ =0,783891 | | | |
| | LM = 1,64139; p = P(Chi-kwadrat(2) > 1,64139) = 0,440127 | | | |
| | Chi-kwadrat(2) = 2,73033; p = 0,255338 | | | |
| | LMF = 0,0495607; p = P(F(1, 10) > 0,0495607) = 0,828311 | | | |
| **Poland** | const | −0,167350 | 0,0947324 | 0,1111 |
| | GDP | 1,01965e-06 | 2,76507e-07 | 0,0050 |
| | $SD_{(t-1)}$ | 0,643625 | 0,195316 | 0,0093 |
| | $R^2$= 0,906512 | | | |
| | LM = 7,08206 p = P(Chi-kwadrat(5) > 7,08206) = 0,214608 | | | |
| | Chi-kwadrat(2) = 3,12508; p = 0,209602 | | | |
| | LMF = 2,57012; p = P(F(1, 8) > 2,57012) = 0,147567 | | | |

Source: https://ec.europa.eu/eurostat/databrowser/, 20.06.2023.

Table 3 presents the results of estimating interdependent equations using the SUR method. They show that the individual pillars of sustainable development depend on various macroeconomic factors. Moreover, the level of economic growth is also crucial for developing

the sector in its three dimensions, and this may be because this sector plays for economic development and how strongly it depends on the financial situation of other sectors.

**Table 3.**
*The SUR estimation: dependent variables: E, S, Env*

| Country | Variable | | Coefficient | Std. D. | P-value | R2 |
|---|---|---|---|---|---|---|
| France | E | const | −0,307241 | 0,0545062 | 0,0003 | 0.98 |
| | | Env | −0,324455 | 0,0309831 | 2,43e-06 | |
| | | GDP | 5,55886e-07 | 1,93112e-08 | 3,59e-010 | |
| | | Un | 0,0182773 | 0,00368869 | 0,0008 | |
| | S | Const | 0,644328 | 0,0525159 | 2,37e-07 | 0.89 |
| | | E | 0,438793 | 0,0441894 | 1,70e-06 | |
| | | Un | −0,0142293 | 0,00423029 | 0,0072 | |
| | Env | const | −2,07130 | 0,491697 | 0,0040 | 0.97 |
| | | E | −2,42080 | 0,323779 | 0,0001 | |
| | | GDP | 2,29712e-06 | 2,77312e-07 | 7,29e-05 | |
| | | Ex | −1,54630e-06 | 6,14003e-07 | 0,0399 | |
| | | Un | 0,0832354 | 0,0170099 | 0,0018 | |
| | | HICP | 0,0202278 | 0,00895590 | 0,0585 | |
| Germany | E | const | 0,317308 | 0,0842674 | 0,0044 | 0,967772 |
| | | GDP | 5,50828e-07 | 1,14798e-07 | 0,0010 | |
| | | Wag | −6,88582e-07 | 2,22041e-07 | 0,0127 | |
| | | Env | −0,283526 | 0,0413290 | 7,39e-05 | |
| | S | const | −0,749984 | 0,155946 | 0,0013 | 0,976978 |
| | | GDP | 1,67868e-07 | 4,22586e-08 | 0,0041 | |
| | | Im | 6,19601e-07 | 1,48793e-07 | 0,0031 | |
| | | Unep | 0,0827545 | 0,0121518 | 0,0001 | |
| | | HICP | −0,0183637 | 0,00627481 | 0,0191 | |
| | Env | const | 1,45504 | 0,160095 | 3,79e-06 | 0,682976 |
| | | GDP | 4,72741e-07 | 8,52760e-08 | 0,0002 | |
| | | E | −2,40988 | 0,388184 | 0,0001 | |
| Poland | E | const | 0,311942 | 0,0766714 | 0,0048 | 0,995605 |
| | | GDP | −2,64879e-06 | 8,09858e-07 | 0,0137 | |
| | | Im | 3,19255e-06 | 6,22500e-07 | 0,0014 | |
| | | Wag | 5,25476e-06 | 1,30361e-06 | 0,0050 | |
| | | Un | −0,0107163 | 0,00253885 | 0,0039 | |
| | | S | 0,373762 | 0,104924 | 0,0092 | |
| | S | const | −0,457819 | 0,187475 | 0,0372 | 0,940299 |
| | | GDP | 3,93154e-06 | 8,07355e-07 | 0,0009 | |
| | | Ex | −2,63182e-06 | 9,47812e-07 | 0,0215 | |
| | | Un | 0,00982750 | 0,00501692 | 0,0818 | |
| | Env | const | −1,73286 | 0,326079 | 0,0003 | 0,784380 |
| | | GDP | 1,66351e-05 | 2,49399e-06 | 5,57e-05 | |
| | | Im | −2,40964e-05 | 3,85149e-06 | 9,43e-05 | |

Source: https://ec.europa.eu/eurostat/databrowser/, 20.06.2023.

The research results indicate that macroeconomic conditions are statistically significant for the sustainable development of enterprises. A positive phenomenon is that the dynamics of sustainable development are positive in the analyzed period. The key issue for the stable development of the transport sector is to conduct a rational and sustainable macroeconomic policy.

## 5. Discussion

The sustainable development of transport enterprises in France, Germany, and Poland showed a positive trend from 2008 to 2020. The level of this development is varied, with the Polish transport sector showing the highest development dynamics. Moreover, one has to agree with the majority of scientists who indicate in studies that it did not deteriorate at the time of the outbreak of the Covid-19 pandemic (Wang, Huang, 2021; Comporek et al., 2022; Clemente-Suárez et al., 2022); this is because emissions of harmful substances into the atmosphere have significantly decreased due to temporary restrictions on conducting business.

In addition, it should be emphasized that in 2019 and 2020, the sustainable development of Polish enterprises exceeded this development in France and Germany. Undoubtedly, the analyzed period shows that sustainable development takes place gradually, requires both economic and social conditions, and environmental protection regulations influence the involvement of sectors and their level. Introducing new, more restrictive environmental standards means that transport companies must implement innovative green solutions in their operations and switch to low-emission means of transport.

The research results confirm that macroeconomic conditions are important for the sustainable development of transport companies (Comporek et al., 2022). At the same time, the GDP level is crucial for the sustainable development of enterprises in the surveyed countries. The main research hypothesis is true. Thus, the analysis confirms other researchers' research results, simultaneously indicating that the direction of this influence is positive (Prus, Sikora, 2021; van Zanten, van Tulder, 2021; Bao et al., 2023).

The first sub-hypothesis of the research is also true because the environmental pillar is developing the fastest, which is a positive phenomenon proving that ecological solutions are being introduced in the sector of transport companies to reduce its emissivity.

The second sub-hypothesis is also true because the Covid-19 pandemic has not hurt sustainable development. The environmental pillar largely influenced this state of affairs, while it is noticed that the economic and social pillars slightly deteriorated.

The third sub-hypothesis is also true because the impact of macroeconomic factors on the individual pillars of sustainable development varies in terms of direction and strength of impact. At the same time, one of the essential aspects is to maintain an appropriate pace of economic growth, which affects both the economic, social and environmental dimensions of development.

The individual pillars of development, economic, social and environmental, vary depending on the analyzed macroeconomic conditions. Thus, to assess sustainable development, it is important to analyze various macroeconomic variables to respond best to the opportunities and threats related to implementing the sustainable development strategy.

The study has research limitations related to data availability at the level of sectors, the selected research period, the selection of variables, and the normalization method. Moreover, the econometric methods were selected for estimating equations.

Despite certain limitations, the study allows for formulating several theoretical and empirical implications. Theoretical implications include reviewing the literature on the subject and formulating a definition of sustainable development and research methodology. The empirical implications include that the research results can help those in power (formulation of specific legal regulations and conditions for sustainable development of enterprises). Furthermore, those managing enterprises should focus not only on the company's internal situation but also on analyzing macroeconomic factors continuously.

## 6. Conclusions

Sustainable development, including simultaneous development in three economic, social and environmental areas, is crucial for the stable development of current and future generations. The study shows that its dynamics are positive, and it recorded the greatest progress in Poland.

Macroeconomic conditions have a statistically significant impact on the sustainable development and its pillars. At the same time, economic growth, which increases the level of green investments, is of pivotal importance.

Further scientific research will be devoted to assessing the impact of geopolitical conditions related to the war in Ukraine and related social and economic turmoil and problems on the sustainable development of enterprises in selected sectors of the economies of Central and Eastern Europe.

## References

1. Albloushi, B., Alharmoodi, A., Jabeen, F., Mehmood, K., Farouk, S. (2023). Total quality management practices and corporate sustainable development in manufacturing companies: the mediating role of green innovation. *Management Research Review, vol. 46, no. 1,* DOI: 10.1108/MRR-03-2021-0194.
2. Aminzadegan, S., Shahriari, M., Mehranfar, F., Abramović, B. (2022). Factors affecting the emission of pollutants in different types of transportation: A literature review. *Energy Reports, vol. 8,* DOI: 10.1016/j.egyr.2022.01.161.

3. Bao, L., Kusadokoro, M., Chitose, A., Chen, Ch. (2023). Development of socially sustainable transport research: A bibliometric and visualization analysis. *Travel Behaviour and Society, vol. 30,* DOI: 10.1016/j.tbs.2022.08.012.
4. Borys, T. (2005). *Wskaźniki zrównoważonego rozwoju*. Warszawa-Białystok: Ekonomia i Środowisko.
5. Burchell, J. (2008). *The Corporate Social Responsibility Reader*. London and New York: Routledge; Taylor & Francis Group.
6. Christensen, E.R., Wang, Y., Huo, J., Li, A. (2022). Properties and fate and transport of persistent and mobile polar organic water pollutants: A review. *Journal of Environmental Chemical Engineering, vol. 10, iss. 2,* 107201, DOI: 10.1016/j.jece.2022.107201.
7. Clemente-Suárez, V.J., Rodriguez-Besteiro, S., Cabello-Eras, J.J., Bustamante-Sanchez, A., Navarro-Jiménez, E., Donoso-Gonzalez, M., Beltrán-Velasco, A.I., Tornero-Aguilera, J.F. (2022). Sustainable Development Goals in the COVID-19 Pandemic: A Narrative Review. *Sustainability, 14(13),* 7726, DOI: 10.3390/su14137726.
8. Comporek, M., Kowalska, M., Misztal, A. (2022). Macroeconomic stability and transport companies' sustainable development in the eastern European Union. *Journal of Business Economics and Management, no. 23*, 10.3846/jbem.2021.15913.
9. Costa, A.J., Curi, D., Bandeira, A.M., Ferreira, A., Tomé, B., Joaquim, C., Santos, C., Góis, C., Meira, D., Azevedo, G. et al. (2022). Literature Review and Theoretical Framework of the Evolution and Interconnectedness of Corporate Sustainability Constructs. *Sustainability, vol. 14*, 4413, DOI: 10.3390/su14084413.
10. Duran, C.D., Gogan, L.M., Artene, A., Duran, V. (2015). The components of sustainable development - a possible approach. *Procedia Economics and Finance, no. 26*.
11. Dvořáková, L., Zborková, J. (2014). Integration of sustainable development at enterprise level. *Procedia Engineering, 69*, DOI: 10.1016/j.proeng.2014.03.043.
12. Dyllick, T., Hockerts, K. (2002). Beyond the Business Case for Corporate Sustainability. *Business Strategy and the Environment*, vol. 11.
13. Eckert, N., Giacona, F. (2023). Towards a holistic paradigm for long-term snow avalanche risk assessment and mitigation. *Ambio, 52*, DOI: 10.1007/s13280-022-01804-1.
14. Elkington, J. (1998). Cannibals with Forks. The Triple Bottom Line of the 21st Century. Oxford: Capstone Publishing.
15. Grabara, J., Bajdro, P., Mihaescu, L. (2015). Steps of sustainable development implementation into enterprise activities. *Management of Sustainable Development Sibiu, vol. 7, no. 1*.
16. Grudzewski, W.M., Hejduk, I.K., Sankowska, A., Wańtuchowicz, M. (2010). *Sustainability w biznesie, czyli przedsiębiorstwo przyszłości - zmiany paradygmatów i koncepcji zarządzania*. Warszawa: Poltext.
17. Guo, T., Chen, J., Liu, P. (2022). Impact of Emerging Transport Technologies on Freight Economic and Environmental Performance: A System Dynamics View. *International*

*Journal of Environmental Research and Public Health*, *19(22)*, 15077, DOI: 10.3390/ijerph192215077.

18. Hilson, G., Murcka, B. (2000). Sustainable development in the mining industry: clarifying the corporate perspective. *Resources Policy*, *no. 26*.
19. Hou, F., Liao, F., Liu, J., Xiong, H. (2019). Signing Auditors' Foreign Experience and Debt Financing Costs: Evidence for Sustainability of Chinese Listed Companies. *Sustainability*, *11*, 6615.
20. Hussain, M.M., Pal, S., Villanthenkodath, M.A. (2023). Towards sustainable development: The impact of transport infrastructure expenditure on the ecological footprint in India. *Innovation and Green Development*, *vol. 2, iss. 2,* 100037, DOI: 10.1016/j.igd.2023.100037.
21. Kharlamova, T., Desfonteines, L., Barykin, S., Gavrilova, R. (2022). Prospects for the development of transport infrastructure to ensure sustainable development. *Transportation Research Procedia*, *vol. 63,* DOI: 10.1016/j.trpro.2022.06.075.
22. Kiełczewski, D. (2010). Zrównoważony rozwój – istota, interpretacje, związek ze społeczeństwem wiedzy. In: B. Poskrobko (ed.), *Ekonomia zrównoważonego rozwoju. Materiały do studiowania*. Białystok: Wyższa Szkoła Ekonomiczna.
23. Koengkan, M., Fuinhas, J.A. (2022). Does the Obesity Problem Increase Environmental Degradation? Macroeconomic and Social Evidence from the European Countries. *Economies*, *10(6)*, 131, DOI: 10.3390/economies10060131.
24. Kryk B. (2005). Koncepcja społecznej odpowiedzialności przedsiębiorstwa za środowisko 17 przyrodnicze. In: D. Kopycińska, *Teoretyczne aspekty gospodarowania*. Szczecin: Wydawnictwo Katedra Mikroekonomii Uniwersytetu Szczecińskiego.
25. Kuc-Czarnecka, M., Markowicz, I., Sompolska-Rzechuła, A. (2023). SDGs implementation, their synergies, and trade-offs in EU countries – Sensitivity analysis-based approach. *Ecological Indicators*, *vol. 146,* 109888, DOI: 10.1016/j.ecolind.2023.109888.
26. Laszlo, C. (2008). *Sustainable value*. Stanford: Stanford Business Books.
27. Lazaretti, K., Giotto, O.T., Sehnem, S., Bencke, F.F. (2020). Building sustainability and innovation in organizations. *Benchmarking: An International Journal*, *vol. 27, no. 7*, DOI: 10.1108/BIJ-08-2018-0254.
28. Majewski, E. (2008). *Trwały rozwój i trwałe rolnictwo: teoria a praktyka gospodarstw rolniczych.* Warszawa: SGGW.
29. Misztal, A. (2022). Sustainable development of manufacturing enterprises in the socio-economic context. The case of Poland and Germany. *Optimum. Economic Studies*, *2(108)*, DOI: 10.15290/oes.2022.02.108.05.
30. Mohamad Taghvaee, V., Assari Arani, A., Nodehi, M., Khodaparast Shirazi, J., Agheli, L., Neshat Ghojogh, H.M., Salehnia, N., Mirzaee, A., Taheri, S., Mohammadi Saber, R., Faramarzi, H., Alvandi, R., Ahmadi Rahbarian, H. (2023). Sustainable development goals:

transportation, health and public policy. *Review of Economics and Political Science*, *vol. 8, no. 2,* DOI: 10.1108/REPS-12-2019-0168.

31. Nundy, S., Ghosh, A., Mesloub, A., Albaqawy, G.A., Alnaim, M.M. (2021). Impact of COVID-19 pandemic on socio-economic, energy-environment and transport sector globally and sustainable development goal (SDG). *Journal of Cleaner Production*, *vol. 312*, 127705, DOI: 10.1016/j.jclepro.2021.127705.
32. Ozturen, A., Ozgit, H. (2022). Conclusion: transitioning from unsustainable to sustainable solutions. *Worldwide Hospitality and Tourism Themes*, *vol. 14, no. 4,* DOI: 10.1108/WHATT-03-2022-0040.
33. Pabian, A. (2017). Zrównoważone przedsiębiorstwo jako rezultat zmian organizacyjnych. *Zarządzanie organizacjami*, *nr 11*.
34. Parrish, B.D. (2010). Sustainability – driven entrepreneurship: Principles of organization design. *Journal of Business Venturing*, *25*.
35. Pieloch-Babiarz, A., Misztal, A., Kowalska, M. (2021). An impact of macroeconomic stabilization on the sustainable development of manufacturing enterprises: the case of Central and Eastern European Countries. *Environ Dev Sustain, no. 23*, 8669-8698, DOI: 10.1007/s10668-020-00988-4.
36. Porter, M.E., Kramer, M.R. (2002). *The competitive advantage of corporate philanthropy*. *Harv. Bus. Rev., no. 80(12).*
37. Prus, P., Sikora, M. (2021). The Impact of Transport Infrastructure on the Sustainable Development of the Region—Case Study. *Agriculture, 11(4),* 279, DOI: 10.3390/agriculture11040279.
38. Singh, J., Del Bosque, I.R. (2008). Understanding corporate social responsibility and product perceptions in consumer markets: a cross-cultural evaluation. *J. Bus. Ethics*, *vol. 80(3).*
39. Singh, S., Holvoet, N., Pandey, V. (2018). Bridging Sustainability and Corporate Social Responsibility: Culture of Monitoring and Evaluation of CSR Initiatives in India. *Sustainability, 10*, 2353.
40. Sun, H., Wang, G., Bai, J., Shen, J., Zheng, X., Dan, E., Chen, F., Zhang, L. (2023). Corporate Sustainable Development, Corporate Environmental Performance and Cost of Debt. *Sustainability*, *15*, 228, DOI: 10.3390/su15010228.
41. Trojanowski, T. (2015). Przedsiębiorstwo wobec wyzwań zrównoważonego rozwoju. *Zeszyty Naukowe Politechniki Śląskiej, Organizacja i zarządzanie*, z. *77*.
42. van Zanten, J.A., van Tulder, R. (2021). Towards nexus-based governance: defining interactions between economic activities and Sustainable Development Goals (SDGs). *International Journal of Sustainable Development & World Ecology*, *28,* 3, DOI: 10.1080/13504509.2020.1768452.

43. Wang, Q., Huang, R. (2021). The impact of COVID-19 pandemic on sustainable development goals – A survey. *Environmental Research, vol. 202,* 111637, DOI: 10.1016/j.envres.2021.111637.
44. Zhang, L., Zhang, X., An, J., Zhang, W., Yao, J. (2022). Examining the Role of Stakeholder-Oriented Corporate Governance in Achieving Sustainable Development: Evidence from the SME CSR in the Context of China. *Sustainability*, *14(13),* 8181, DOI: 10.3390/su14138181.
45. Zu, L. (2013). Sustainable Enterprise Development. In: S.O. Idowu, N. Capaldi, L. Zu, A.D. Gupta (eds.), *Encyclopedia of Corporate Social Responsibility*. Berlin-Heidelberg: Springer. DOI: 10.1007/978-3-642-28036-8_253.