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Valuation of the Environmental Effects of Socially Responsible Investments in Europe

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Abstract: This paper evaluated the environmental effects of socially responsible investments (SRIs) in European countries and analyzed the differentiation between them in terms of SRIs and selected features in the environmental dimension. The first section of the paper discusses contemporary trends in Europe and in certain European countries, whilst the second compares SR environmental investments and environmental factors in selected European countries from a multidimensional perspective. The aim of the study was to identify and evaluate these trends as well as to find similarities and differences between European countries, and subsequently to indicate groups of countries with similar approaches to pro-ecological investments. In order to solve the problem, descriptive and multidimensional statistical methods were used, namely correspondence analysis (CA). Although the research results clearly revealed upward tendencies in the volume of SR environmental investments in the analyzed period, they nonetheless represent a relatively low share in the total number of socially responsible investments. The overall growth in SRIs in Europe may have resulted from the more intense activities of policymakers in some countries as a consequence of concluding agreements reached during the 21st Conference of the Parties (COP21) in 2015. The results of the study also revealed no significant correlations between SR environmental investments and environmental variables among the European countries analyzed; hence, there is no substantial evidence that investors' assets contribute to the improvement of the environment.

Keywords: ethical finance; socially responsible investment; themed investment; ecology; environmental protection; ecological relationship modeling

1. Introduction

In recent years, a steady growth in the ecological awareness of societies and their interest in the condition of the natural environment has been observed. The importance of both the quality of the environment and its resources to quality of life are increasingly widely acknowledged. Special attention is now being paid to climate change that results from the growth in worldwide demand for energy, the production of which mainly comes from fossil fuels that generate huge amounts of greenhouse gases. As a result, numerous environmental actions are being undertaken globally and locally nowadays. From a global perspective, they result from the agreements concluded by many countries, e.g., during the 21st Conference of the Parties (COP21) in Paris in 2015, a worldwide compromise was reached to limit climate changes; whereas locally, the effect of this agreement is reflected in the action plan on sustainable finance established at the EU level, which has three main objectives [1], namely:

- To reorient capital flows towards sustainable investment in order to achieve sustainable and inclusive growth;
- To manage the financial risk stemming from climate change, environmental degradation, and social issues;

- To foster transparency and long-termism in financial and economic activity.

This international agreement is a preliminary phase. The next stage is the implementation of proper legislation that will regulate ecological policy in particular countries. Nevertheless, the assumptions on which the implementation of such policy is based depend on many prerequisites, the most important of which include geological, political, and market factors. Geological conditions constitute the potential which, if properly used, may determine the advantages of a given region. Political circumstances result from environmental policy conducted by regional or national authorities, whereas market conditions depend on the level of social and economic development of particular countries, i.e., on positive quantitative and qualitative changes, thanks to which phenomena already existing in the sphere of any economic, cultural, and social activities expand and improve, while new ones are formed and developed.

Particular countries introduce policies and various regulatory instruments of environmental protection policy in order to directly or indirectly influence the behavior of users of the environment and direct their actions towards pro-environmental objectives [2,3]. All such regulations encompass all forms of social control in their broadest sense, including those which take advantage of nongovernmental efforts, such as actions undertaken by companies and other social entities [4–7].

Due to their character, these regulatory instruments may be divided into three groups [8,9]:

- Decentralized instruments;
- Direct management and control instruments;
- Economic instruments.

The first group includes those instruments that encompass general legal provisions, such as civil liability, criminal liability, or property rights. The second group constitutes tools of legal and administrative character, which directly influence the behavior of business entities, such as emissions or product norms, or general standards of behavior [10]. The third group is comprised of those instruments that are a less severe form of legal regulation than legal and administrative provisions, since they are tools that have an indirect impact on business entities. According to the OECD classification, economic instruments include: taxes, fees and charges, tradable permits, deposit-refund systems, and subsidies [11].

This article did not analyze environmental protection policy per se, but rather financial investments that are consciously supported by pro-ecological investors within the environmental dimension of socially responsible investments, namely sustainability-themed investments (STIs). Nonetheless, the actions taken by policy makers that may influence the level of ST investments were assessed. Sustainability-themed investments are those financial investments in which investors' resources are channeled to pro-environmental activities. This concerns, for example, the use of renewable energy sources, the improvement of energy efficiency, water, or waste management. The term STI used in this article resulted from the direct classification adopted by the pan-European organization promoting sustainability [12]. Sustainability-themed investing requires a fundamental understanding of the impact of long-term economic, political, and social trends, which reveal investment opportunities.

STIs may be carried out by socially responsible investors, as well as conventional investors who are looking for high return rates on invested funds. Socially responsible investors expect profit maximization through the fulfillment of qualitative criteria (ESG—environmental, social, governance), and in this case environmental factors above all; hence, profit is not their only expectation. Such investors consciously undertake investment risk as a result of portfolio limitations. On the contrary, conventional investors who opt for such investments consciously bear investment risk while simultaneously expecting high rates of return.

The potential for the development of STIs is high. Experts emphasize that due to, for example, climate changes or the depletion of existing sources of energy, investments in renewable sources of energy should develop dynamically. According to the report by New Energy Outlook 2019, by 2050, solar and wind technology will comprise 48% of the total electricity produced worldwide [13].

According to most recent Eurostat data, there is some progress in the EU towards the Europe 2020 target for renewable energies. According to the target, there has been an increase in the share of renewable energy in gross final energy consumption. The dynamic development of renewable energies worldwide has been the result of adopting different energy strategies in particular countries. According to White et al. [14], the role of the government in the cases concerning renewable energy should be limited to establishing rules and regulations. The role of public policy was also examined by Nybakk et al. [15]. They found out that policy played an important role in eco-innovations of companies. Wüstenhagen et al. [16] emphasized the importance of social acceptance of development of renewable energy. The authors showed that it might be social acceptance that impedes the government policy on renewable energies. According to the authors, this is apparent in the case of wind energy, which has become a subject of contested debates in several countries, largely due to its visual impact on landscapes. Lund [17], based on the case of Denmark, discussed the problems and perspectives of converting energy systems into a 100% renewable energy system. From the author's point of view, such development is possible. If further technological improvements of the energy system are achieved, then the renewable energy system can be created. In a later study, Lund and Mathiesen [18], using computer simulations, indicated that a 100% renewable energy supply based on domestic resources is physically possible, and that the first step towards 100% renewable energy will be feasible in 2030.

Considering the existing engagement of investors in STIs in Europe and the potential resulting from current challenges such as climate factors, the following research questions were formed:

Research Question 1: *What are the tendencies in the development of STIs in European countries?*

Research Question 2: *Are there any similarities between the countries surveyed regarding STIs and selected ecological features?*

This study presents three novel elements. Firstly, most studies present the investor's perspective when evaluating the performance of investment portfolios; only a very few research papers have been devoted to the assessment of such investments from the perspective of social influence, testing the impact of funds invested on the improvement of the natural environment. Secondly, to the best of our knowledge, there has been no research conducted to date that assessed the differentiation of European countries in terms of the volume of sustainability-themed investments and selected environmental factors. This was also confirmed by a systematic review of research conducted by Talan and Sharma [19]. Thirdly, we have based our analysis on multidimensional statistical methods, which allows for the comparison of countries based on a multivariate approach.

The paper is organized as follows: Section 2 presents a review of the literature, Section 3 describes the methodology and the main characteristics of the presented data, and Section 4 presents the research results, and Section 5 presents the discussion on study results.

2. Literature Review

The studies carried out on sustainability-themed investments to date have been relatively scarce. These analyses were and are mainly aimed at examining the impact of a company fulfilling environmental standards on the value of that company, and the methods of managing environmental risk, which presents the actual perspective of managers of a given company. The conclusions drawn from the research are not unambiguous. It may be assumed that restrictive environmental standards should increase the operational costs of a company, with a negative impact on profitability as a result. Such an outcome was revealed in research by Chen and Metcalf [20], Jaggi and Freedman [21], and Wagner and Wehrmeyer [22]. However, there is evidence that following environmental standards, irrespective of the high costs, positively influences the value of a company. An event study by Klassen and McLaughlin [23] found significant positive abnormal returns after a company was rewarded for eco-innovations, and significant negative abnormal returns after an environmental crisis. Dowell, Hart,

and Yeung [24] stated that corporations based in the United States that adopt restrictive environmental standards have a much higher market value than those with less restrictive standards.

The motivation of socially responsible investors may usually be divided into two categories, i.e., one group of investors feels the need to invest money in such a way that does not violate their personal values and goals, whereas the other group feels a stronger need to allocate their money to actively support and encourage others to improve the quality of life and the natural environment for future generations. Generally speaking, an SR investor who belongs to the latter group is called an 'activist', concentrating more on capital as a facilitator of positive changes throughout society [25]. Apart from SR investors, there are also classical investors focused on obtaining profits. On the other hand, there are providers of financial instruments (shares and bonds) whose actions are market-driven.

The assessment of the impact of the environmental dimension of SRIs on the value of investments has been conducted by numerous researchers. Derwall, Gunster, Bauer, and Koedijk [26] formed capital portfolios based on the ecological criterion, or more specifically ecological efficiency measured in points based on Innovest Strategic Value Advisors, and examined the behavior of these portfolios by means of the Fama and French [27–29] and Carhart [30] four-factor model. The portfolios of companies with a high number of environmental points based on positive selection obtained much better results than the portfolios of companies that scored fewer points.

Many studies also included the assessment of the profitability of investment portfolios, including ecological ones, or so-called green portfolios. In investment practice, there are numerous problems with the formation of green portfolios, resulting from both the restrictions connected with the selection of companies in the portfolios, and consequently the limited diversification possibilities of such portfolios, as well as objective possibilities of obtaining truly distinctive qualitative information. The issue of revealing nonfinancial information and the effective assessment thereof is still being debated. It refers not only to the environmental dimension of socially responsible investment, but sustainable investment in general. Hence, many investors adopt a tactical and creative approach to themed investments, usually as a form of supplementing the portfolio. Themed investments, in other words green portfolios, are usually characterized by higher risk and lower profitability than portfolios comprising classical socially responsible investments [31,32]. Keefe [33,34] proved in his research that green investments are better defined and not as restrictive as socially responsible investments (SRIs). Ielasi and Rossolini [35,36] assessed STI and themed investment portfolios (themed investment in companies whose goal was not environmental protection) and classical SRI portfolios. They proved that the efficiency of ST funds adjusted for risk is related more to their responsible character than the thematic approach as such. According to the authors, STIs are more similar to other socially responsible investments than to themed investments, which was confirmed by the analysis of our results.

As previously mentioned, STIs are dedicated to long-term investors. Although traditional financial analysis assumes that time is not favorable to investments, for themed investments, a higher discount rate (which is the cost of time) may mean, for example, a future reduction in the effects of climate change. From the perspective of a socially responsible investor, the time factor is perceived as a positive effect, but for a conventional investor, time is a limitation when it comes to obtaining complex profits. STIs are also characterized by higher levels of risk than usual, as indicated by the results of research conducted by Mallett and Michelson [31]; Climent and Soriano [32]; and Chang, Nelson, and Witte [37].

Reflections upon the profitability of SR investments are made to show how difficult the assessment of their potential advantage over other financial investments is, and that the indicated long-term investment horizon may decrease the interest of socially responsible investors or even discourage conventional investors. The confirmation of such a perception of STIs by investors may be the reason for the low value of STIs under the management of institutional investors.

The research also aimed to explain how different social and economic factors influenced readiness to finance pro-ecological actions. For example, the literature provides numerous pieces of evidence indicating a positive relationship between social capital and readiness to finance environmental protection actions or strengthening regulations and creating a strong environmental policy [38–42].

Other studies emphasized the impact of renewable energy on economic well-being and economic growth [15,43]. It means that the level of social capital represented by a given society may also feed into the volume of STI.

3. Hypothesis, Materials, and Methods

The initiative to research the relationship between the value of STIs on the financial market and the level of a country's ecological development was motivated mainly by a lack of proper analyses of the issue at hand. Hence, this article analyzed the diversification of sustainability-themed investments in European countries. What was considered particularly interesting was the examination of the reasons for STI diversification among European countries representing a relatively strongly integrated social and economic zone. The reasons for such diversification may be numerous, whether geological, political, economic, or even cultural. However, so far the reflections pertaining to the problem itself have given rise to the following research hypothesis:

Hypothesis1 (H1): *Sustainability-themed investments do not have a significant impact on environmental activities in European countries.*

Such a lack of significant influence results from the low level of assets under management in sustainability-themed investment, as well as the low level of investor interest in such strategies. There are several reasons for this, such as there being no evidence to prove their higher profitability, high investment risk, and the long-term investment horizon.

Data collected for 2005–2017 by Eurosif [12,44–47] enabled the analysis of institutional and retail assets from 13 different European markets (Italy, France, Switzerland, the United Kingdom, Spain, Germany, Belgium, the Netherlands, Sweden, Austria, Denmark, Poland, and Finland). During the first stage, the analysis of the dynamics of the absolute level of STIs, and that relative to SRIs, was made. The study was conducted for two-year periods due to the availability of Eurosif data. In order to assess the changes over time, individual dynamics indices and compound annual growth rate (CAGR), which indicates the average annual investment growth in the examined periods, were used. CAGR is described in the following formula:

$$CAGR(t_0, t_n) = \left(\frac{V(t_n)}{V(t_0)} \right)^{\frac{1}{t_n - t_0}} - 1 \quad (1)$$

$V(t_0)$, $V(t_n)$ —the initial/the end value;

t_0 , t_n —the initial/the end period.

In order to give a preliminary assessment of relations between the volume of STIs and pro-ecological activity in the examined countries, Spearman's rank correlation coefficient was used. A set of variables was selected for the analysis based on Eurostat data [48–52], SDG indicators, and Europe 2020 indicators. The SDGs indicator set comprises 100 indicators that are structured according to the 17 Sustainable Development Goals and their 169 related targets, with reference to the UN's 2030 Agenda for Sustainable Development [53]. Europe 2020 indicators were calculated in five areas: Employment, Research & Development, Climate Change & Energy, Education, Poverty, and Social Exclusion. The Europe 2020 strategy is the EU's agenda that emphasizes smart, sustainable and inclusive growth in order to improve Europe's competitiveness and productivity and underpin a sustainable social market economy. Apart from the relative index of STIs per capita (STI/1000), the total amount of STIs (million EUR) was also applied in the correlation analysis due to low levels of sustainability-themed investments. On the basis of correlated selected variables with STIs and STI/1000, the selection of variables that significantly influence the volume of sustainability themed strategy, which reflect ecology strategy, was made. The variables were chosen according to data from 2017 and constitute the latest source of information on socially responsible assets in the countries of

Europe [12]. The correlation analysis helped to specify ecology factors, which may significantly affect sustainability themed assets in European countries.

In order to assess mutual relations between the categories of selected variables, a multi-dimensional analysis of correspondence (MCA—multiple correspondence analysis) was applied. This is a data analysis technique for categorical data used to detect and represent underlying structures in a dataset [54,55].

In the correspondence analysis, a contingency table constitutes the basis of the construction, the so-called correspondence matrix P . The matrix is based on observable frequencies of distribution of particular variable categories and includes the numbers from the contingency table standardized according to the following formula:

$$p_{ij} = \frac{n_{ij}}{n} \quad (2)$$

The boundary values of the rows and columns of the correspondence matrix are vectors $p_{i\bullet}$ and $p_{j\bullet}$. They constitute the basis for the formation of diagonal matrices of row frequencies D_r and columns D_c . Next, so-called rows and columns profiles are defined, from which the principal axes of orientation of categorical data are derived. On the basis of correspondence matrices and proper diagonal matrices of frequencies, the matrices of rows R and columns C profiles are formed:

$$R = \left[\frac{n_{ij}}{n_{i\bullet}} \right] = \left[\frac{p_{ij}}{p_{i\bullet}} \right] = D_r^{-1}P \quad C = \left[\frac{n_{ij}}{n_{j\bullet}} \right] = \left[\frac{p_{ij}}{p_{j\bullet}} \right] = D_c^{-1}P \quad (3)$$

Average profiles are the boundary values of the rows and columns $p_{i\bullet}$ and $p_{j\bullet}$, so-called centroids. The point representing an average row (or column) profile is the intersecting point of the principal axes of projection, i.e., the origin of coordinates on the graph/correspondence map.

Cross-referencing of the profiles provides information on their interdependencies. The points illustrating the categories whose profiles have similar values are located close to each other, whereas those of different values are far from each other. If the profile values of the analyzed category are similar to the value of an average profile, then the points illustrating the categories in the coordinate system are close to the center of projection. When the values of the analyzed profile are significantly different from the values of an average profile, the point illustrating the category in the coordinate system is located far from the center.

The distances between row profiles are defined by weighted Euclidean distance—so-called Chi-squared distance—defined as follows:

$$d_{(i,i')}^2 = \sum_{j=1}^c \frac{\left(\frac{n_{ij}}{n_{i\bullet}} - \frac{n_{i'j}}{n_{i'\bullet}} \right)^2}{\frac{n_{j\bullet}}{n}} = \sum_{j=1}^c \frac{\left(\frac{p_{ij}}{p_{i\bullet}} - \frac{p_{i'j}}{p_{i'\bullet}} \right)^2}{p_{j\bullet}} \quad (4)$$

where the weights are boundary values of the columns, whereas i and i' mean two different categories of the feature inscribed in the rows. Analogically, the distances between categories in the columns are calculated.

In the case of analyzing interdependencies between multivariate variables, the graphical representation of the interdependencies facilitates the use of so-called matrix distribution according to singular value decomposition (SVD) as a means of enhancing the allocation of coordinates of the categories of analyzed features. A simultaneous, graphic representation of the categories of analyzed features is possible by means of the procedure based on the transformation of matrix P into matrix A , i.e., weighted profile deviations from the row and column center:

$$A = D_r^{-1/2}(P - rc^T)D_c^{-1/2}, \quad (5)$$

where r refers to row centroid and c refers to column centroid.

For the purpose of the research, each quantity variable was ascribed to three categories reflecting the level of this phenomenon (low “+”, medium “++”, or high “+++”). Objects (countries) within the same category are close together, while objects in different categories are far apart on the correspondence map. Each object is as close as possible to the category points of categories that apply to the object. In this way, the categories divide the objects into homogeneous subgroups. Variables are considered homogeneous when they classify objects in the same categories into the same subgroups [56]. Variables representing environmental factors for MCA analysis were selected on the basis of two criteria: the substantive evaluation thereof and a significant correlation with sustainability themed investment. Due to the lack of data/lack of investments in 2017, Poland and Finland were excluded from the analysis.

4. Results

4.1. Dynamics of STI

In Europe, as shown in Figure 1, STIs remained at a somewhat low level to 2013, not exceeding 59 billion Euros. STIs grew rapidly between 2013 and 2015 from 59 to 145 billion Euros (+146%), and the compound annual growth rate (CAGR) was 57%. Between 2005 and 2007, CAGR was larger still at 96%, which resulted from low levels of investment in 2005. The assets of themed funds decreased slightly in 2009 (−4% when compared to 2007). In the last period of observation, between 2015 and 2017, total assets increased slightly (+2%). Together with the growth of STI, their share in the sum of SRIs remained at a stable, low level, only exceeding 1% (1.32%) in 2015.

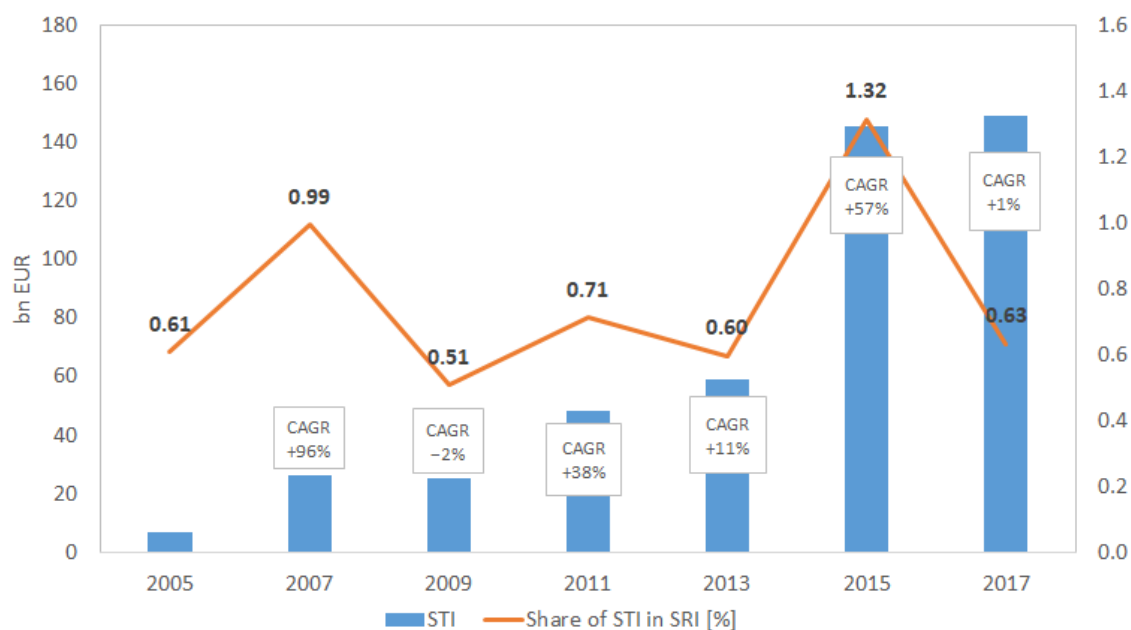


Figure 1. Growth of sustainability-themed investments (STIs) in Europe in 2005–2017 and share in socially responsible investments (SRIs) (%).

When evaluating specific areas of STI, it is difficult to indicate the dominant ones clearly. In 2015, investors mostly preferred areas such as the building sector and renewable energy (Figure 2), whereas in 2017 investments concentrated mainly on water management and the category labelled “other”, containing investments related to climate change—in these two categories there was a significant increase in investment expenditure (+31% and +48%, respectively, in comparison to 2015). Moreover, investments in land use/forestry/agriculture (+87%) and sustainable transport (+65%) increased significantly. A decline in investments in 2017 was recorded in only two sectors: the building sector (−52%) and renewable energy (−38%), but investments in these areas remained at a relatively high level (over 15 billion Euros).

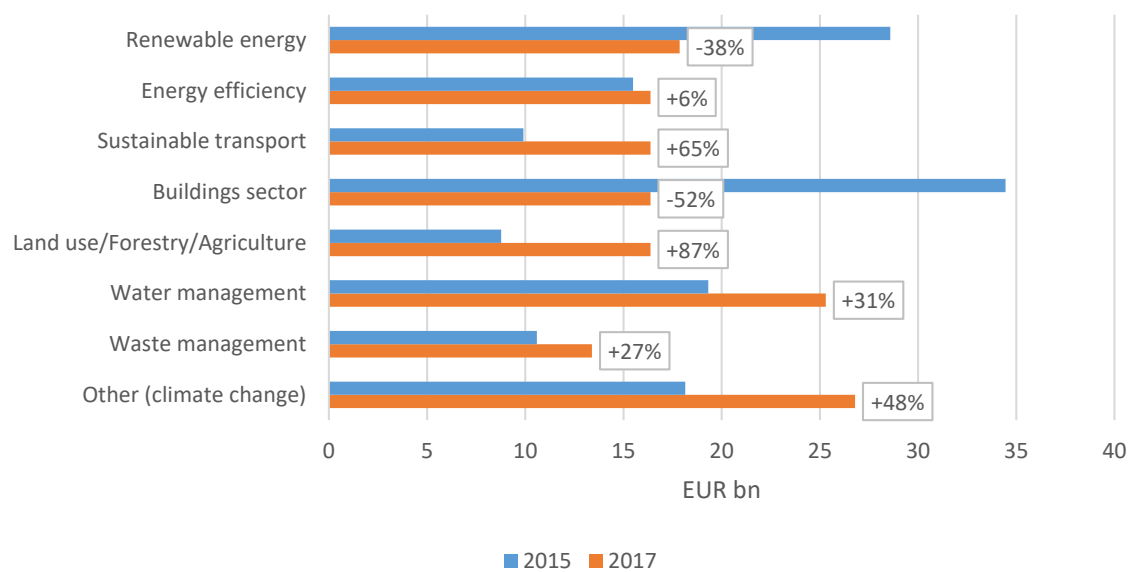


Figure 2. Sustainability-themed investments by specific areas of investment (EUR bn) in 2015 and 2017.
Note: other (multi-theme, climate-related opportunities, healthcare, education, safety, well-being).

The development of climate change-related sectors may be connected with activities undertaken internationally, in particular the COP21 climate agreement signed in Paris, which took place in 2015. Since then, climate- and energy-related topics are high on the agenda at different levels of national administration and nongovernmental organizations all over the world.

As shown in Table 1 and Figure 3, France, Switzerland, the United Kingdom, and the Netherlands demonstrated the greatest enthusiasm for STIs throughout the analyzed period, which was confirmed by the high value of absolute investments. In 2017, the highest absolute value of assets was measured in France, Italy, Spain, Switzerland, and the UK. In the remaining countries, STIs were at a low level. Italy and Spain only had high levels of STIs in 2017; earlier, from 2009 to 2015, there was a low level of such investments (below 4% in Italy and below 1% in Spain). The dispersion (CV) of European countries with respect to STIs (measured by standard deviation from the average) throughout the period was very high, but in the subsequent periods recorded a slight tendency to decline—with 200% in 2009 and up to 180% in 2017.

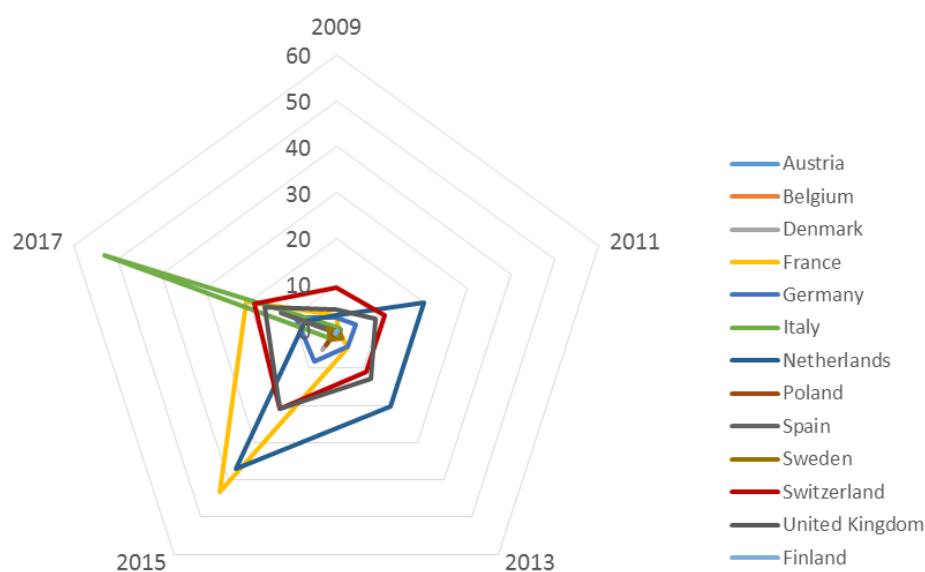


Figure 3. Sustainability-themed investments (EUR bn) by country in 2009–2017.

Table 1. The level of STIs in millions of EUR and dynamic indices between 2009 and 2017 (two-year periods).

	STI 2009	2007–2009	STI 2011	2009–2011	STI 2013	2011–2013	STI 2015	2013–2015	STI 2017	2015–2017
Austria	129	nc	56	−56.6%	82	46.4%	271	230.5%	992	266.1%
Belgium	595	nc	367	−38.3%	816	122.3%	275	−66.3%	8101	2845.8%
Denmark	0	nc	43	nc	nm	nc	5232	nc	65	−98.8%
Finland	0	nc	322	nc	220	−31.7%	656	198.2%	nm	nc
France	3279	nc	623	−81.0%	4392	605.0%	43,065	880.5%	20,620	−52.1%
Germany	2995	nc	4523	51.0%	4127	−8.8%	8157	97.6%	9184	12.6%
Italy	987	nc	1051	6.5%	1094	4.1%	2064	88.7%	52,861	2461.1%
Netherlands	3324	nc	19,914	499.1%	20,163	1.3%	37,114	84.1%	7125	−80.8%
Norway	0	nc	676	nc	2078	207.4%	nm	nc	nm	nc
Poland	0	nc	0	nc	0	nc	3762	nc	0	−100.0%
Spain	0	nc	107	nc	82	−23.4%	300	265.9%	12,665	4121.7%
Sweden	0	nc	396	nc	1985	401.3%	2315	16.6%	1966	−15.1%
Switzerland	9508	nc	11,079	16.5%	11,061	−0.2%	21,017	90.0%	18,775	−10.7%
United Kingdom	4544	nc	8932	96.6%	12,860	44.0%	21,022	63.5%	16,463	−21.7%
Europe	25,361	nc	48,090	89.6%	58,961	22.6%	145,249	146.3%	148,840	2.5%
MEAN	3381.5	.	6411.9	.	8422.9	.	20,749.9	.	22,896.7	.
SD	6627.0	.	12,867.1	.	15,747.9	.	38,534.2	.	40,359.8	.
CV	200%	.	200%	.	190%	.	190%	.	180%	.

4.2. European Countries from a Multidimensional Perspective

Table 2 presents the results of the Spearman correlation analysis between selected environmental variables and the volume of STI. In the first stage of the study, subsequent correlations were indicated for STI/1000; however, due to the lack of significant interdependencies, the interdependence of the same variables from STIs were studied nominally, where significant interdependencies were revealed only in a few cases. A strong and significant correlation appeared between the nominal value of STIs and the resources spent on the international 100bn USD commitment to climate-related expenditure. It may be assumed that the countries that spend more on this goal also have a higher value of STIs. A high level of correlation was also observed between STIs and total greenhouse gas emission in its carbon dioxide equivalent, municipal waste generated (thousands of metric tons) and municipal waste collected (thousands of tons), whereas a negative and significant correlation appeared between the interdependence of STIs and the recycling rate of municipal waste (% of total waste generated) (see Table 2).

The results of correlation analysis between selected variables, the absolute value STIs and the value of STI/1000 were used in the correspondence analysis (MCA); the diversification of the European countries in terms of environmental factors and the relationships between them were presented in the correspondence diagrams. A useful tool in the interpretation of the links between variable categories is clustering. On the basis of the coordinate values obtained, hierarchical clustering was conducted by means of Ward's method (with Manhattan distance). As a result, the concentrations of related categories were obtained (see the ellipses in the diagrams).

Table 2. The Spearman correlation coefficient between selected environmental variables and the size of STI.

Group of Indicators/Variables	Indicators/Variables	Correlation Coefficient (STI/1000) (p-Value)	Correlation Coefficient (STI) (p-Value)
Eurostat database/ sustainable development indicators/climate action	Primary energy consumption, Goals 7 and 13	0.218 (0.519)	0.218 (0.519)
	Final energy consumption, Goals 7 and 13	0.218 (0.519)	0.218 (0.519)
	Share of renewable energy in gross final energy consumption (%) [in electricity], Goals 7 and 13	−0.273 (0.417)	−0.273 (0.417)
	Share of renewable energy in gross final energy consumption (%) [in heating and cooling], Goals 7 and 13	−0.308 (0.355)	−0.308 (0.355)
	Share of renewable energy in gross final energy consumption (%) [in transport], Goals 7 and 13	0.065 (0.853)	0.065 (0.853)
	Average CO2 emissions per km by new passenger cars (source: EEA, DG CLIMA)	−0.464 (0.151)	−0.464 (0.151)
	Greenhouse gas emissions (source: EEA)	−0.301 (0.342)	−0.301 (0.342)
	Greenhouse gas emissions—intensity of energy consumption (source: EEA and Eurostat)	0.091 (0.790)	0.091 (0.790)
	Climate-related economic losses by type of event (source: EEA)	0.091 (0.779)	0.091 (0.779)
	Contribution to the international 100bn USD commitment to climate-related expenditure (source: DG CLIMA, EIONET)	0.164 (0.631)	0.164 (0.631)
	Population covered by the Covenant of Mayors for Climate & Energy signatories (source: Covenant of Mayors)	0.252 (0.430)	0.252 (0.430)
Eurostat database/sustainable development indicators/affordable and clean energy	Energy productivity, Goals 7 and 13	0.509 (0.110)	0.455 (0.160)
Eurostat database/sustainable development indicators/sustainable cities and communities	Recycling rate of municipal waste (% of total waste generated)	−0.434 (0.159)	−0.678 * (0.015)
	Recycling rate of packaging waste by type of packaging	0.236 (0.484)	−0.118 (0.729)
Eurostat database/sustainable development indicators/good health and well-being	Exposure to air pollution by particulate matter (source: EEA)	−0.252 (0.430)	0.000 (1.000)

Table 2. Cont.

Group of Indicators/Variables	Indicators/Variables	Correlation Coefficient (STI/1000) (p-Value)	Correlation Coefficient (STI) (p-Value)
Eurostat database/environment and energy	Total greenhouse gas emission in its carbon dioxide equivalent	0.136 (0.689)	0.655 (0.029)
	Municipal waste generated (thousands of tons)	0.077 (0.812)	0.608 (0.036)
	Municipal waste collected (thousands of tons)	0.155 (0.650)	0.700 (0.016)
	Waste generated (kilograms per capita)	0.018 (0.957)	0.126 (0.696)
	Waste treatment (kilograms per capita)	−0.088 (0.787)	0.021 (0.948)
	Recovery—energy recovery (R1) (kilograms per capita)	0.039 (0.905)	−0.235 (0.463)
	Recycling—material (kilograms per capita)	−0.014 (0.966)	−0.088 (0.787)
Europe 2020 indicator/climate change and energy	Share of energy from renewable sources in gross final energy consumption	−0.291 (0.385)	−0.155 (0.650)
	Greenhouse gas emissions tons per capita (source: EEA)	−0.301 (0.342)	−0.448 (0.145)
	Greenhouse gas emissions (1990 = 100)	0.336 (0.386)	0.098 (0.762)
Europe 2020 indicators/Nature and Ecosystems	Urban population exposed to PM10 concentrations exceeding the daily limit value (50 µg/m3 on more than 35 days in a year)	−0.268 (0.399)	−0.051 (0.876)

* $p < 0.05$; ** $p < 0.01$.

In the first place (see Figure 4), the variables of final energy consumption (FEC), contribution to the international 100bn USD commitment to climate-related expenditure (CC), and greenhouse gas emissions in tons (GGE) were analyzed. The goal was to assess the relationships between the volume of resources spent on sustainable investments obtained from investors and different forms of influencing the environment in particular countries. As a result, three groups of countries with various levels of STIs were identified and categories of variables characteristic to each group were specified. Italy, Spain, and the Netherlands were included in a group of similar countries due to a moderate level of commitment to climate-related expenditure, greenhouse gas emissions in tons, and final energy consumption, as well as a high level of STIs at the same time. In the group comprising the countries with an average level of STI, but the highest values for the remaining variables, the following countries were included: Germany, France, and the UK. The subsequent group, containing Austria, Sweden, Belgium, and Denmark, had low levels of STIs as well as low values of commitment to climate-related expenditure, greenhouse gas emissions in tons, and final energy consumption. Switzerland, which shows a strong similarity with this group, albeit characterized by a relatively high level of STI, was also included.

The second diagram (see Figure 5) analyzes exposure to air pollution in terms of the particulate matter (EAP) and waste treatment (WT) variables. The goal was to estimate whether countries with high levels of engagement in financial pro-environmental investments simultaneously have high levels of waste treatment and are less vulnerable to air pollution. In the diagram of the multiple-change correspondence analysis, separate groups of countries with low, average, and high levels of STI/1000, respectively, were presented and variables grouped around them. In this case, due to the hierarchical clustering, four separate groups were formed, which indicates a strong diversification of variable categories. Switzerland is a country with a very high level of STI/1000, whereas Germany and Denmark have the lowest—these two groups share very high waste treatment indicators. Another group included Italy, Belgium, Spain, Sweden, and the United Kingdom—these countries are characterized by a low level of waste processing and high exposure to air pollution, as well as average level of investment per capita. Another group of countries of similar characteristics included Austria, France, and the Netherlands, which had low STI/1000 indicators and average levels of waste treatment and exposure to air pollution by particulate matter.

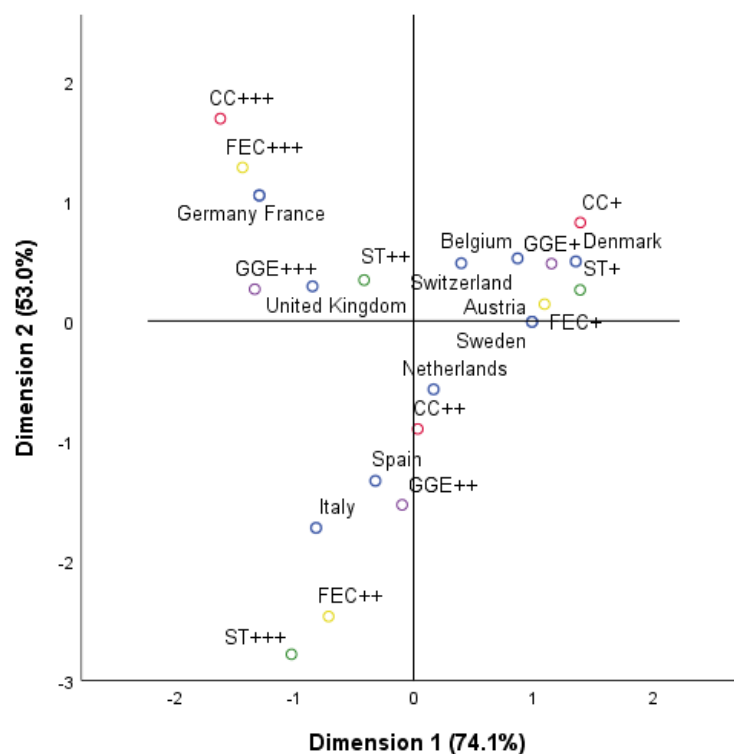


Figure 4. Correspondence diagram (MCA) of the following features: sustainability-themed investments (ST); contribution to the international 100bn USD commitment to climate-related expenditure (CC); greenhouse gas emissions in tons (GGE); final energy consumption (FEC) Dimension 1 explains 74.1% of the variance; dimension 2 explains 53.0% of the variance.

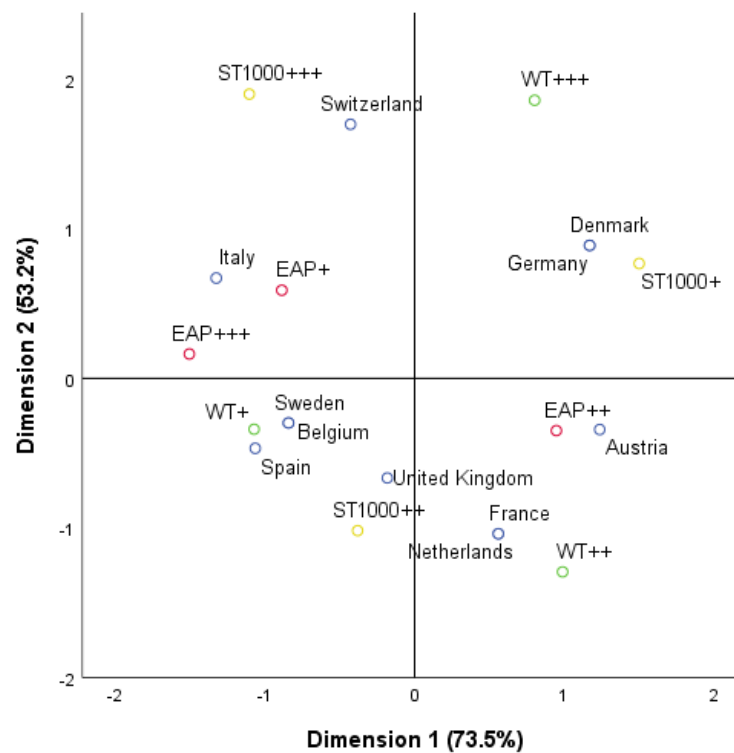


Figure 5. Correspondence diagram (MCA) of the following features: STI/1000, (ST1000), exposure to air pollution by particulate matter (EAP), waste treatment (WT). Dimension 1 explains 73.5% of the variance; dimension 2 explains 53.2% of the variance.

The third diagram (see Figure 6) also analyzes the behavior of countries against variables of nonenvironmental character, however indicating the level of innovativeness in terms of the innovation index (INN), expenditure on research and development (RD), and an environmental variable: share of energy from renewable sources in gross final energy consumption (RS). The goal of such an analysis was to estimate whether countries with high levels of innovativeness and expenditure on R&D use green energy from renewable energy sources. The MCA diagram presents three separate groups obtained due to clustering and the variables grouped around them. The most innovative countries with high expenditure on R&D, using renewable sources of energy, included Austria, Denmark, and Sweden—these countries had the lowest level of STI.

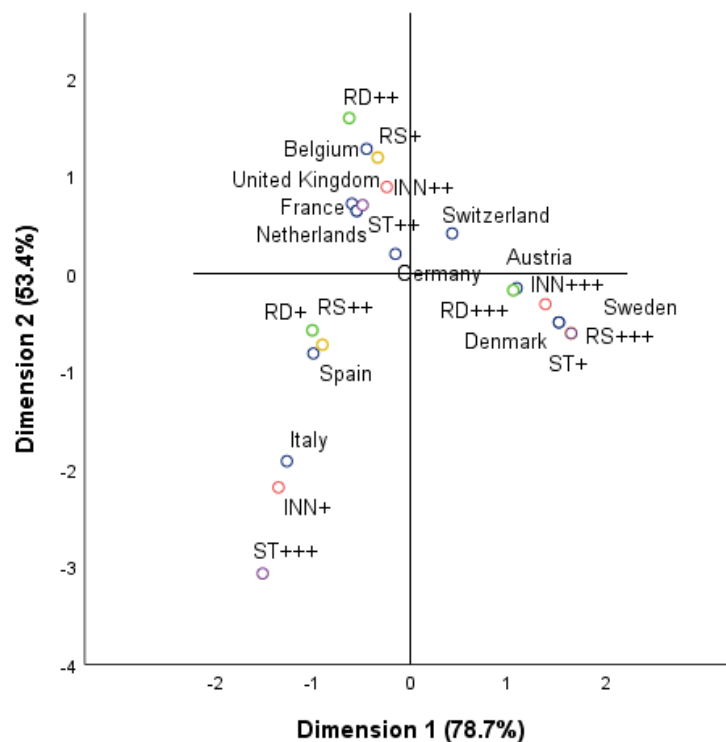


Figure 6. Correspondence diagram (MCA) of the following features: sustainability-themed investments (STI); innovation index (INN); expenditure on R&D (RD); share of energy from renewable sources in gross final energy consumption (RS). Dimension 1 explains 78.7% of the variance; dimension 2 explains 53.4% of the variance.

Another group included the Netherlands, Belgium, Germany, and the UK, which had moderate levels of STI, expenditure on R&D, and innovation index scores and a low share of energy from renewable sources in gross final energy consumption. This group also included France and Switzerland, who showed a significant similarity despite relatively high values of STI. In Italy and Spain, despite low innovativeness indices and expenditure to R&D, as well as an average use of renewable energy sources, STI values were high.

5. Discussion

The results of the study indicate limited investor engagement in pro-environmental activity in Europe. The general increasing tendency towards sustainability-themed investment is observable; however, the share of STIs in socially responsible investment remains at a very low level, not exceeding 2%. This means that all SRI strategies are increasingly being adopted, not only those aimed at environmental protection. The analysis of STI value in European countries showed strong differentiation among them and no clear trends. Italy was the leader in terms of STIs in 2017, taking over from France

and the Netherlands in 2015. High shares and a stable level over time were also visible in the UK and Switzerland.

The increased activity of these countries may be explained by actions undertaken by policymakers who have begun to implement EU resolutions outlined in the Action Plan: Financing Sustainable Growth. This is reflected in a relatively high share of investments in renewable energy (in spite of a tendency to decline) and the growth of investments in climate change as well. Policymakers have exhibited this responsibility, particularly in Italy and France, which has been confirmed by the application of numerous instruments for environmental protection in national legal systems [57]. However, the effects of such regulations, in particular their profitability, might be judged only from a long-term perspective.

Generally, tax incentives are factors that stimulate the development of given sectors of the economy. The renewable energy sector, which usually consumes vast amounts of capital, especially at the beginning, requires such incentives. These activities may attract socially responsible investors as well as conventional ones focused mainly on profit generation. For example, the Italian government has committed to increasing the percentage of electric energy from renewable sources to 40 percent by 2030 [58]. The implementation of these goals is supported by tax incentives. The increase of STIs in Italy in 2017 may again reflect the interest in climate investment funds. France is enormously engaged in pro-ecological activities. The new energy act reducing the share of nuclear energy from 75 to 50 percent by 2035 [59] and increasing the share of renewable energy from 17 to 40 percent by 2030 [58] determines new directions of energy production in France. To strengthen pro-ecological policy and to encourage the development of renewable sources of energy, carbon taxes have also been introduced. The transparency of ecological investments is crucial as well, e.g., specially labeled financial ecological products, because they increase the recognition of such products (e.g., the GreenFin mark in France, the ecolabel for mutual funds in Sweden, and label of ESG financial products in Spain).

Italy had the highest level of investment in 2017, followed by France, Switzerland, and the UK, while investment per capita (STI/1000) revealed the dominance of Italy, Switzerland, and Belgium. Therefore, Italy and Switzerland both have an advantage over other countries in terms of both STIs (EUR bn) and per capita (STI/1000) values.

The countries with the lowest STI, both in absolute values and per capita (STI/1000), were Denmark, Austria, and Sweden respectively, whereas Poland did not register any STIs in 2017. Sweden recorded a low level of STI, even though it is perceived as an environmentally friendly country; more specifically, many actions to promote green investments were undertaken in Sweden in 2017. Additionally, Stockholm Green Digital Finance was set up to serve as an independent innovation platform, especially for green fintech innovations, and the Swedish Government has launched the Stockholm Sustainable Finance Centre.

As per the research results, no significant correlation was indicated between STIs in European countries and selected ecological variables.

Germany and the UK are countries with considerable levels of air pollution; at the same time, they show average STI values. France was also part of this group, although it displays a high level of STIs. Switzerland, which is particularly highly involved in waste treatment, with the highest rate of STIs per capita, is clearly separate in the diagram showing correspondence between STIs and waste treatment and exposure to air pollution by particulate matter. Among innovative countries with high expenditure for R&D, there are no countries that recorded a high level of STI. Simultaneously, these countries show a high share of renewable energy in total energy consumption—as has been observed in Austria, Denmark and Sweden. Especially in the Scandinavian countries, with high environmental awareness, a relatively low share of STIs should be attributed to involvement of the state in activities having public approval. In 2007, even before the COP21, research was conducted in the Danish market [17,18] on the possibility of obtaining 100% energy from renewable sources in the country.

The research conducted proves that investments in the capital market are not a factor determining the development of investments aimed at environmental protection. This means that investors do not invest capital in companies in such an amount so as to contribute to significant and measurable effects. Therefore, other factors should be considered. It might be assumed that a well-conducted and transparent regulatory policy is a factor stimulating activities aimed at environmental protection. Also, previous studies [2–7] have indicated these factors.

The results obtained confirm the hypothesis that the ecological dimension of socially responsible investment did not have a significant impact on environmental activities in European countries in the analyzed period.

6. Conclusions

The environment—due to its features of a public good—is of crucial importance to the development of the entire economy. When it is regulated by law, it has a significantly different meaning to entities operating in the economy. Such entities, by undertaking actions aimed at environmental protection, not only improve their external image, but also follow through on their commitments towards society through these actions. The destructive effects of environmental pollution, such as global warming, holes in the ozone layer, or acid rain, increase the need for environmental protection. Of vital importance to coherent environmental protection activities are international agreements concluded worldwide, without which it is almost impossible to enforce changes in the legal system in particular, which result, for example, from the protection of the interests of different social groups. Furthermore, geological conditions are crucial because they prove the potential of a country. Taking advantage of such potential may be supported by a country to a different extent.

The capital market is a reliable source of capital for pro-environmental investments. Enterprises, if properly encouraged, may take advantage of different forms of financing, and investors—seeing the potential for growth in the value of funds invested in pro-ecological activities—may constitute stable and loyal shareholders.

In recent years, especially after the COP21, intensified environmental protection activities have been observed in some European countries at the legislative and declaration level, but they are still insufficient. It is difficult to expect that changes will take place quickly, because it is a long-term process, often lasting generations; however, positive trends such as increased values of ST investments and their dynamic development may confirm that the direction of legislative changes is correct.

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