South-Eastern Europe Journal of Economics 1 (2023) 53-80 SEEJE

DRIVERS (PREDICTORS) OF GREEN MANAGEMENT PRACTICES AND GREEN INVESTMENT. EMPIRICAL EVIDENCE FROM CENTRAL AND EASTERN EUROPEAN FIRMS

ROXANA-GABRIELA MOZOLEA[1]
Alexandru I. Cuza University, Iasi, Romania

Abstract
There is a continuous need to understand and develop green practices and investments in order to emphasize environmental focus. This article's purpose is to analyze how firms from Central and Eastern Europe approach the topic of green management and correlate their decisions with their eco-friendly actions. The methodology applied is binary logistic regression and our data sample consists of 5,472 businesses/firms/companies from 12 countries. Results indicate that firms whose strategy entailed objectives regarding ecological aspects and that had set up a management position dedicated to these objectives are more likely to monitor their energy consumption, to set targets on energy consumption and CO_2 emissions and to invest in more eco-friendly machinery or heating and cooling devices. On the other hand, if the firms are experiencing losses due to pollution, there is no significant probability for them to implement the above-stated actions. This paper offers interesting implications for stakeholders and managers to understand the predictability of their actions and to assess the correlations between inside firm actions in depth.

Keywords: binary logistic regression, green investments, green management practices, predictability.
JEL Classification: Q50, C25, D22

The paper has been awarded by the Board of ASECU with the Tsekouras Prize for Young Economists, in 2023. A first form of the paper has been also presented in the 19th International Conference of ASECU, Yerevan, Armenia, May 2023.

---

1. ***Corresponding address:*** Roxana-Gabriela Mozolea, PhD Student, Alexandru I. Cuza University, Finance Department, Faculty of Economics and Business Administration, Iasi, Romania. E-mail roxana.mozolea@yahoo.com

I. Introduction

The accelerated effects of climate change have encouraged an increasing number of both public and private entities, as well as international organizations, to develop and implement green management practices. The aim of this study is to identify and evaluate the drivers of green management practices and green investment using 5,472 firms' data from 12 Central and Eastern European countries, namely: Albania, Bulgaria, Croatia, the Czech Republic, Hungary, Poland, Romania, the Slovak Republic, Slovenia, Estonia, Lithuania, and Latvia. The data sample of our paper originate from the EBRD-EIB-WBG Enterprise Surveys conducted in 2018-2020 that covered almost 28,000 enterprises in 41 economies of the EU, Eastern Europe, Central Asia, the Middle East and North Africa.

The statistical model is based on the objectives of this study, i.e., understanding the drivers of green management practices and green investment regarding two core aspects: monitorization and targets on energy and CO_2 for the former and resource allocation for upgrading eco related aspects for the latter. Dependent variables focus on internal monitorization, external audits as well as implementing targets and investments focused on environmental benefits. The drivers selected for these variables were 7 after testing them through binary logistic regression: whether the firms had a written business strategy; whether their business strategy included aspects regarding environmental issues; whether there was a management position dedicated to environmental issues; whether there were investments in R&D inside or outside the business; whether there were losses caused by pollution or by extreme weather events.

Results indicate that the drivers (predictors) with significant predictability rates on both management practices and green investment are the presence of a management position dedicated to environmental issues and strategic objectives that mention environmental or climate change matters. Those with lower predictability rates are R&D investments within the business, a written business strategy, and losses from extreme weather events. Investments in R&D outside the business have a lower predictability rate on the majority of the selected dependent variables. On the other hand, in our model, losses due to pollution are either non-significant or reduce the likelihood of adopting green practices or investments.

This study highlights the main predictors of green management practices and green investment from Central and Eastern European firms and the significant implications these drivers have for practitioners. Companies are accountable not just for generating a profit, but also for improving society and the economy in a way that is environmentally friendly; this is why it is essential to understand what internal aspects have a positive impact on "green" actions and sustainability. Understanding which aspects of the firms can increase the predictability of green practices or investments can create a model in which actions are strongly related and have an emphasized focus on environmental aspects.

The paper is organized as follows: Section II is based on the analysis of existing literature regarding green management practices and the third part describes the data and methodology employed in the empirical study, as well as motivation. Section IV presents the empirical results and the final part highlights the conclusions, the limitations and future research opportunities.

II. Literature review

In a broad sense, sustainable investments describe responsible investments, socially conscious investments, and investments with an eye on the environment (Utz et al., 2015). The term "*green*" is a very broad definition for numerous types of activities and assets, entailing either absolute (a technology is green or not green) or relative concepts (firm X produces lower CO_2 emissions than firm Y). Regarding some industries (such as renewable energy), products (such as renewable energy credits), services (such as waste management), and technologies, there appears to be a sizable intersection of different definitions in existing literature.

The effects of climate change on institutional asset allocation are assessed by Mercer (2011), which indicates that traditional strategic asset allocation (SAA) does not take climate change into account. Three dimensions make up an evaluation framework for climate change risk: low-carbon technology; the effects of climate change; and the price of emissions brought on by policy changes. The use of green investments to strengthen sustainable development and address environmental issues results in changes in consumer behavior, as more and more consumers choose to purchase organic over conventional goods (Yen, 2018). In addition, companies whose management informs society of the advantages of the green investments they make are more likely to attract investors (Martin & Moser,2016).

Using green technology reduces specific taxes, helps meeting customer demands to consume green products and protect the environment, while it also raises stakeholders' satisfaction, especially investors' satisfaction, these being just a few of the benefits of implementing green investments. The reasons for making green investments vary as well. Understanding the various driving forces of green investors is crucial because it will influence how they define and interpret the term "green investment."

Earlier studies examined the effects of green practices on organizational performance and identified both beneficial and significant correlations between them (Cankaya & Sezen, 2019). However, there are several internal and external aspects that encourage firms to go green and, thereby, enhance their performance in terms of sustainability. Even though there are numerous external and internal drivers that influence investments and practices regarding environmental actions, it's complicated to assess these predictors, especially regarding their strength and feasibility (Table 1).

Table 1. Classification of the drivers of sustainable supply chain management

External Drivers	Internal Drivers
• Market Pressure	• Corporate Strategy
• Social Pressure	• Organizations' Culture
• Regulatory Pressure	• Organizations' Resources
	• Organizations' Characteristics

Source: Saeed & Kersten, 2019

Enterprises relying on external inputs to change take advantage of possibilities by making more sustainable investments. According to a study that examined over 5300 investment decisions at the level of 462 companies in the field of energy efficiency showed that, when using internal and external change agents simultaneously, there is no impact on the effect of external drivers (Hoppman et al., 2018). Government pressure, competitor pressure, consumer pressure, and supplier pressure are the primary external variables affecting green investment (Paul et al., 2017).

According to Du et al. (2019), the main factors influencing green investments are political, economic, and environmental. By building infrastructure and putting laws and norms into place to safeguard the environment, political issues have a significant impact on green investments. These include environmental taxes, giving discounts to customers who purchase organic items, offering subsidies to businesses making green investments, and fining businesses that violate pollution restrictions.

One of the most important topics in the literature on corporate sustainability is what motivates businesses to invest in activities linked to sustainability (Bansal & Roth, 2000; Ervin et al., 2013). Most studies assume that businesses are more motivated to invest in sustainable activities if there is a direct economic benefit, such as cost reduction or profit increase. For example, energy efficiency measures contribute both to helping the environment and to business finances, but not all companies choose to make this kind of investments even though they entail only advantages (Lyneis & Sterman, 2016; Backlund et al., 2012).

According to Marcus and Geffen (1998), a company's internal capabilities (such as organizational learning and looking for outside people, technology, and ideas) can aid ~~in~~ the acquisition of external skills, which are then helpful in enhancing environmental performance. Process innovation and implementation are necessary for pollution avoidance technologies to provide the firm with a low-cost advantage (Christmann, 2000). According to Sharma et al. (2004), organizations that can integrate shareholders, organizational learning, cross-functional integration, continuous innovation, shared vision, and strategic proactivity are more likely to develop green strategies.

Existing studies analyze numerous perspectives of the green actions companies take to fight climate changes. In addition, drivers with the highest impulses for implement green practices and investments can be subtracted. On the other hand, in my knowledge, there is no existing study to support the main drivers (predictors) that influence green investments and practices in businesses of Central and Eastern European countries.

III.1. Data & Methodology

The European Bank for Reconstruction and Development (EBRD), the European Investment Bank (EIB), and the World Bank Group collaborated to create the EBRD-EIB-WB Enterprise Surveys. Nearly 28,000 businesses were surveyed as part of the EBRD-EIB-WBG Enterprise Surveys between 2018 and 2020 in 41 countries across the EU, Eastern Europe, Central Asia, the Middle East, and North Africa. The Green Economy module of the EBRD-EIB-WBG Enterprise Surveys covered green investments and green management techniques.

After data cleaning procedures and selection of the firms from Central and Eastern European countries (Albania, Bulgaria, Croatia, the Czech Republic, Hungary, Poland, Romania, the Slovak Republic, Slovenia, Estonia, Lithuania, and Latvia), the data sample comprises information for 5.742 businesses.

The purpose of the survey is to gather opinions from businesses about how they view the environment in which they operate in EBRD operational countries (and beyond), as well as to contribute to the development of a panel of business data that will enable monitoring changes in the business environment over time.

The statistical model applied in this study is **binary logistic regression** which predicts the probability that an observation falls into one of two categories of a dichotomous dependent variable. In regression analysis, logistic regression (also known as logit regression) estimates a logistic model's parameters (the coefficients in the linear combination). In binary logistic regression, there is a single binary dependent variable with two values denoted by numbers "0" and "1," whereas the independent variables can each be either a binary variable or a continuous variable (any real value). The choice of this model is based on the format of the data, mainly questions with Yes/No answers.

The article model is developed in accordance with our motivation, i.e., to understand which the internal drivers of the businesses are for selected CEE countries regarding green management practices and investments. We selected 7 independent variables (IV) as internal drivers that may influence environmentally-oriented actions: whether the firms have a written business strategy; whether the business strategy includes aspects regarding environmental issues; whether there is a management position dedicated to environmental issues; whether there are investments in R&D inside or outside the business; whether there are losses caused by pollution or by extreme weather events.

The chosen dependent variables (DV) focus on 7 important aspects regarding green practices and investments: whether businesses monitor their energy consumption; whether there are targets for energy consumption and CO_2 emissions and whether resources are allocated for heating and cooling improvements, climate-friendly energy, machinery upgrades or energy management.

III.2. Motivation

The motivation of this article focuses on the need to understand if there are internal drivers that may influence green investments and practices for businesses in Central and Eastern European countries. The objective of this study is to assess whether particular actions inside the firm have the capacity to predict concerning specific environmental aspects and to provide an answer to the question: "Does any of the selected independent variables predict the probability of actions based on/regarding dependent variables?

In this study, I have identified two primary directions: green investments, focused on upgrades or changes, and green practices, which analyze and constantly evaluate consumption and pollution produced during firms' activity.

Independent Variables (Yes/No?)	Dependent variables (Yes/No?)
• Does the Firm have a Formalized Written Business Strategy?	• Over the Last 3 Years, Has This Establishment Monitored Its Energy Consumption?
• In the Last FY, Do Strategic Objectives Mention/Include Environmental or Climate Change Issues?	• Over the Last 3 Years, Has This Establishment Had Targets for Energy Consumption?
• In the Last FY, Is There a Manager Responsible for Environmental or Climate Issues?	• Does This Establishment Have Targets For CO2 Emissions?
• During the Last 3 Yrs, Has the Establishment Spent on R&D within the Establishment?	• Over the Last 3 Years, Have Heating and Cooling Improvements Been Adopted?
• During the Last 3 Yrs, Has the Establishment Spent on R&D Contracted Outside the Establishment?	• Over the Last 3 Years, Have More Climate-Friendly Energy Generation Been Adopted on Site?
• Over the Last 3 the Years, Has the Firm Experienced Monetary Losses Due to Extreme Weather Events?	• Over the Last 3 Years, Have Machinery Upgrades Been Adopted?
• Over the Last 3 Years, Has the Experienced Monetary Losses Due to Pollution?	• Over the Last 3 Years, Has Energy Management Been Adopted?

IV predict the actions from DV

IV. Results

➢ **Descriptive statistics**

The first part of the analysis consists in understanding the data, the qualitative information, and the distribution across clusters, considering both the whole sample and the sample split by country. The sample comprises 1,215 large firms, 1,706 medium firms and 2,551 small firms (Figure 1); the distribution across countries is uneven (Figure 2.). The highest number of surveyed businesses come from Poland (1,001) and the lowest from Estonia (254).

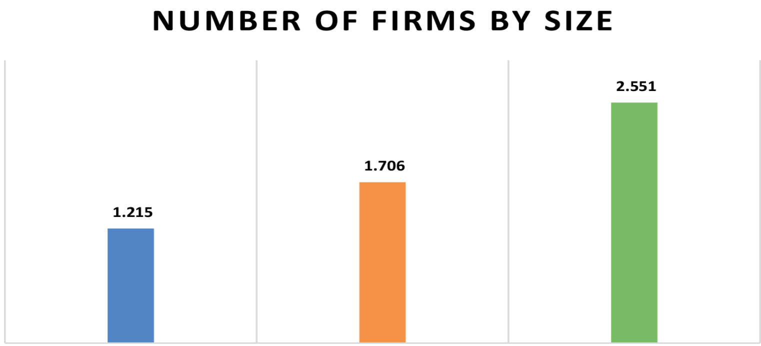

Figure 1. Number of firms by size

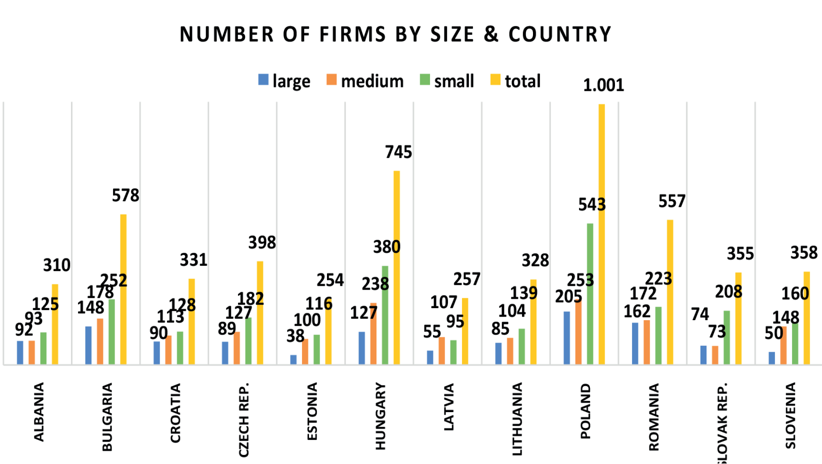

Figure 2. Number of firms by size & country

The highest number of firms, i.e., 1,244, are in *other services,* followed by *retail, manufacturing, food & beverages,* the lowest number, i.e., 97, being in the *textile* industry (Figure 3.).

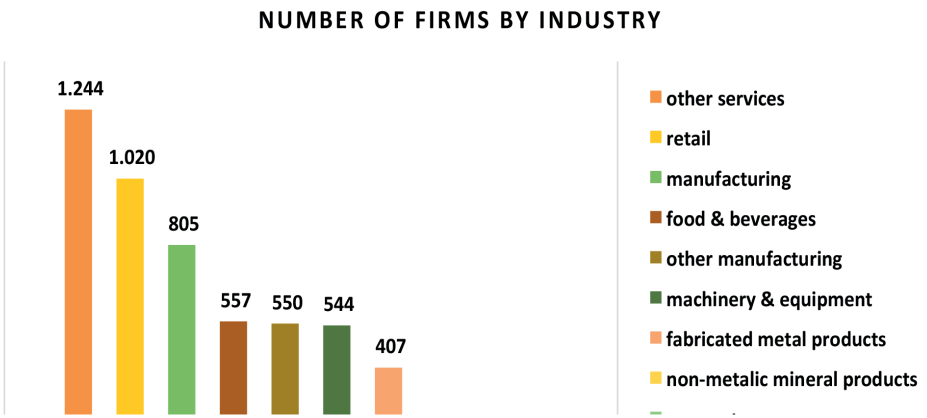

Figure 3. Number of firms by industry

A key aspect in developing our analysis and our statistical model is understanding the distribution of answers from independent and dependent variables (Figure 4. and Figure 5.).

Around 40% of the businesses surveyed have a written strategy, but only 23% of them include a focus on environmental aspects in their objectives and only 15% of the firms have a dedicated manager for green aspects. 18% of them invest in R&D inside the business and 9% outside the business. The percentages of the interviewed companies that experienced losses due to extreme weather events or pollution are only 10% and 2%, respectively.

Analysis of green practices and investments shows that 57% of the firms monitor their energy consumption, but only 30% and 7%, have targets on energy consumption and on CO_2 emissions, respectively. 38% of businesses adopt heating and cooling improvements, 14% of them adopt more climate-friendly energy generation on-site and 30% adopt energy management. The highest percentages of green investments, i.e., 51%, are observed in machinery upgrades.

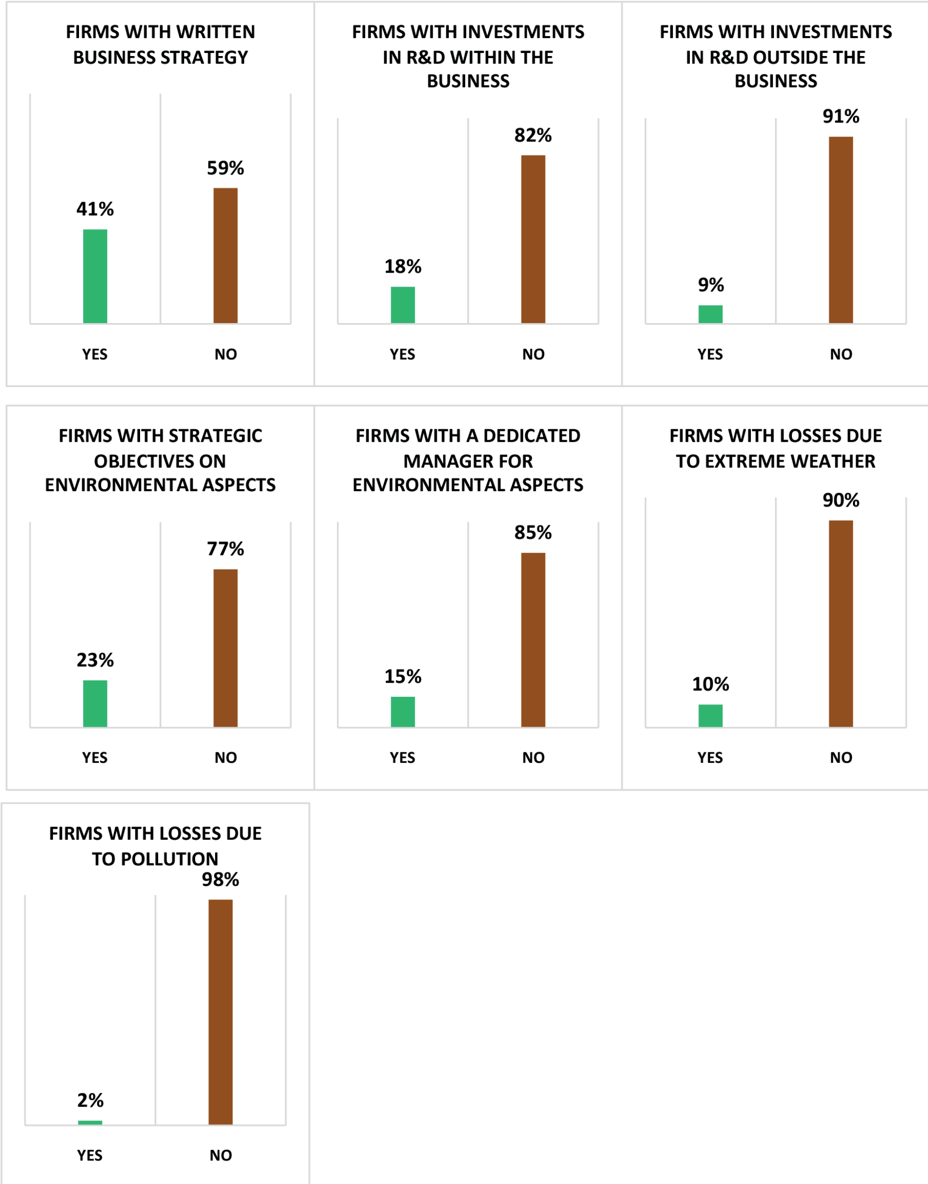

Figure 4. Distribution of answers from independent variables

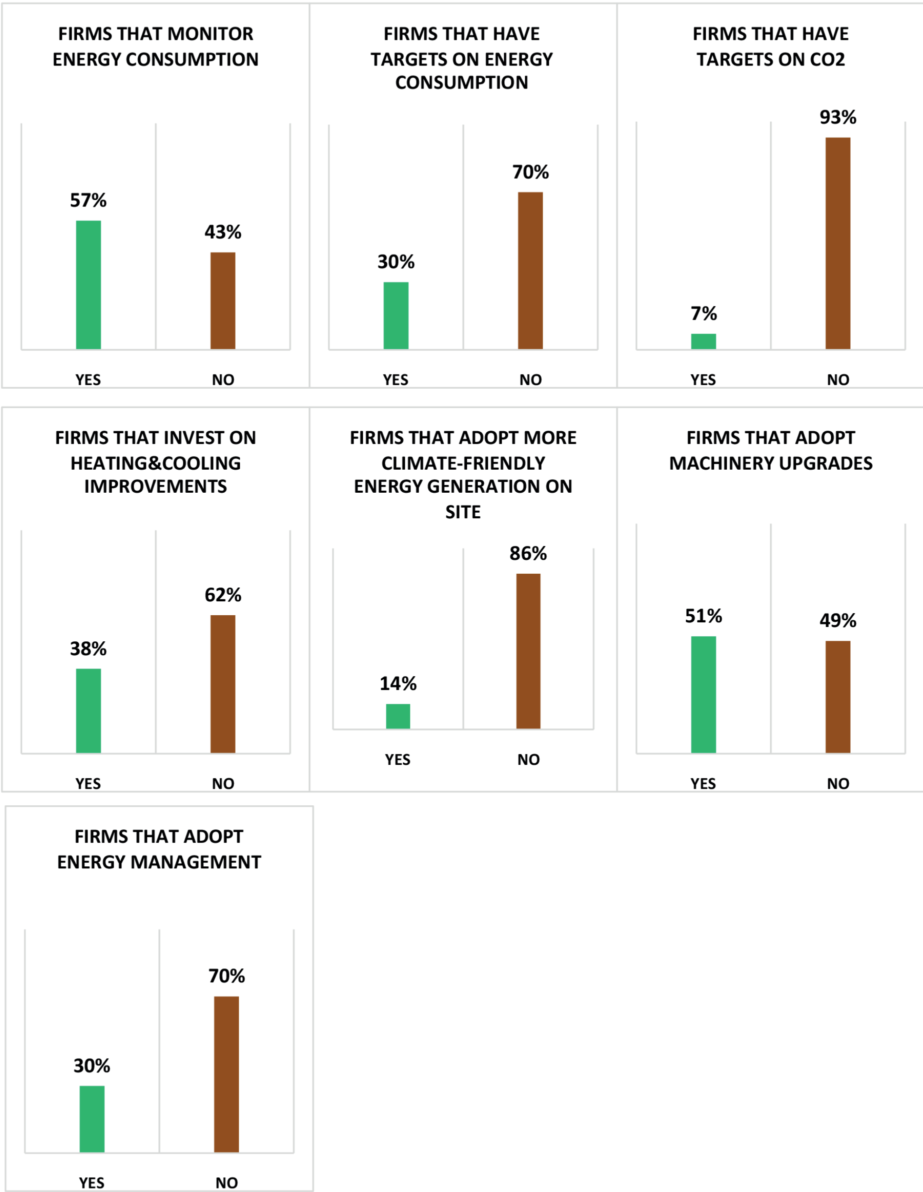

Figure 5. Distribution of answers from dependent variables

- **Binary logistic regression**

  In this part of the study the results of the binary logistics regression applied for each of the selected dependent variables will be presented.

1. **Over the last 3 years, has this establishment monitored its energy consumption?**

Research question: Can we predict whether the establishment monitored its energy consumption based on whether it had a written business strategy, whether it invested in R&D inside or outside the business? On whether the business strategy included aspects regarding environmental issues, whether there was a management position dedicated to environmental issues and whether the firm experienced losses due to extreme weather or pollution?

Table 2. Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	.301	.027	121.361	1	.000	1.352

Table 3. Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	589.514	7	.000
	Block	589.514	7	.000
	Model	589.514	7	.000

We can observe a statistically significant result in Sig. value, lower than 5% (Table 2.). The overall model is statistically significant, $\chi2(7) = 589.514$, $p < .05$ (Table 3.).

Table 4. Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	6873.548[a]	.102	.137

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Both Cox & Snell and Nagelkerke R Square values, used to calculate the variation explained, are listed in Table 4. Sometimes referred to as ”pseudo R2 values,” these values are interpreted in the same manner; in other words, the variation explained in the dependent variable is based on our model ranges from 10.2% to 13.7%, depending on whether we reference the Cox & Snell R2 or the Nagelkerke R2 methods, respectively.

Table 5. Hosmer and Lemeshow Test			
Step	Chi-square	df	Sig.
1	4.994	5	.417

The Hosmer-Lemeshow test examines the null hypothesis that the model's predictions exactly match the group memberships observed. When comparing the frequencies observed to those predicted by the linear model, a chi-square statistic is calculated. A non-significant chi-square and Sig mean that the data were well-fitted to the model (Table 5).

Table 6. Classification Table[a]					
	Observed		Predicted		
		monitor_energy_consumption		Percentage Correct	
		no	yes		
Step 1	monitor_energy_consumption	no	1310	1017	56.3
		yes	1014	2131	67.8
	Overall Percentage				62.9
a. The cut value is .500					

With the independent variables added, the model now correctly classifies 62.9% of overall cases (see "Overall Percentage" row), a Percentage accuracy in classification.

- 67.8 % of businesses that monitor their energy consumption were also predicted by the model to monitor their energy consumption (see the "Percentage Correct" column in the "Yes" row of the categories observed) Sensitivity

- 56.3 % of businesses that did not monitor their energy consumption were correctly predicted by the model not to be monitoring their energy consumption (see the "Percentage Correct" column in the "No" row of the categories observed) Specificity

Table 7. Categorical Variables Codings			
		Frequency	Parameter coding
			(1)
written_strategy	no	3210	1.000
	yes	2262	.000

Table 7. shows us that the written strategy was parameter coded as no (1) = 1 and yes (1) =0.

Table 8. Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B) Lower	95% C.I.for EXP(B)	
								Upper	
Step 1[a]	written_strategy(1)	-.316	.062	25.945	1	.000	.729	.645	.823
	RnD_within_business	**.790**	**.097**	**66.685**	**1**	**.000**	**2.204**	1.823	2.665
	RnD_outside_business	.600	.146	16.939	1	.000	1.821	1.369	2.423
	strategic_environment	.428	.087	24.452	1	.000	1.534	1.295	1.818
	environment_manager	**.758**	**.109**	**48.594**	**1**	**.000**	**2.134**	1.724	2.641
	losses_weather	**.793**	**.116**	**47.023**	**1**	**.000**	**2.210**	1.762	2.773
	losses_pollution	-.025	.231	.012	1	.913	.975	.620	1.534
	Constant	.084	.055	2.309	1	.129	1.088		

a. Variable(s) entered on step 1: written_strategy, RnD_within_business, RnD_outside_business, strategic_environment, environment_manager, losses_weather, losses_pollution.

As Table 8. presents, The Wald test (”Wald” column) is used to determine statistical significance for each of the independent variables. The statistical significance of the test is found in the ”Sig.” column. From these results it is apparent that written strategy (p = .000), R&D within the business (p = .000), R&D outside the business (p= .000), strategic_environment (p= .000), environment_manager (p= .000) and losses_weather (p = .000) significantly added to the model/prediction, but losses_pollution (p = .913) did not significantly add to the model/prediction.

A binary logistic regression was performed to ascertain the effects of written business strategy, investments in R&D inside or outside the business, business strategy including aspects regarding environmental issues, a management position dedicated to environmental issues and losses experienced due to extreme weather or pollution on the likelihood of participants having monitored their energy consumption in the last 3 years. The logistic regression model was statistically significant, i.e., $\chi2(7)$ = 589.514, $p < .05$. The model explained 13.7 % (Nagelkerke R2) of the variance in monitoring energy consumption and correctly classified 62.9% of cases.

Firms without a written business strategy were associated with a reduction (0.729) in the likelihood of monitoring energy consumption. On the other hand, firms that invest in R&D within and outside the business presented a figure of 2.204, which means they are 1.821 times more likely to monitor their energy consumption. A similarly increased likelihood can be observed for the firms that have strategic objectives regarding the environment (1.534), a dedicated manager for environmental issues (2.134) and that have experienced losses due to extreme weather events (2.210). However, losses due to pollution have no statistical significance on the model (Sig = .913).

2. Over the last 3 years, has this establishment set targets on energy consumption?

Research question: Can we predict whether the establishment sets targets on energy consumption based on whether it has a written business strategy, invests in R&D inside or outside the business, its business strategy includes aspects regarding environmental issues, has a management position dedicated to environmental issues and experienced losses due to extreme weather or pollution?

We will apply the same binary logistic regression interpretation as in Sub-chapter 1.

Table 9. Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-.829	.029	795.055	1	.000	.437

Table 10. Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	914.898	7	.000
	Block	914.898	7	.000
	Model	914.898	7	.000

Table 11. Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	5806.268[a]	.154	.218

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Table 12. Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	13.687	5	.018

Table 13. Classification Table[a]

	Observed		Predicted		
		targets_energy_consumption		Percentage Correct	
		no	yes		
Step 1	targets_energy_consumption	no	3536	273	92.8
		yes	1109	554	33.3
	Overall Percentage				74.7

Table 14. Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper	
Step 1[a]	**written_strategy**	**.624**	**.067**	**85.846**	**1**	**.000**	**1.866**	1.636	2.130
	RnD_within_business	.602	.091	44.281	1	.000	1.827	1.530	2.181
	RnD_outside_business	.247	.123	4.037	1	.045	1.280	1.006	1.627
	strategic_environment	**1.062**	**.082**	**166.939**	**1**	**.000**	**2.892**	2.461	3.397
	environment_manager	.597	.096	38.983	1	.000	1.817	1.507	2.192
	losses_weather	.611	.105	33.568	1	.000	1.842	1.498	2.265
	losses_pollution	-.366	.210	3.037	1	.081	.694	.460	1.047
	Constant	-1.706	.049	1199.733	1	.000	.182		

a. Variable(s) entered on step 1: written_strategy, RnD_within_business, RnD_outside_business, strategic_environment, environment_manager, losses_weather, losses_pollution.

A binary logistic regression was performed to ascertain the effects of written business strategy, investments in R&D inside or outside the business, the business strategy includes aspects regarding environmental issues, a management position dedicated to environmental issues and of the experienced losses due to extreme weather or pollution on the likelihood of participants having set targets on energy consumption in the last 3 years. The logistic regression model was statistically significant, $\chi2(7) = 914.898$, $p < .05$. The model explained 21,8% (Nagelkerke R2) of the variance in targets on energy consumption and correctly classified 74,7% of cases.

Firms with a written business strategy were associated with an increase (1.866) in the likelihood of having targets on energy consumption. Firms that invest in R&D within and outside the business presented a figure of 1.827 which means they are

1.280 times more likely to target their energy consumption. A similarly increased likelihood can be observed for firms that have strategic objectives regarding the environment (2.892), a dedicated manager for environmental issues (1.817) and with experience of losses due to extreme weather events (1.842). On the other hand, losses due to pollution have no statistical significance on the model (Sig = .081).

3. Did this establishment set targets for CO_2 emissions?

Research question: Can we predict whether the establishment set targets for CO2 based on whether it has a written business strategy, invests in R&D inside or outside the business, has a business strategy including aspects regarding environmental issues, has a management position dedicated to environmental issues and experienced losses due to extreme weather or pollution?

We will apply the same binary logistic regression interpretation as in Sub-chapter 1.

Table 15. Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-2.618	.054	2376.513	1	.000	.073

Table 16. Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	535.099	7	.000
	Block	535.099	7	.000
	Model	535.099	7	.000

Table 17. Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	2183.266[a]	.093	.238
a. Estimation terminated at iteration number 6 because parameter estimates changed by less than .001.			

Table 18. Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	9.465	5	.092

Table 19. Classification Table (a)

	Observed		Predicted		
			targets_CO2		Percentage Correct
			no	yes	
Step 1	targets_CO2	no	5094	6	99.9
		yes	367	5	1.3
	Overall Percentage				93.2
a. The cut value is .500					

Table 20. Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Step 1 (a)	written_strategy	.524	.133	15.621	1	.000	1.689	1.302	2.189
	RnD_within_business	.415	.144	8.259	1	.004	1.514	1.141	2.010
	RnD_outside_business	.262	.170	2.371	1	.124	1.299	.931	1.814
	strategic_environment	**1.419**	**.144**	**97.535**	1	**.000**	**4.134**	**3.119**	**5.479**
	environment_manager	**.926**	**.136**	**46.377**	1	**.000**	**2.524**	**1.933**	**3.294**
	losses_weather	.441	.157	7.905	1	.005	1.555	1.143	2.115
	losses_pollution	.441	.248	3.173	1	.075	1.555	.957	2.527
	Constant	-4.033	.118	1.174.101	1	.000	.018		
a. Variable(s) entered on step 1: written_strategy, RnD_within_business, RnD_outside_business, strategic_environment, environment_manager, losses_weather, losses_pollution									

A binary logistic regression was performed to ascertain the effects of written business strategy, investments in R&D inside or outside the firm, a business strategy including aspects regarding environmental issues, a management position dedicated to environmental issues and experience of losses due to extreme weather or pollution on the likelihood of participants having set targets for CO_2 emissions. The logistic regression model was statistically significant, i.e., $\chi 2(7) = 535.099$, $p < .05$. The model explained 23.8% (Nagelkerke R2) of the variance in targets for CO_2 emissions and correctly classified 93.2% of cases.

Firms with a written business strategy were associated with an increase (1.689) in the likelihood of having targets for CO_2 emissions. Firms that invest in R&D within the business are 1.514 times more likely to target their CO_2 emissions. A similarly increased likelihood can be observed among firms with strategic objectives regarding the environment (4.134), a dedicated manager for environmental issues (2.524) and experience of losses due to extreme weather events (1.555). On the other hand, investments in R&D outside the business and losses due to pollution have no statistical significance on the model (Sig = .913 and Sig = .07, respectively.).

4. Over the last 3 years, have heating and cooling improvements been adopted?

Research question: Can we predict whether the establishment adopted heating and cooling improvements based on whether it has a written business strategy, it invests in R&D inside or outside the business, has a business strategy including aspects regarding environmental issues, has a management position dedicated to environmental issues and experience of losses due to extreme weather or pollution?

We will apply the same binary logistic regression interpretation as in ~~the~~ Subchapter 1.

Table 21. Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-.487	.028	305.621	1	.000	.615

Table 22. Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	532.689	7	.000
	Block	532.689	7	.000
	Model	532.689	7	.000

Table 23. Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	6738.382[a]	.093	.126

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Table 24. Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	12.682	5	.027

Table 25. Classification Table[a]					
	Observed		Predicted		
		heating_improvements		Percentage Correct	
		no	yes		
Step 1	heating_improvements	no	2997	392	88.4
		yes	1385	698	33.5
	Overall Percentage				67.5
a. The cut value is .500					

Table 26. Variables in the Equation									
		B	S.E.	Wald	df	Sig.	Exp(B) Lower	95% C.I.for EXP(B)	
								Upper	
Step 1[a]	written_strategy	.330	.062	28.061	1	.000	1.392	1.231	1.573
	RnD_within_business	**.610**	**.086**	**50.547**	**1**	**.000**	**1.841**	1.556	2.178
	RnD_outside_business	.511	.119	18.426	1	.000	1.667	1.320	2.105
	strategic_environment	**.639**	**.080**	**63.152**	**1**	**.000**	**1.895**	1.618	2.218
	environment_manager	.436	.094	21.702	1	.000	1.546	1.287	1.857
	losses_weather	.385	.101	14.592	1	.000	1.470	1.206	1.791
	losses_pollution	-.257	.199	1.662	1	.197	.774	.523	1.143
	Constant	-1.043	.042	624.108	1	.000	.353		
a. Variable(s) entered on step 1: written_strategy, RnD_within_business, RnD_outside_business, strategic_environment, environment_manager, losses_weather, losses_pollution.									

A binary logistic regression was performed to ascertain the effects of written business strategy, investments in R&D inside or outside the business, a business strategy including asingpects regarding environmental issues, a management position dedicated to environmental issues and experience of losses due to extreme weather or pollution on the likelihood of firms having adopted healing and cooling improvements. The logistic regression model was statistically significant, with $\chi 2(7) = 532.689$, $p < .05$. The model explained 12.6% (Nagelkerke R2) of the variance of firms that had adopted healing and cooling improvements and correctly classified 67.5% of cases.

Firms with a written business strategy were associated with an increase (1.392) in the likelihood of having adopted healing and cooling improvements. Firms that invest in R&D within and outside the business present a figure of 1.841, which means they are 1.667 times more likely to adopt healing and cooling improvements. A similarly increased likelihood can be observed among firms with strategic objectives regarding the environment (1.895), a dedicated manager for environmental issues (1.546) and experience of losses due to extreme weather events (1.470). On the other hand, losses due to pollution have no statistical significance on the model (Sig = .197).

5. Over the last 3 years, have more climate-friendly energy generation been adopted on site?

Research question: Can we predict whether the establishment adopted more climate-friendly energy generation on site based on whether it has a written business strategy, it invests in R&D inside or outside the business, has a business strategy including aspects regarding environmental issues, has a management position dedicated to environmental issues and experience of losses due to extreme weather or pollution?

We will apply the same binary logistic regression interpretation as in Sub-chapter 1.

Table 27. Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-1.832	.039	2184.829	1	.000	.160

Table 28. Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	501.238	7	.000
	Block	501.238	7	.000
	Model	501.238	7	.000

Table 29. Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	3890.269[a]	.088	.159

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Table 30. Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	6.640	4	.156

Table 31. Classification Table[a]					
	Observed		Predicted		
		climate_friendly_energy		Percentage Correct	
		no	yes		
Step 1	climate_friendly_energy	no	4697	20	99.6
		yes	740	15	2.0
	Overall Percentage				86.1

a. The cut value is .500

Table 32. Variables in the Equation									
		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper	
Step 1[a]	**written_strategy**	**.438**	**.090**	**23.551**	**1**	**.000**	**1.549**	1.298	1.848
	RnD_within_business	.396	.110	13.070	1	.000	1.486	1.199	1.843
	RnD_outside_business	.125	.139	.812	1	.367	1.133	.863	1.488
	strategic_environment	**1.242**	**.100**	**153.778**	**1**	**.000**	**3.463**	2.846	4.215
	environment_manager	.366	.109	11.337	1	.001	1.441	1.165	1.783
	losses_weather	.200	.127	2.504	1	.114	1.222	.953	1.566
	losses_pollution	.301	.217	1.919	1	.166	1.351	.883	2.069
	Constant	-2.696	.070	1496.708	1	.000	.067		

a. Variable(s) entered on step 1: written_strategy, RnD_within_business, RnD_outside_business, strategic_environment, environment_manager, losses_weather, losses_pollution.

A binary logistic regression was performed to ascertain the effects of a written business strategy, investments in R&D inside or outside the business, a business strategy including aspects regarding environmental issues, a management position dedicated to environmental issues and experience of losses due to extreme weather or pollution on the likelihood of firms having more climate-friendly energy generation on site. The logistic regression model was statistically significant, i.e., $\chi2(7) = 501.238$, $p < .05$. The model explained 15.6% (Nagelkerke R2) of the variance of firms that have adopted more climate-friendly energy generation on site and correctly classified 86.1% of cases.

Firms with a written business strategy were associated with an increase (1.549) in the likelihood of having adopted more climate-friendly energy generation on site.

Firms that invest in R&D within the business are 1.496 times more likely to adopt more climate-friendly energy generation on site. A similarly increased likelihood can be observed for firms with strategic objectives regarding the environment (3.463) and a dedicated manager for environmental issues (1.441). On the other hand, investments in R&D outside the business, losses due to extreme weather events and pollution have no statistical significance on the model (Sig = .367; Sig= .114; Sig= .166).

6. Over the last 3 years, have machinery upgrades been adopted?

Research question: Can we predict whether the establishment adopted machinery upgrades based on whether it has a written business strategy, it invests in R&D inside or outside the business, has a business strategy including aspects regarding environmental issues, has a management position dedicated to environmental issues and experience of losses due to extreme weather or pollution?

We will apply the same binary logistic regression interpretation as in Sub-chapter 1.

Table 33. Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	.053	.027	3.789	1	.052	1.054

Table 34. Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	631.482	7	.000
	Block	631.482	7	.000
	Model	631.482	7	.000

Table 35. Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	6950.531[a]	.109	.145

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Table 36. Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	27.987	5	.000

Table 37. Classification Table[a]					
	Observed		Predicted		
		machinery_upgrades		Percentage Correct	
		no	yes		
Step 1	machinery_upgrades	no	2031	633	76.2
		yes	1289	1519	54.1
	Overall Percentage				64.9

Table 38. Variables in the Equation									
		B	S.E.	Wald	df	Sig.	Exp(B) Lower	95% C.I.for EXP(B) Upper	
Step 1[a]	written_strategy	.277	.061	20.391	1	.000	1.319	1.170	1.488
	RnD_within_business	**.928**	**.093**	**99.066**	**1**	**.000**	**2.530**	2.108	3.038
	RnD_outside_business	.415	.134	9.545	1	.002	1.514	1.164	1.969
	strategic_environment	.553	.084	43.363	1	.000	1.739	1.475	2.050
	environment_manager	**.733**	**.103**	**50.868**	**1**	**.000**	**2.081**	1.701	2.545
	losses_weather	.567	.107	28.065	1	.000	1.762	1.429	2.174
	losses_pollution	-.734	.207	12.583	1	.000	**.480**	.320	.720
	Constant	-.490	.039	159.070	1	.000	.613		

a. Variable(s) entered on step 1: written_strategy, RnD_within_business, RnD_outside_business, strategic_environment, environment_manager, losses_weather, losses_pollution.

A binary logistic regression was performed to ascertain the effects of a written business strategy, investments in R&D inside or outside the business, a business strategy including aspects regarding environmental issues, a management position dedicated to environmental issues and experience of losses due to extreme weather or pollution on the likelihood of firms adopting machinery upgrades. The logistic regression model was statistically significant, with $\chi2(7) = 631.482$, $p < .10$. The model explained 145% (Nagelkerke R2) of the variance of firms having adopted machinery upgrades and correctly classified 64.9% of cases.

Firms with a written business strategy were associated with an increase (1.319) in the likelihood of having adopted more climate-friendly energy generation on site. Firms that invest in R&D within and outside the business present a figure of 2.539, which means it is 1.514 times more likely to adopt machinery upgrades. A similarly increased likelihood can be observed for firms with strategic objectives regarding the environment (1.739), with a dedicated manager for environmental issues (2.081), and for firms that experienced losses due to extreme weather events (1.762). On the other hand, losses due to pollution reduce the likelihood of firms adopting machinery upgrades by 0.480 times.

7. Over the last 3 years, has energy management been adopted?

Research question: Can we predict whether the establishment adopted energy management based on whether it has a written business strategy, it invests in R&D inside or outside the business, has a business strategy including aspects regarding environmental issues, has a management position dedicated to environmental issues and experience of losses due to extreme weather or pollution?

We will apply the same binary logistic regression interpretation as in Sub-chapter 1.

Table 39. Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-.840	.029	813.178	1	.000	.432

Table 40. Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	720.638	7	.000
	Block	720.638	7	.000
	Model	720.638	7	.000

Table 41. Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	5978.835[a]	.123	.175

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Table 42. Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	14.703	6	.023

Table 43. Classification Table[a]

	Observed		Predicted		
		energy_management		Percentage Correct	
		no	yes		
Step 1	energy_management	no	3516	306	92.0
		yes	1107	543	32.9
	Overall Percentage				74.2

Table 44. Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B) Lower	95% C.I.for EXP(B) Up-per	
Step 1[a]	written_strategy	.389	.067	33.707	1	.000	1.476	1.294	1.683
	RnD_within_business	.607	.089	46.492	1	.000	1.835	1.541	2.184
	RnD_outside_business	.310	.120	6.655	1	.010	1.364	1.077	1.726
	strategic_environment	**.861**	**.082**	**110.694**	**1**	**.000**	**2.367**	2.016	2.779
	environment_manager	**.748**	**.094**	**63.312**	**1**	**.000**	**2.112**	1.757	2.539
	losses_weather	.329	.105	9.791	1	.002	1.389	1.131	1.707
	losses_pollution	-.416	.207	4.050	1	.044	**.660**	.440	.989
	Constant	-1.550	.047	1082.366	1	.000	.212		

a. Variable(s) entered on step 1: written_strategy, RnD_within_business, RnD_outside_business, strategic_environment, environment_manager, losses_weather, losses_pollution.

A binary logistic regression was performed to ascertain the effects of a written business strategy, investments in R&D inside or outside the business, a business strategy including aspects regarding environmental issues, a management position dedicated to environmental issues and experience of losses due to extreme weather or pollution on the likelihood of firms adopting energy management. The logistic regression model was statistically significant, with $\chi2(7) = 720.638$, $p < .05$. The model explained 17.5% (Nagelkerke R2) of the variance of firms having adopted energy management and correctly classified 74.2% of cases.

Firms with a written business strategy were associated with an increase (1.476) in the likelihood of firms having adopted more climate-friendly energy generation on site. Firms that invest in R&D within and outside the business present a figure of

1.835, which means they are 1.364 times more likely to adopt machinery upgrades. A similarly increased likelihood can be observed for the firms that have strategic objectives regarding the environment (2.367), a dedicated manager for environmental issues (2.112), and experience of losses due to extreme weather events (1.389). On the other hand, losses due to pollution reduce the likelihood of firms' adopting machinery upgrades by 0.660 times.

V. Conclusions

People anticipate/expect that managers use resources smartly and responsibly, safeguard the environment, reduce the amount of air/gas, water, energy, minerals, and other materials found in the finished goods people consume, recycle these goods to the fullest extent possible, and reuse them as much as possible rather than depend on nature to resupply them. The requirement for environmentally friendly management is unavoidable from a moral or normative standpoint, and whether becoming green ”pays” or not is only partially relevant (Marcus & Fremeth, 2009).

The need to determine whether there are internal forces that might have an impact on green investments and business practices in countries in Central and Eastern Europe is the motivation behind this article. This study aims to determine whether specific business activities may anticipate certain environmental factors and to answer the question: Which of the chosen independent variables can predict the likelihood of actions based on/regarding dependent variables?

Findings demonstrate that the presence of a management position dedicated to environmental issues and the presence of environmental or climate change issues in strategic objectives are drivers (predictors) with significant predictability on the likelihood of both management practices and green investment by companies. A firm's R&D expenditures, documented business strategies, and losses due to extreme weather incidents, all have lower predictability indices. The bulk of the dependent variables chosen is less predictable when R&D investments are made outside the firm. On the other hand, costs associated with pollution either don't matter in our model or make adopting green investments or activities less likely.

There are several limitations in this study, mainly due to the variables chosen, that may not concern all essential green practices and investments. For example, the article can be extended by choosing more predictors or other examples of variables, such as other/more/different environmental targets, diversity of employees, financial practices, etc. In addition, the sample can be extended to include other/more countries in Europe or other continents.

References

Alfred, A. M., & Adam, R. F. (2009). Green Management Matters Regardless. Academy of Management Perspectives, 23(3), 17–26. doi:10.5465/amp.2009.43479261

Backlund, S., Thollander, P., Palm, J., & Ottosson, M. (2012). Extending the energy efficiency gap. Energy Policy, 51, 392–396. https://doi.org/10.1016/j.enpol.2012.08.042

Bansal, P., & Roth, K. (2000). Why companies go green: A model of ecological responsiveness. Academy of Management Journal, 43(4), 717–736. https://doi.org/10.2307/1556363

Çankaya, S. Y., & Sezen, B. (2019). Effects of green supply chain management practices on sustainability performance. Journal of Manufacturing Technology Management, 30(1), 98-121

Christmann, P. (2000). Effects of 'Best Practices' of environmental management on cost advantage: The role of complementary assets. Academy of Management Journal, 43(4), 663–680.

Du, H. S., Zhan, B., Xu, J., & Yang, X. (2019). The influencing mechanism of multi-factors on green investments: A hybrid analysis. Journal of Cleaner Production, 117977. doi:10.1016/j.jclepro.2019.117977

Ervin, D., Wu, J., Khanna, M., Jones, C., & Wirkkala, T. (2013). Motivations and barriers to corporate environmental management. Business Strategy and the Environment, 22(6), 390–409. https://doi.org/10.1002/bse.1752

Lyneis, J., & Sterman, J. (2016). How to save a leaky ship: Capability traps and the failure of win–win investments in sustainability and social responsibility. Academy of Management Discoveries, 2(1), 7–32. https://doi.org/10.5465/amd.2015.0006

Martin, P. R., & Moser, D. V. (2016). Managers' green investment disclosures and investors' reaction. Journal of Accounting and Economics, 61(1), 239–254. doi:10.1016/j.jacceco.2015.08.004

Mercer (2011), Climate Change Scenarios – Implications for Strategic Asset Allocation.

Paul, A.K., Bhattacharyya, D.K., & Anand, S. (2017) Green Initiatives for Business Sustainability and Value Creation (Advances in Business Strategy and Competitive Advantage (ABSCA)), 1st ed.; IGI Global: Hershey.

Saeed, M., & Kersten, W. (2019). Drivers of Sustainable Supply Chain Management: Identification and Classification. Sustainability, 11(4), 1137. doi:10.3390/su11041137

Sharma, S., Aragón-Correa, J. A., & Rueda, A. (2004). A contingent resource-based analysis of environmental strategy in the Ski industry, ASAC, 1–26.

Utz, S., Wimmer, M., & Steuer, R. E. (2015). Tri-criterion modeling for constructing more-sustainable mutual funds. European Journal of Operational Research, 246(1), 331–338. doi:10.1016/j.ejor.2015.04.035

Yen, Y.-X. (2018). Buyer-supplier collaboration in green practices: The driving effects from stakeholders. Business Strategy and the Environment. doi:10.1002/bse.2231