The double-edged role of firm environmental behaviour in the creation of product innovation in Central and Eastern European Countries

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Abstract

Prior research has primarily focused on how firm environmental behaviour affects firm performance and eco-innovation, whereas the mechanisms involved in this relationship were treated as a black box. This study steps back to focus on the reverse relationship between firms' environmental behaviour and 'general' product innovations in Central and Eastern European countries, which generally face low levels of consciousness about environmental issues. Specifically, we focus on the Czech Republic, Estonia, Latvia, Lithuania, Poland, and Slovakia. The results show that firms' environmental behaviour acts in two ways and brings significant differences between the considered countries. Surprisingly, the monitoring of energy consumption helps increase firms' chance to create more product innovation in lagging countries, such as Slovakia and Poland, than in leading innovation countries, such as the Czech Republic, Lithuania, and Latvia. Moreover, adopting measures of water management proved to be a significant determinant of product innovation despite the fact that it is not often used. The presented article contributes to the current state of knowledge in the areas of (i) determinants of (eco-) innovation; (ii) ongoing discussion about the Porter hypothesis; and (iii) catching-up literature dealing with (eco-) innovation in Central and Eastern European countries. In the final section, practical contributions in the form of implications are presented.

Keywords

Environmental behaviour; Product innovation; Central and Eastern Europe; Sustainable development

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1 Introduction

Strong environmental issues foster the awareness of sustainable development and the shift towards a circular economy on the global agenda, and the role of firms in this relationship has increasingly developed (Demirel & Danisman, 2019). Firms have changed their behaviours in different ways to adapt successfully to social and environmental fitness and, more specifically, to institutional legitimacy. This is understandable because environmental problems require firms to (i) develop more innovative responses (Paulraj, 2009), (ii) improve green productivity (Zhang & Vigne, 2021); (iii) enhance energy efficiency and cleaner production (Dauda et al., 2021). In this context, firms have the ability to change their normative settings and generate concrete actions through which they can influence the behaviour and engagement of other stakeholders. Therefore, with respect to sustainability, business sectors prove to be (i) a catalyst of or a barrier to environmental changes (Rauter et al., 2017); (ii) a part of the solution addressing environmental degradation (Bischoff and Volkmann, 2018). Moreover, as firms' movement towards sustainable development becomes more evident, they could find interesting competitive opportunities in building their green images and reputations (Amores-Salvadó et al., 2014).

Following these arguments, unlocking the relationship between firms' environmental behaviour and competitiveness is crucial for contemporary business researchers, policymakers, and practitioners (Papadas et al., 2019). Prior research has demonstrated the relationship among firms' environmental behaviour, environmental innovation, and (environmental) regulations (Yasir et al., 2020). The relationship between firms' innovation activities and environmental performance has also been confirmed (Mondéjar-Jiménez et al., 2015). However, to the best of our knowledge, few studies have analysed the reverse relationship between firms' recognition of the importance of the environmental issues (environmental behaviour) and non-environmental innovation. Such a reverse relationship could exist despite the fact that green environmental management may not directly contribute to firm performance, but it is intermediated through activity outcomes such as innovations (Shu et al., 2016).

The main motivation of this research is to *explore whether a reverse relationship exists between firms' environmental behaviour and product innovations in the countries of Central and Eastern Europe (CEE)*, specifically the Czech Republic, Estonia, Latvia, Lithuania, Poland, and Slovakia. These countries are seen as places where consciousness about environmental issues is, compared to Western countries, lower and where regulation activities have become much more important than in countries where environmental topics were recognized and perceived by the general society (Horbach, 2016). This situation could be due to the fact that low interest in environmental issues is historically rooted in some CEE countries which had to deal with serious environmental burdens resulting from the neglect of the environment by the communist regime, such as in the Czech Republic (Opršal & Harmáček, 2019). Moreover, general analyses of environmentalism within CEE countries have often been based on concepts and models from Western countries, leading to CEE firms' environmentalism efficiency analysis assessments to be based on criteria developed specifically for the Western context. As a result, CEE countries have been perceived as being in a perpetual state of catching up with their Western counterparts (Jehlička & Jacobsson, 2021).

The paper contributes to both, theory and practice. From the theoretical perspective, we are linking and developing different theoretical perspectives about the Porter hypothesis, determinants of (eco-) innovation, and the literature and research on 'catching-up' CEE countries. In comparison with prior research, our findings also contribute to a better understanding of the reverse relationship between firms' environmental behaviour and general product innovations. From the practical perspective, since we consider the country factor in our analyses, it allows us to open the debate whether CEE countries that are undergoing a similar process of 'environmental transformation' are rather homogeneous or heterogeneous. This finding is an important question for public policy makers. The use of several variables expressing environmental behaviour also allows us to design specific practical implications for firms in different CEE countries. These implications are aimed both at increasing firms' environmental awareness and at achieving an environmental and economic win-win situation, for example, by increasing energy efficiency.

The remainder of this study continues as follows. Section 2 provides the theoretical background of this research and develops the research questions. Section 3 describes the research methodology. The results are presented in Section 4 and discussed in Section 5, including contributions of this study. Concluding remarks, directions of future research, practical implications, limitations and future directions are presented in Section 6.

2 Literature review

2.1 Analysing firms' environmental behaviour and its consequences for (eco-) innovation

This paper aims to combine different complementary theoretical perspectives – namely, the rather recent debate about the most important internal and external determinants of (eco-) innovation, the ongoing discussion about the Porter hypothesis (Porter and van der Linde, 1995), and the "catching-up literature" dealing with (eco-) innovation in CEE countries (Sempere-Ripoll et al., 2020; Prokop et al., 2021; Świadek et al., 2021). Prior research has focused on various relevant topics regarding the overall research question of this study, including potential relationships between firms' environmental behaviour and (eco-) innovation in relation to products and/or processes as well as firm performance.

The first reviewed complex of research focuses on different relationships between environmental and economic firm performance. For example, Amores-Salvadó et al. (2014) showed that environmental innovations could help firms improve their efficiency, achieve cost reductions, and meet the demands of consumers, which are sensitive to environmental factors, for the case of Spanish metal firms. Yasir et al. (2020) investigated the relationship between firms' environmental orientation and environmental performance (resource usage, regulatory compliance, stakeholder interaction, and productivity) for the case of manufacturing industries in Pakistan. In addition, Andries and Stephan (2019) found that environmental engagement and innovations could help firms improve their economic and financial performance by using a survey and lagged annual account data on Flemish companies.

Another string of important studies focused on the relationships among environmental regulations, firm research and development (R&D), and innovation, expressed as the Porter hypothesis (Porter and van der Linde, 1995). For example, Lv et al. (2020) demonstrated that the dynamics of environmental policy have an asymmetric impact on the general and environmental innovation of oil and gas firms in Canada. Fang et al. (2020) confirmed the relationship between environmental regulation and firm innovation, expressed as a weak version of the Porter hypothesis, in China between 2004 and 2009. The authors pointed out that the financial constraint is an important channel that affects firm innovation.

This review of previous research indicates that the authors dealt with the issue of firms' determinants of environmental behaviour as well as the impacts of these activities on the innovation and performance of firms. In sum, scholars have previously proposed a variety of terms to capture and describe firms' general approaches to environmental issues (Menguc & Ozanne, 2005). To structure these different approaches, Table 1 provides an overview of terms, definitions, and perspectives on the issue of firms' environmental behaviour and related issues. We label firms' implementation of environmentally friendly activities as firms' environmental behaviour. Consistent with this perspective, firms' environmental behaviour, among other factors, reflects firms' shift towards sustainability, involving activities such as setting environmental targets, monitoring environmental burdens, and adopting measures of environmental burdens.

Table 1 Overview of terms, definitions, and perspectives on firms' environmental behaviour

Authors	**Term**	**Definition**	**Research sample**	**Findings**
Menguc & Ozanne (2005)	Natural environmental orientation (NEO)	Entrepreneurship, corporate social responsibility, commitment to the natural environment	Australian manufacturing firms	NEO is related to: • profit after tax and market share (positively) • sales growth (negatively)
Hong et al. (2009)	Strategic green orientation (SGO)	Long-term activities to produce environmentally sound products and services	Manufacturing units of 24 countries	SGO is more important for manufacturing firms in a highly competitive market environment
Amores-Salvadó et al. (2014)	Green (environmental) image	Signal of environmental commitment towards firm key stakeholders	Spanish metal firms	Positive relationships exists between green image and: • firm performance • environmental product innovation
Jakobsen & Clausen (2016)	Environmental mode	Adoption of environmental objectives by the firm	Norwegian firms across industries	Positive relationships exist between: • environmental goals • goals related to the product and process development
Jiang et al. (2018)	Green entrepreneurial orientation (GEO)	Green activities to pursue potential opportunities to produce economic and ecological benefits.	Chinese firms across industries	GEO positively influences environmental and financial performance
Aboelmaged (2018)	Environmental orientation (EO)	Ability to satisfy environmental and societal needs while meeting firms' economic goals.	Chain hotels in United Arab Emirates	EO is related to • eco-innovation • environmental supplier collaboration • hotel performance
Gerstlberger et al. (2019)	Strategic environmental firm goal	Potential relationship between firms' strategic environmental goals and innovation activities.	Danish manufacturing firms	Firms' strategic environmental goals have a significantly positive effect on their product innovation activities
Zhou et al. (2019)	Green management (GM)	Managerial practices addressing environmental issues.	Chinese firms across industries	Strategic and managerial innovation facilitate GM, which in turn mediates these effects on new product performance

Previous studies confirmed that firms' environmental behaviour and (eco-) innovation are influenced by various external forces and that firms have to pay close attention to the respective flows from different external sources. These flows include, for example, government policies, the voices of competitors and customers, and the public interest. Such information flows from external sources can also spur firms' R&D activities and enable firms to engage in out-of-the-box thinking during the process of innovation creation (Shu et al., 2016). Therefore, the question is what will happen if we step back, unlike the prior literature focused on firms' environmental behaviour and eco-innovation (e.g., Jakobsen & Clausen, 2016), to focus on the relationship between firms' environmental behaviour and 'general' product innovations that are not directly linked to environmental impacts.

2.2 Reverse relationship between firms' environmental behaviour and innovation

Existing research confirming that firm environmental behaviour can be profitable leads to another question – namely, whether firm environmental behaviour could help set the course for higher overall firm innovation and performance. Moreover, some studies have proved that firm environmental behaviour could positively influence both firm environmental and financial performance. For example, Gerstlberger et al. (2019) demonstrated for a sample of 150 Danish manufacturing companies with 10 or more employees that these firms' strategic environmental goals show a significantly positive interaction with their product innovation activities. Jiang et al. (2018) proved this statement among a sample of 264 Chinese firms, showing that environmentally oriented firms are keener to emphasize building the capabilities of absorbing new environmental knowledge (R&D), which results in taking advantage of R&D and producing environmental outputs. Moreover, Jakobsen and Clausen (2016) found that firms' environmental mode influences their objectives and ambitions, both directly and indirectly, when it comes to the development and implementation of new products and process.

Yet prior research also has some limitations. Some studies have yielded different, double-edged results in their analyses of firms' environmental behaviour and performance. For example, Menguc and Ozanne (2005) confirmed the relationship between firms' natural environmental orientation and selected performance measures in the case of Australian manufacturing firms. They showed that the higher-order construct of natural environmental orientation is positively and significantly related to after-tax profits and market share. Yet they also demonstrated that firms' natural environmental orientation is negatively related to sales growth.

Shu et al. (2016) argued that previous research has primarily focused on how firms' green practice affects firm performance, whereas the mechanisms involved in this relationship were treated as a black box. They stated that green management may not contribute to the firm performance directly. Therefore, there is a need to analyse intermediate outcomes (innovation). In this case, Shu et al. (2016) found the relationship between firm product innovation and green management and showed that green management is more likely to lead to radical product innovation than to incremental product innovation. According to Zhou et al. (2019), a two-way relationship exists where firm innovation opens windows for green management firms' strategies, practices, or management determination related to green business processes can simultaneously trigger innovation. These authors examined three types of firm innovation (strategic, managerial, and product innovation) and their respective relationships with green management, considering several dimensions of environmental turbulence in the case of 303 Chinese firms. However, their study is limited because it uses only firms in China, which represents an emerging economy with unique features; therefore, one should be cautious when generalizing the findings of this study to other contexts. This can generally be seen as a limitation of all of the previously mentioned studies, which often focused on specific countries or industries.

Based on the arguments summarized thus far, there is a need for additional multinational studies analysing the relationships between distinct types of firm innovation and firm environmental behaviour. Such a need includes, for example, studies exploring CEE countries that belong, according to their innovation performance (expressed in Innovation Performance Scoreboard developed by the European Commission, 2020), to the group of moderate EU innovators (except Estonia - strong innovator). These countries are expected to have the greatest potential for developing further innovation (Benetyte & Krusinskas, 2019). Moreover, these countries have been associated with a lower awareness of environmental issues and, thus, lower environmental performance in the past.

2.3 Research questions for the case of CEE countries

Despite the fact that the analysis of the linkages between environmental innovation and firm performance is an important topic in the existing literature, a number of questions remain about these relationships, specifically within transition economies in CEE (Przychodzen & Przychodzen, 2015). These countries represent a group that can often be perceived as lagging behind compared to, for example, Western European countries. Moreover, CEE countries are associated with lower innovation performance, such as in the European Commission's European Innovation Performance Scoreboard measurements (Prokop & Stejskal, 2017). One explanation for this association is that less attention has been devoted to organizations regarding their strategic orientations and adopting innovation strategies under the conditions of continuous institutional change and rapid economic development (Kallaste et al., 2019). In addition, prior research pointed out other problems such as limited creation of social capital, a lack of funds, or insufficient incentives to cooperate (Kotkova Striteska & Prokop, 2020).

Regarding firms' and populations' awareness of environmental issues and behaviours, CEE countries (e.g., the Czech Republic, Lithuania, Romania, and Slovakia) have been characterized as having a lower awareness of environmental problems in recent years (Horbach, 2016). Therefore, the isolated ecological activity of firms within post-socialist countries (e.g., Poland and Hungary) stemmed from economic reality rather than from applicable law and voluntary choice of management (Przychodzen & Przychodzen, 2015). Excessively polluted soils, the depletion of raw materials, and the lack of technology were some triggers of these activities. Moreover, firms within CEE countries have often adopted ecologically responsive practices in an effort to reduce costs through, for example, a reduction of material and energy use (Horbach, 2014). Therefore, the majority of CEE countries, unlike other EU member states, have scored below average on the Eco-Innovation Observatory's Eco-innovation scoreboard performance in previous years (Loucanova et al., 2015). Similar results were also achieved by the Baltic States (Estonia, Latvia, and Lithuania), which are also CEE countries. According to Melece (2015), a number of factors contribute to the lags in terms of eco-innovation in the Baltic States, such as the lack of specific policy measures aimed at promoting environmental innovation or the absence of explicit eco-innovation policy strategy or environmental action plans.

In order to contribute to the current state of knowledge in the research examining the relationship between firm environmental behaviour and innovation, consistent with Shu et al. (2016) and Jakobsen and Clausen (2016), we aim to explore whether a reverse relationship exists between firms' environmental behaviour and product innovations in CEE countries – namely, the Czech Republic, Estonia, Latvia, Lithuania, Poland, and Slovakia. To this end, we define our first research question as follows:

RQ_1: Is there a reverse relationship between firm environmental behaviour and the creation of product innovations in the selected countries of Central and Eastern Europe?

Moreover, as previously stated, we express firms' environmental behaviour as activities such as setting environmental targets, monitoring environmental burdens, and adopting measures of environmental burdens. Therefore, to better understand the current situation in CEE countries and reveal how these activities affect product innovation, we define a second research question:

RQ_2: How do activities belonging to the groups of setting environmental targets, monitoring environmental burdens, and adopting measures of environmental burdens affect firms' product innovations in the selected countries of Central and Eastern Europe?

3 Methodology

3.1 Research sample

The World Bank's Enterprise Survey (WBES) 2019 was applied for this study. WBES is an international firm-level survey with a representative sample of an economy's private sector (The World Bank, 2021). It includes various topics focused on the business environment (e.g., performance measures, access to finance, infrastructure, competition, and others) and provides data on enterprises in the manufacturing and service sectors using a global methodology that includes standardized survey instruments and a uniform sampling methodology (stratified random sampling). The underlying interviews are conducted with business owners and top managers in formal (registered) firms with five or more employees. Firms' accountants and human resource managers can also get involved into the respective interviews to better answer selected questions in the sales and labour sections of the survey (for more information, see www.enterprisesurveys.org/en/methodology). WBES also contains a module on the green economy that was used. It provides us with information on environment-related aspects, management and the environment, environmental policy and regulation, and environmental impact of the establishment. In total, 3,299 firms from six CEE countries were analyzed.

For the dependent variable, firms' product innovation activity (whether or not the firm introduced new or improved products or services) was chosen. The explained variable is binary (1 indicates the answer is yes, 0 indicates the answer is no).

3.2 Independent Variables

Explanatory variables, shown in Table 2, are divided into three groups: setting environmental targets, monitoring environmental burdens, and adopting measures of environmental burdens. These are binary variables (1 indicates the answer is yes, 0 indicates the answer is no).

Table 2 Explanatory variables and their descriptions

Group	Variable	Description	Rel. Freq. (in %)	
			Yes	No
Setting environmental targets (Tar)	Energy consumption	Over the last three years, did this establishment have targets for energy consumption?	30.40	69.60
	CO_2 emissions	Over the last three years, did this establishment have targets for CO_2 emissions?	6.30	93.70

Monitoring environmental burden (Mon)	Energy consumption	Over the last three years, did this establishment monitor its energy consumption?	56.81	43.19
Adopting measures of environmental burden (Mea)	Air pollution control measures	Over the last three years, did this establishment adopt any of the following measures?	14.19	85.81
	Energy management		26.10	73.90
	Heating and cooling improvements		37.86	62.14
	Improvements to lighting systems		48.14	51.86
	Machinery and equipment upgrades		52.17	47.83
	More climate-friendly energy generation on site		11.73	88.27
	Other pollution control measures		10.25	89.75
	Upgrades of vehicles		40.41	59.59
	Waste minimization, recycling and waste management		50.59	49.41
	Water management		17.31	82.69

Following Jiang et al. (2018), we also involved control variables representing the firm's age, industry sector, and membership in a firm group (for more details, see Table 3). These variables were also used by other studies. First, Sidorkin (2015) controlled for firm's age in the study by focusing on the impact of management quality on innovation input and output of manufacturing firms in emerging countries, including Bulgaria, Lithuania, Poland, and Romania. Second, Banerjee et al. (2003) dichotomized industries based on the different environmental impacts and moderation effects in North America and proved that there are significant differences between industries, such as competitive intensity or barriers to entry. Similarly, Alos-Simo et al. (2020) point out that every industry can be affected by sector-specific factors (e.g., technology). Third, according to Prokop et al. (2021), creating long-term partnerships and participation in firms' groups proved to be important for innovative firms from CEE.

Because all explanatory variables are categorical (factors), each parameter β_j in Eq. (1) and Eq. (2) (see subsection 3.3) is represented by q-1 estimated parameters, where q means the number of categories (levels) of corresponding explanatory variables. In this case, it is necessary to specify the reference category of each variable. For dichotomous environmental variables, the reference category is set to 0, which means that a company does not measure (monitor or target on) the corresponding variable. A similar situation is the firm group membership variable, where the reference category indicates non-membership. The remaining control variables, the reference categories are manufacturing, less than 10 years, and the Czech Republic for the variables Sector, Firm age, and Country, respectively.

Table 3 Control variables and relative frequencies (in %) of corresponding categories

Country	Rel. Freq. (in %)	Firm Age (in years)	Rel. Freq. (in %)	Sector	Rel. Freq. (in %)	Firm group membership	Rel. Freq. (in %)
Czech Republic	14.79	less than 10	10.37	Manufacturing	31.74	Yes	74.39
Estonia	10.88	from 10 to 19	30.43	Retail	19.57	No	25.61
Latvia	10.85	from 20 to 29	42.92	Other services	48.69		
Lithuania	10.82	over 29	16.28				
Poland	39.74						
Slovakia	12.91						

3.3 Model description

Because the explained (dependent) variable is dichotomous, a binary logistic regression model is used. The general form of the binary logistic model is:

$$\ln \frac{\pi_i}{1-\pi_i} = \beta_0 + \sum_{j=1}^{p} \beta_j x_{ij}. \quad (1)$$

The expression on the left side of Eq. (1) is often called logit, and $\pi_i = \mathrm{Prob}[Y_i = 1|\mathbf{x}_i]$ denotes the probability that, for the i-th individual and given values of explanatory variables $X_1, \dots, X_p$, the explained variable Y is equal to 1. According to Eq. (1) the probability π_i has the expression:

$$\pi_i = \frac{\exp\left(\beta_0 + \sum_{j=1}^{p} \beta_j x_{ij}\right)}{1 + \exp\left(\beta_0 + \sum_{j=1}^{p} \beta_j x_{ij}\right)}. \quad (2)$$

An odds ratio OR is used to interpret the influence of the k-th explanatory variable X_k on a dependent variable Y and is given by:

$$\frac{\left(\frac{\mathrm{Prob}\left[Y=1|X_k=1, X_1, \dots, X_{k-1}, X_{k+1}, \dots, X_p\right]}{\mathrm{Prob}\left[Y=0|X_k=1, X_1, \dots, X_{k-1}, X_{k+1}, \dots, X_p\right]}\right)}{\left(\frac{\mathrm{Prob}\left[Y=1|X_k=0, X_1, \dots, X_{k-1}, X_{k+1}, \dots, X_p\right]}{\mathrm{Prob}\left[Y=0|X_k=0, X_1, \dots, X_{k-1}, X_{k+1}, \dots, X_p\right]}\right)} = \exp(\beta_k). \quad (3)$$

In this case, we assume that the explanatory variable X_k is dichotomous and the other $p-1$ explanatory variables may or may not be dichotomous. Therefore, the value of $\exp(\hat{\beta}_k)$ is the estimated odds ratio OR between Y and X_k when the values of the other $p-1$ explanatory variables are fixed. Details concerning the logistic regression model and its applications can be found in, for example, Agresti (2002).

4 Results

We included all of the mentioned variables in the model (including the interaction between explanatory environmental and control variables). We subsequently selected a subset of input variables by reducing the full model (with all explanatory variables) in a stepwise fashion based on the Akaike information criterion (AIC) introduced in Akaike (1973). The final model contains ten (main effects) variables, six environmental and four control variables, and two interaction variables (see Tab 4).

Table 4 Estimated regression coefficients, odds ratios (including 95% confidence intervals) and corresponding p-values for product innovations

Variable name	Variable level	Coefficient	OR	Lower CI	Upper CI	p-value	Sign.c.
Intercept		-0.661	0.516	0.288	0.907	0.023	*
Tar.: En. cons.	1	0.439	1.551	1.222	1.968	0.000	***
Mon.: En. cons.	1	-0.232	0.793	0.455	1.410	0.420	
Mea.: Air poll. control mea.	1	-0.173	0.841	0.655	1.076	0.170	
Mea.: Heat. and cool. imp.	1	0.191	1.211	1.004	1.459	0.045	*
Mea.: Mach. and equip. upg.	1	0.480	1.617	1.340	1.951	0.000	***
Mea.: Water management	1	0.259	1.295	1.029	1.629	0.027	*
Country	Estonia	-0.515	0.597	0.302	1.180	0.137	
	Latvia	0.244	1.277	0.643	2.555	0.487	
	Lithuania	-0.228	0.796	0.418	1.526	0.489	
	Poland	-1.006	0.366	0.214	0.638	0.000	***
	Slovakia	-1.938	0.144	0.069	0.293	0.000	***
Firm age	10 to 19 years	-0.318	0.728	0.547	0.971	0.030	*
	20 to 29 years	-0.418	0.659	0.500	0.870	0.003	**
	over 29	-0.209	0.811	0.591	1.116	0.198	
Sector	Retail	0.080	1.084	0.853	1.375	0.509	
	Other services	-0.218	0.804	0.658	0.982	0.033	*
Membership	1	0.195	1.216	0.802	1.811	0.346	
Mon.: En. cons. * Country	1: Estonia	0.746	2.109	0.993	4.489	0.052	.
	1: Latvia	0.143	1.153	0.538	2.454	0.712	
	1: Lithuania	0.196	1.217	0.584	2.520	0.599	
	1: Poland	0.605	1.832	0.987	3.343	0.051	.
	1: Slovakia	1.270	3.561	1.593	8.099	0.002	**
Mon.: En. cons. * Membership	1:1	0.612	1.843	1.149	2.995	0.012	*

Signif. codes: '***': p-value less than 0.001, '**': 0.01, '*': 0.05; '.': 0.1

The final model included six variables expressing firms' environmental behavior. The relative frequencies of these variables are shown in Figure 1. The results in Figure 1 indicate that firms in CEE countries pay the highest attention to (i) *monitoring energy consumption* and (ii) *adopting measures of machinery and equipment upgrades*. However, the fact that firms mostly monitor or adopt these variables does not necessarily mean that these variables most influence the implementation of product innovations. This is clearly shown by the variable *Mea: Water management*, which is not widely adopted by firms but is nevertheless significant in the model.

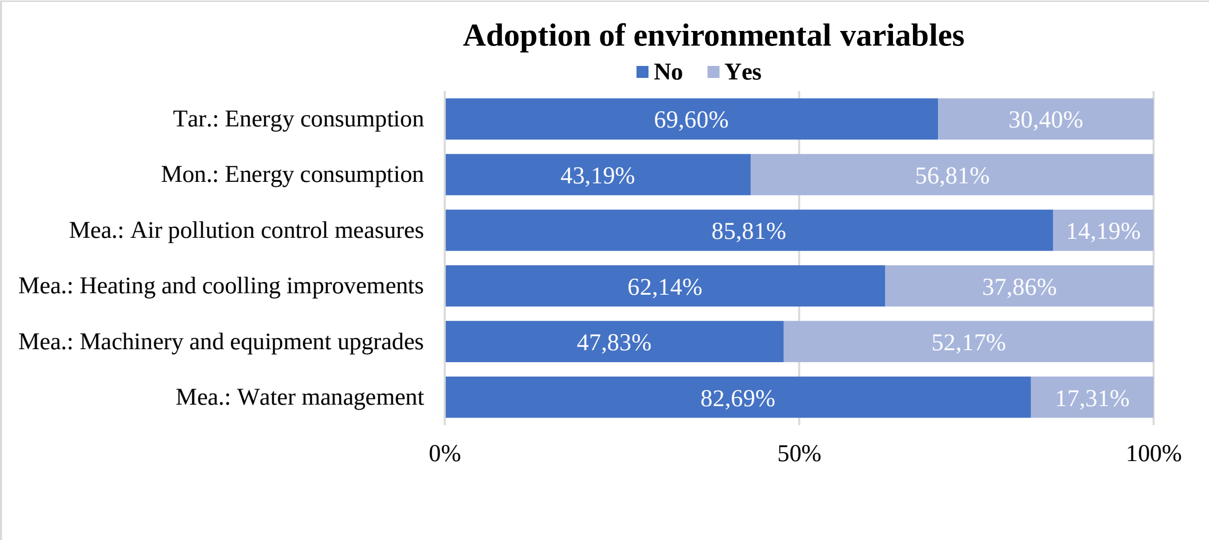

Figure 1 Adoption of environmental variables included in logistic regression model expressed in relative frequencies (in %) of corresponding categories

Regarding the environmental targets, we can see in Table 4 that only the variable *Tar: Energy consumption* is statistically significant, whereas the setting of this environmental target increases the chance of product innovation by 1.55 times. Looking at Figure 2, where we show the percentage of CEE firms performing product innovations, depending on the setting of environmental targets, we can see that the setting of both environmental targets positively influences product innovations. Unfortunately, a statistically significant effect of CO_2 emission targets in the logistic regression model has not been shown.

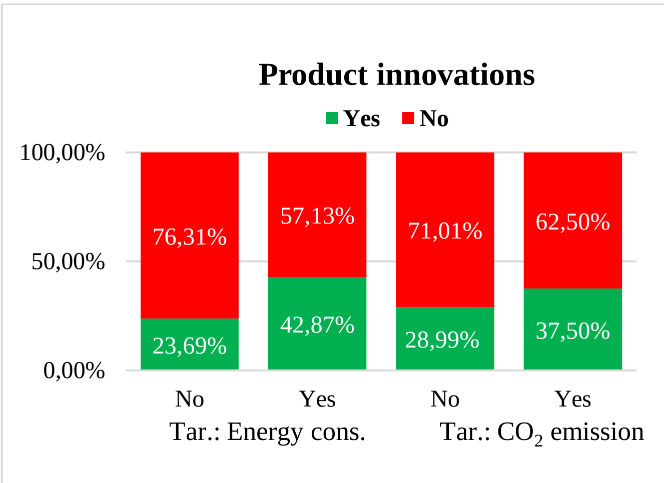

Figure 2 Percentage of firms performing product innovations depending on the setting of environmental targets

Concerning the monitoring of environmental burden, we can see that the variable *Mon: energy consumption* is not statistically significant as the main effect, but in combination with the variable *Membership or Country* its effect has been demonstrated. The percentage of firms monitoring energy consumption depending on the Membership and Country variables is shown in Figure 3 and Figure 4, respectively. We can see that members of firm groups monitor energy consumption much more. Therefore, firms in CEE countries that are monitoring energy consumption and are also part of a firm group have a significantly higher chance (almost by 1.85 times) of performing product innovation (see Table 4).

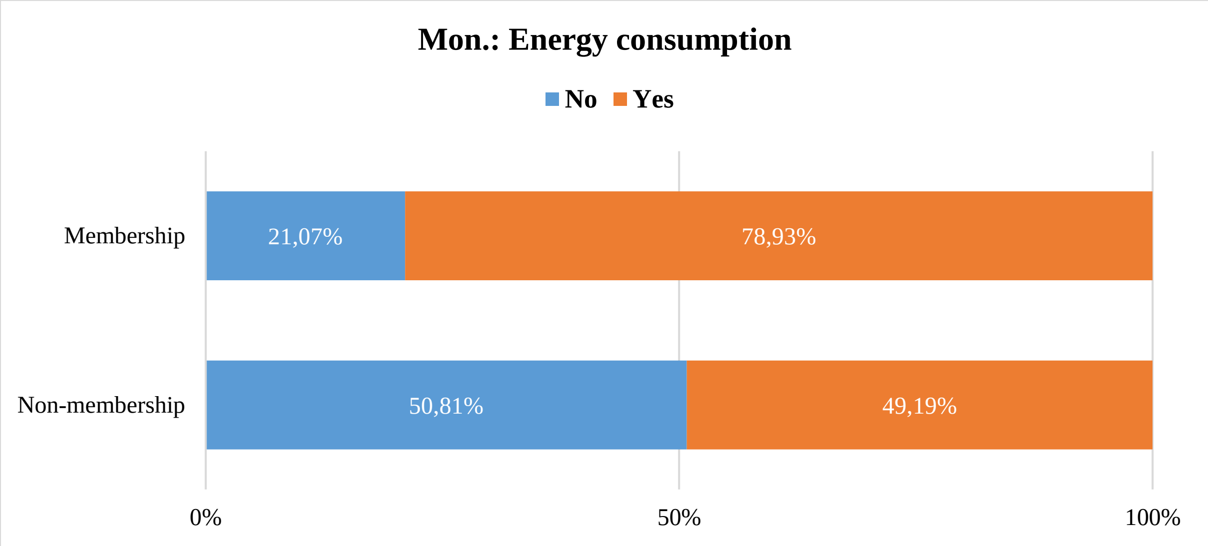

Figure 3 Percentage of firms monitoring energy consumption depending on firm group membership

There are also significant differences in the number of firms that monitor energy consumption between countries (see Figure 4). An interesting result is that, in Slovakia, where this number is the second smallest, the monitoring of energy consumption significantly increases the chance of firms to create product innovations (more than 3.5 times) compared with those that do not monitor energy consumption or are from the Czech Republic (reference level).

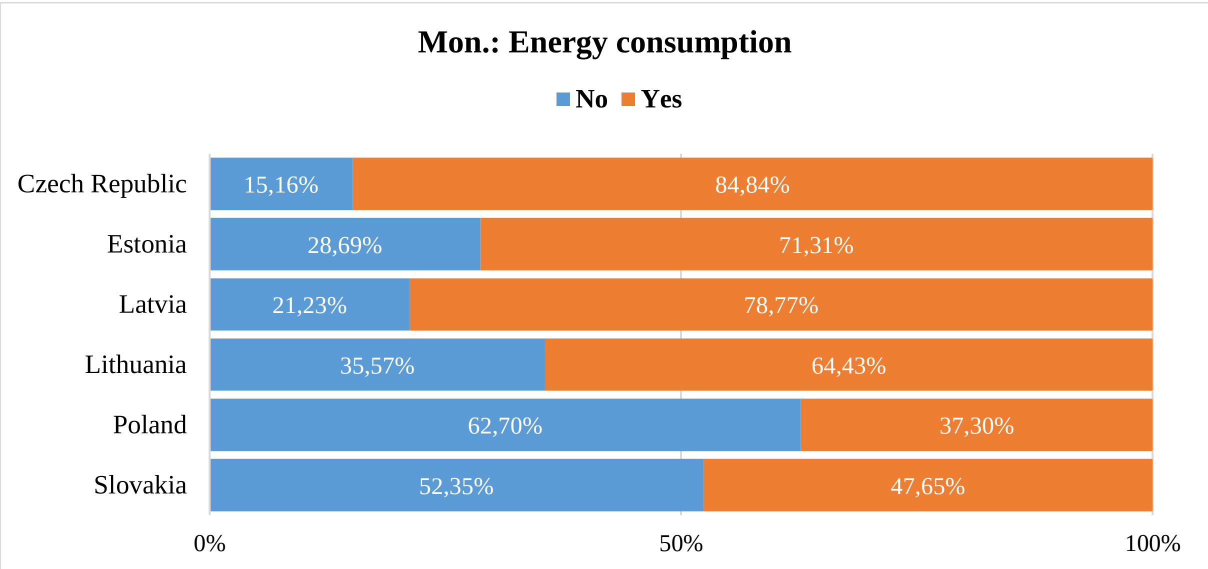

Figure 4 Percentage of firms monitoring energy consumption depending on country variable

The percentage of firms from CEE countries that are performing product innovations depending on the monitoring energy consumption, which are shown in Figure 5, also demonstrate a positive influence and support the acceptance of the research question.

If we focus on the variables associated with adopting measures of environmental burdens, we can say that not all of them significantly affect product innovations. The most important and statistically significant variables are *Mea: Machinery and equipment upgrades*, *Mea: Water management*, and *Mea: Heating and cooling improvements* (see Table 4). We can see that all these variables significantly increase the chances of the product innovations. The variable *Mea:*

Machinery and equipment upgrades has the highest influence (1.6 times increased chance of product innovation).

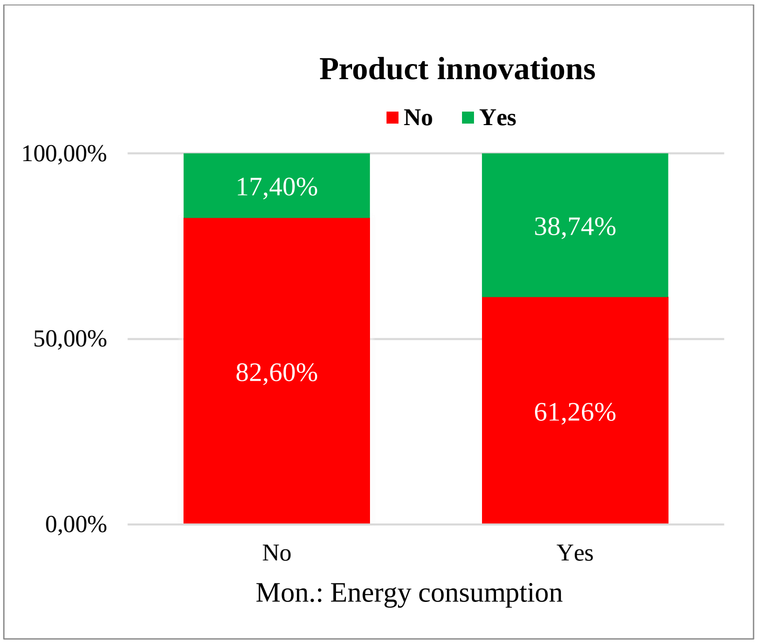

Figure 5 Percentage of firms performing product innovations depending on the monitoring of energy consumption

The separate influence of these variables on product innovations is shown in Figure 6, which shows that each of the measures has a positive effect on the implementation of product innovations (i.e., its adaptation increases the percentage of firms implementing product innovations in CEE countries).

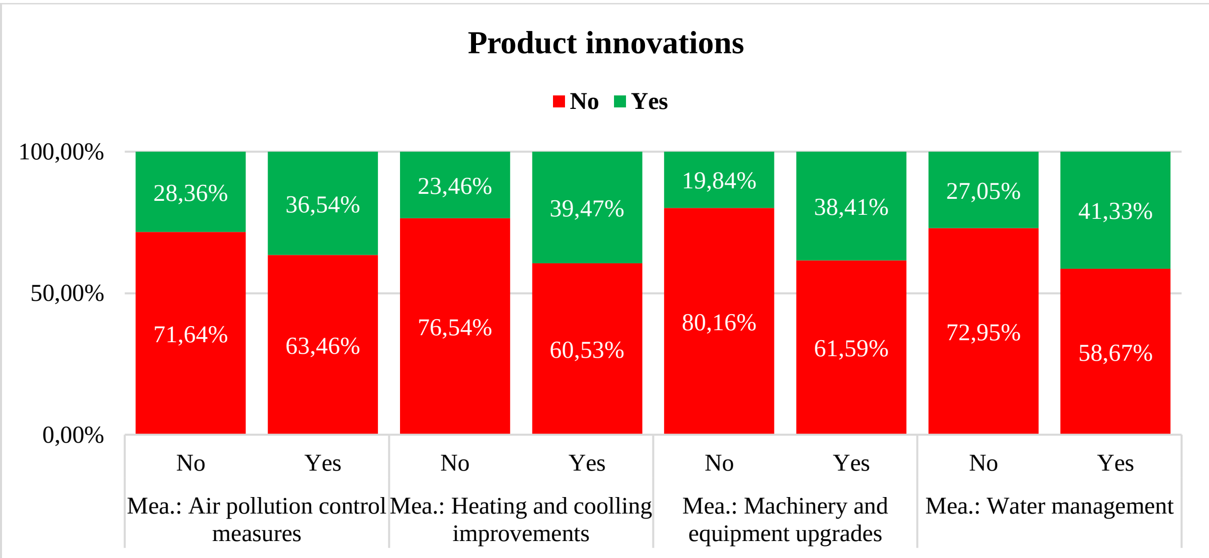

Figure 6 Percentage of firms performing product innovations depending on the adapted measures

5 Discussion

Concerning the first research question of this study, if there is a reverse relationship between a firm's environmental behaviour and the creation of product innovations in the selected countries of Central and Eastern Europe, the obtained empirical results are somewhat mixed.

The first finding of this study with regard to this first research question is that firms in CEE countries pay the highest attention to (i) *monitoring energy consumption* and (ii) *adopting measures of machinery and equipment upgrades*, which is basically in line with the international literature (Gerstlberger et al., 2014; Pace, 2016). These specific activity fields are characterized by high potentials for environmental and economic win–win situations (e.g., Wang & Feng, 2021). For example, if a firm manages to considerably reduce its average energy consumption, this typically leads to both positive environmental and economic effects, at least in a more long-term perspective. In a similar way, waste minimization at the firm level usually also implies a reduction of (raw) material cost as one consequence. This first empirical result of this paper is in line with the Porter hypothesis (Porter & van der Linde, 1995), which is one of the theoretical starting points of the paper.

At least partly surprising is the further finding of the present study that *Mea: Water management*, although not widely adopted by the investigated firms, nevertheless proved significant in the estimated regression model for product innovation. Water management is considered crucial in addressing stakeholder issues, customer satisfaction, corporate reputation, and institutional pressure (Weber & Saunders-Hogberg, 2018). Yet this kind of measure could also be considered 'low-hanging fruits' (Bigliardi et al., 2012). These are activities that are simple and often low in initial financial investments and showing fast results. However, in the long-term perspective, it is more difficult for firms to implement additional (eco-) innovations, because of requirements of various other, e.g. financial, resources.

Our second important finding refers to the demonstrated determinants of product (eco-) innovations. Firms in CEE countries that are monitoring energy consumption and are also part of a firm's membership organization have a significantly higher chance (almost by 1.85 times) of performing product innovation (see Table 4). Consistent with the study of Arranz et al. (2020), a firm's belonging to a group has a positive effect on the adoption of certain types of innovation objectives, such as due to firms' adoption of environmental quality standards, management, and clean production processes. Moreover, participation in a firm group allows the creation of long-term partnerships that help firms in CEE overcome innovation barriers (Prokop et al., 2021).

Regarding the second research question of the present study, how do activities belonging to the groups of setting environmental targets, monitoring environmental burdens, and adopting measures of environmental burdens affect firms' product innovations in the selected countries of Central and Eastern Europe, the obtained empirical findings are consistent.

Concerning the setting of environmental targets, the setting of such targets positively influences product innovations. This finding confirms, for example, the result of a recent study by Gerstlberger et al. (2019) for Danish manufacturing companies with 10 or more employees, which also found a significantly positive effect of firms' (strategic) environmental goals on their product innovation activities. This empirical finding of the present study demonstrates – at least to some extent – an additional alignment of this study's results with the Porter hypothesis as one theoretical starting point of this investigation. Regarding the monitoring of *environmental burden*, in the case of the product innovations model, the variable *Mon: energy consumption* is not statistically significant itself, but in combination with the variable *Membership* or *Country*, a significantly positive effect has been demonstrated.

Taking all these single empirical results for the two research questions of this paper together, our study contributes to something which could be called a ‘differentiated Porter hypothesis’, with a focus on CEE countries. In general, the investigated companies in the considered CEE countries went through a similar process of ‘environmental transformation’ as many comparable firms in Western and Northern countries, but with a considerable time lag.

These results point out that Polish and Slovak firms are lagging behind the other firms from the analysed CEE countries. In terms of product innovation, the Czech Republic and Latvia perform best compared to the other considered CEE countries, especially Poland and Slovakia.

Considering the effects of firms’ environmental behaviour on product innovation, the results show that the monitoring of energy consumption brings significant differences among the considered CEE countries in the creation of product innovations and helps increase firms’ chances of creating product innovation. This is demonstrated primarily in the cases of states that lagged behind the others – namely, Slovakia and Poland. Meanwhile, the lowest effects of this variable occurs in the Czech Republic, Lithuania, and Latvia (i.e., in leading innovation countries). Surprisingly, we found a significant difference between neighbouring countries (i.e., Slovakia and the Czech Republic), where firms in Slovakia that monitor energy consumption significantly increase the chances of product innovation.

These results indicate that, from one perspective, the environmental behaviour of the considered CEE countries increases the chances of product innovation within countries that lagged behind. In contrast, this kind of behaviour may not lead to such significant effects in the case of innovators who perform best in the creation of product innovation compared to other considered CEE countries.

If we consider the effects of different sectors, firms operating in the manufacturing sector have a higher tendency to perform product innovations. The manufacturing sector dominates mainly compared to other service sectors. Regarding firm age, the respective results show that young firms under the age of 10 years have a higher chance of creating product innovations than firms that are older (both 10–19 years old and 20–29 years old).

Surprisingly, unlike the results for countries, we did not prove that the effects of environmental behaviour influence product innovation in the studied sectors differently. The situation is similar for the firm’s age.

6 Conclusion

6.1 Contributions of the study

Looking at the first and main research question of this study, if there is a reverse relationship between firms’ environmental behaviour and the creation of product innovations in firms of the selected CEE countries, overall positive results occur based on the findings of this study.

One main result and contribution of this empirical study focused on ‘catching-up’ CEE countries regarding the second analysed research question is that firms’ activities belonging to the groups of setting environmental targets/goals, monitoring environmental burdens, and adopting measures of environmental burdens affect – mainly positively – firms’ product innovations. In line with the Porter hypothesis and the still scarce literature about this specific topic, this main finding shows that the investigated CEE firms have experienced a similar transformation in recent years as many comparable firms in Western and Northern Europe.

Another important finding of the presented research is that, beyond the already-mentioned overall findings for the studied CEE countries, the firms in this group of nations are rather heterogenous. Based on this result, the country factor proved to be more important than other control variables, like industry and firm age.

These specific findings lead us, very directly, to the question of potential policy recommendations of the presented research. For example, one could ask if there are relevant policy differences between neighbouring countries like the Czech Republic and Slovakia on the one hand as well as Estonia, Latvia, and Lithuania on the other hand.

From a theoretical perspective, this mainly policy-related question also refers to the underlying question about how increasing the absorptive capacity and environmental awareness of firms in the different analysed CEE countries could be supported while keeping an environmental policy focus (Paliokaitė, 2019). The specific policy recommendations in this direction, as currently discussed, include grants for (i) employing managers with environmental background and (ii) additional education and training related to environmental issues, which could increase firms' awareness of the need to implement environmentally friendly activities and innovation (Hojnik & Ruzzier, 2016). Moreover, policy support to strengthen cooperation between firms as well as both foreign and domestic R&D units and cooperation between domestic R&D and foreign scientific institutes and enterprises is also recommended (Świadek et al., 2021). This cooperation could help overcome obstacles such as knowledge gaps and difficulties with cooperation (e.g., between firms and scientific institutes). These activities can be further supported by the participation of firms in the firm's groups, including firms from Western Europe. On the one hand, firms could easily access additional resources and benefit from the reputation of the entire group. On the other hand, such participation may lead to the transfer of the group's perception of environmental issues to individual firms from CEE countries.

In order to gain a longer-term advantage and contribute to achieving environmental and economic win-win situation, in line with our finding that firms in CEE countries pay the highest attention to monitor energy consumption, we recommend firms to focus on increasing their energy efficiency. Firms could realize this focus, for example, by integrating ICT tools into their production that could (i) act as enablers for energy efficient manufacturing and (ii) help to reduce energy costs and CO_2 emissions (Bunse et al., 2011). According to Bunse et al. (2011), firms' ICT infrastructure could include various different systems to support their increase of energy efficiency, such as manufacturing execution systems, product lifecycle management systems, enterprise resource planning systems, and others.

6.2 Limitations and future directions

Furthermore, related to the assessment of the overall results of this study, we need to mention the methodological limitations, such as the limited selection of investigated CEE countries and environmental variables of dichotomous type only. The latter limitation is mainly due to the fact that the data came from a relatively broad survey which did not focus only on environmental issues. However, the use of data from a professional survey ensures the representativeness of the data and justifies the use of the applied statistical methods. Due to these limitations, our suggestions for future studies in the investigated research field refer to a broader selection of included countries as well as possibilities for building up more differentiated quantitative and/or qualitative data sets than the one applied in this study. Subsequently, we recommend the application of a mix method approach.

Considering the socio-economic and political specifics of CEE countries and the results of this study, which indicate the occurrence of significant differences (heterogeneity) between neighbouring countries, such as the Czech Republic and Slovakia, we recommend for future research a deeper comparison of these countries (or among the Visegrad Group countries). Referring to Hojnik et al. (2021), future research could also focus on firms' dynamic capabilities in CEE countries. The main argument for this suggestion is that firms that aim to achieve 'green transformation' need to develop effective dynamic capabilities. These capabilities include, for example, a change in current organizational design of firms by the alignment of firm activities with constantly changing external environment.

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References

Aboelmaged, M. (2018). Direct and indirect effects of eco-innovation, environmental orientation and supplier collaboration on hotel performance: An empirical study. *Journal of cleaner production*, 184, 537-549. https://doi.org/10.1016/j.jclepro.2018.02.192

Agresti, A (2002). *Categorical Data Analysis*. John Wiley & Sons. https://doi.org/10.1002/0471249688

Akaike, H. (1973). Information theory and an extension of the maximum likelihood principle. In *B. N. Petrov & F. Csáki (Eds.), 2nd international symposium on information theory*. Budapest, Hungary: Akadémia Kiadó, 267–281. https://doi.org/10.1007/978-1-4612-1694-0_15

Alos-Simo, L., Verdu-Jover, A. J., & Gomez-Gras, J. M. (2020). Does activity sector matter for the relationship between eco-innovation and performance? Implications for cleaner production. *Journal of Cleaner Production*, *263*, 121544. https://doi.org/10.1016/j.jclepro.2020.121544

Amores-Salvadó, J., Martín-de Castro, G., & Navas-López, J. E. (2014). Green corporate image: moderating the connection between environmental product innovation and firm performance. *Journal of Cleaner Production*, *83*, 356-365. https://doi.org/10.1016/j.jclepro.2014.07.059

Andries, P., & Stephan, U. (2019). Environmental innovation and firm performance: How firm size and motives matter. *Sustainability*, 11(13), 3585. https://doi.org/10.3390/su11133585

Arranz, N., Arroyabe, M., Li, J., & Fernandez de Arroyabe, J. C. (2020). Innovation as a driver of eco-innovation in the firm: An approach from the dynamic capabilities theory. *Business Strategy and the Environment*, *29*(3), 1494-1503. https://doi.org/10.1002/bse.2448

Banerjee, S. B., Iyer, E. S., & Kashyap, R. K. (2003). Corporate environmentalism: Antecedents and influence of industry type. *Journal of marketing*, *67*(2), 106-122. https://doi.org/10.1509/jmkg.67.2.106.18604

Benetyte, R., & Krusinskas, R. (2019). Innovations Risk Factors Analysis Between Innovation Leaders and Moderate Innovators. *Eurasian Business Perspectives*, 129-142. https://doi.org/10.1007/978-3-030-18652-4_10

Bigliardi, B., Bertolini, M., Klewitz, J., Zeyen, A., & Hansen, E. G. (2012). Intermediaries driving eco-innovation in SMEs: A qualitative investigation. *European Journal of Innovation Management*. *15*(4), 442–467. https://doi.org/10.1108/14601061211272376

Bischoff, K., & Volkmann, C. K. (2018). Stakeholder support for sustainable entrepreneurship-a framework of sustainable entrepreneurial ecosystems. *International Journal of Entrepreneurial Venturing*, *10*(2), 172-201.

Bunse, K., Vodicka, M., Schönsleben, P., Brülhart, M., & Ernst, F. O. (2011). Integrating energy efficiency performance in production management–gap analysis between industrial needs and scientific literature. *Journal of Cleaner Production*, *19*(6-7), 667-679. https://doi.org/10.1016/j.jclepro.2010.11.011

Dauda, L., Long, X., Mensah, C. N., Salman, M., Boamah, K. B., Ampon-Wireko, S., & Dogbe, C. S. K. (2021). Innovation, trade openness and CO2 emissions in selected countries in Africa. *Journal of Cleaner Production*, *281*, 125143. https://doi.org/10.1016/j.jclepro.2020.125143

Demirel, P., & Danisman, G. O. (2019). Eco-innovation and firm growth in the circular economy: Evidence from European small-and medium-sized enterprises. *Business Strategy and the Environment*, *28*(8), 1608-1618. https://doi.org/10.1002/bse.2336

European Commission. European Innovation Scoreboard; Internal Market, Industry, Entrepreneurship and SMEs. Available online: https://ec.europa.eu/growth/industry/policy/innovation/scoreboards_en (accessed on 7 June 2021).

Fang, J., Gao, C., & Lai, M. (2020). Environmental regulation and firm innovation: Evidence from National Specially Monitored Firms program in China. *Journal of Cleaner Production*, *271*, 122599. https://doi.org/10.1016/j.jclepro.2020.122599

Gerstlberger, W., da Mota Pedrosa, A., & Smari Atlason, R. (2019). How Firms' Strategic Environmental Goals Influence Product Innovation. In: Bocken N., Ritala P., Albareda L., Verburg R. (eds.) *Innovation for Sustainability*. Palgrave Studies in Sustainable Business In Association with Future Earth. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-319-97385-2_17

Gerstlberger, W., Præst Knudsen, M., & Stampe, I. (2014). Sustainable development strategies for product innovation and energy efficiency. *Business Strategy and the Environment*, *23*(2), 131-144. https://doi.org/10.1002/bse.1777

Hojnik, J., & Ruzzier, M. (2016). The driving forces of process eco-innovation and its impact on performance: Insights from Slovenia. *Journal of cleaner production*, *133*, 812-825. https://doi.org/10.1016/j.jclepro.2016.06.002

Hojnik, J., Prokop, V., & Stejskal, J. (2021). R&D as bridge to sustainable development? Case of Czech Republic and Slovenia. Corporate Social Responsibility and Environmental Management, 1–15. https://doi.org/10.1002/csr.2190

Hong, P., Kwon, H. B., & Roh, J. J. (2009). Implementation of strategic green orientation in supply chain. *European Journal of Innovation Management*, *12*(4), 512-532. https://doi.org/10.1108/14601060910996945

Horbach, J. (2014). Determinants of Eco-innovation from a European-wide Perspective–an Analysis based on the Community Innovation Survey (CIS). *SEEDS Working Paper*, 7, 2014.

Horbach, J. (2016). Empirical determinants of eco-innovation in European countries using the community innovation survey. *Environmental Innovation and Societal Transitions*, 19, 1-14. https://doi.org/10.1016/j.eist.2015.09.005

Horbach, J., Oltra, V., & Belin, J. (2013). Determinants and specificities of eco-innovations compared to other innovations—an econometric analysis for the French and German industry based on the community innovation survey. *Industry and Innovation*, *20*(6), 523-543. https://doi.org/10.1080/13662716.2013.833375

Jakobsen, S., & Clausen, T. H. (2016). Innovating for a greener future: the direct and indirect effects of firms' environmental objectives on the innovation process. *Journal of Cleaner Production*, *128*, 131-141. https://doi.org/10.1016/j.jclepro.2015.06.023

Jehlička, P., & Jacobsson, K. (2021). The importance of recognizing difference: Rethinking Central and East European environmentalism. *Political Geography*, *87*, 102379. https://doi.org/10.1016/j.polgeo.2021.102379

Jiang, W., Chai, H., Shao, J., & Feng, T. (2018). Green entrepreneurial orientation for enhancing firm performance: A dynamic capability perspective. *Journal of Cleaner Production*, 198, 1311-1323. https://doi.org/10.1016/j.jclepro.2018.07.104

Kallaste, M., Kalantaridis, C., & Venesaar, U. (2019). Open Innovation in Enterprise Strategies in Central and Eastern Europe: The Case of Estonia. *Research in Economics and Business: Central and Eastern Europe*, *10*(2).

Kotkova Striteska, M., & Prokop, V. (2020). Dynamic Innovation Strategy Model in Practice of Innovation Leaders and Followers in CEE Countries—A Prerequisite for Building Innovative Ecosystems. *Sustainability*, *12*(9), 3918. https://doi.org/10.3390/su12093918

Loucanova, E., Parobek, J., Kalamarova, M., Palus, H., & Lenoch, J. (2015). Eco-innovation performance of Slovakia. *Procedia Economics and Finance*, *26*, 920-924. https://doi.org/10.1016/S2212-5671(15)00906-5

Lv, X., Qi, Y., & Dong, W. (2020). Dynamics of environmental policy and firm innovation: Asymmetric effects in Canada's oil and gas industries. *Science of The Total Environment*, 712, 136371. https://doi.org/10.1016/j.scitotenv.2019.136371

Melece, L. (2015). Eco-innovation and its development in Baltic states. *Management Theory and Studies for Rural Business and Infrastructure Development*, *37*(3), 415-424. http://dx.doi.org/10.15544/mts.2015.36

Menguc, B., & Ozanne, L. K. (2005). Challenges of the "green imperative": A natural resource-based approach to the environmental orientation–business performance relationship. *Journal of Business Research*, 58(4), 430-438. https://doi.org/10.1016/j.jbusres.2003.09.002

Mondéjar-Jiménez, J., Segarra-Oña, M., Peiró-Signes, Á., Payá-Martínez, A. M., & Sáez-Martínez, F. J. (2015). Segmentation of the Spanish automotive industry with respect to the environmental orientation of firms: towards an ad-hoc vertical policy to promote eco-innovation. *Journal of Cleaner Production*, *86*, 238-244. https://doi.org/10.1016/j.jclepro.2014.08.034

Opršal, Z., & Harmáček, J. (2019). Is Foreign Aid Responsive to Environmental Needs and Performance of Developing Countries? Case Study of the Czech Republic. *Sustainability*, 11(2), 401. https://doi.org/10.3390/su11020401
Pace, L. A. (2016). How do tourism firms innovate for sustainable energy consumption? A capabilities perspective on the adoption of energy efficiency in tourism accommodation establishments. *Journal of Cleaner Production*, *111*, 409-420. https://doi.org/10.1016/j.jclepro.2015.01.095
Paliokaitė, A. (2019). An innovation policy framework for upgrading firm absorptive capacities in the context of catching-up economies. *Journal of Entrepreneurship, Management and Innovation*, *15*(3), 103-130. https://doi.org/10.7341/20191534
Papadas, K. K., Avlonitis, G. J., Carrigan, M., & Piha, L. (2019). The interplay of strategic and internal green marketing orientation on competitive advantage. *Journal of Business Research*, *104*, 632-643. https://doi.org/10.1016/j.jbusres.2018.07.009
Paulraj, A. (2009). Environmental motivations: a classification scheme and its impact on environmental strategies and practices. *Business strategy and the Environment*, *18*(7), 453-468. https://doi.org/10.1002/bse.612
Porter, M. E., & Van der Linde, C. (1995). Toward a new conception of the environment-competitiveness relationship. *Journal of economic perspectives*, 9(4), 97-118. http://dx.doi.org/10.1257/jep.9.4.97
Prokop, V., & Stejskal, J. (2017). Different approaches to managing innovation activities: An analysis of strong, moderate, and modest innovators. *Engineering Economics*, *28*(1), 47-55. http://dx.doi.org/10.5755/j01.ee.28.1.16111
Prokop, V., Stejskal, J., Klimova, V., & Zitek, V. (2021). The role of foreign technologies and R&D in innovation processes within catching-up CEE countries. *PLoS ONE*, *16*(4), e0250307. https://doi.org/10.1371/journal.pone.0250307
Przychodzen, J., & Przychodzen, W. (2015). Relationships between eco-innovation and financial performance–evidence from publicly traded companies in Poland and Hungary. *Journal of Cleaner Production*, *90*, 253-263. https://doi.org/10.1016/j.jclepro.2014.11.034
Rauter, R., Jonker, J., & Baumgartner, R. J. (2017). Going one's own way: drivers in developing business models for sustainability. *Journal of Cleaner Production*, *140*, 144-154. https://doi.org/10.1016/J.JCLEPRO.2015.04.104
Sempere-Ripoll, F., Estelles-Miguel, S., Rojas-Alvarado, R., & Hervas-Oliver, J. L. (2020). Does technological innovation drive corporate sustainability? Empirical evidence for the European financial industry in catching-up and central and Eastern Europe countries. *Sustainability*, *12*(6), 2261. https://doi.org/10.3390/su12062261
Shu, C., Zhou, K. Z., Xiao, Y., & Gao, S. (2016). How green management influences product innovation in China: The role of institutional benefits. *Journal of Business Ethics*, *133*(3), 471-485. https://doi.org/10.1007/s10551-014-2401-7
Sidorkin, O. (2015). The impact of management quality on innovation performance of firms in emerging countries. *CERGE-EI Working Paper Series*, (555). http://dx.doi.org/10.2139/ssrn.2700629
Świadek, A., Gorączkowska, J., & Godzisz, K. (2021). Conditions Driving Low-Carbon Innovation in a Medium-Sized European Country That Is Catching Up–Case Study of Poland. *Energies*, *14*(7), 1997. https://doi.org/10.3390/en14071997
The World Bank. Survey Methodology. Available online: https://www.enterprisesurveys.org/en/methodology (accessed on 1 October 2021).
Wang, M., & Feng, C. (2021). The win-win ability of environmental protection and economic development during China's transition. *Technological Forecasting and Social Change*, *166*, 120617. https://doi.org/10.1016/j.techfore.2021.120617
Yasir, M., Majid, A., & Qudratullah, H. (2020). Promoting environmental performance in manufacturing industry of developing countries through environmental orientation and green business strategies. *Journal of Cleaner Production*, *275*, 123003. https://doi.org/10.1016/j.jclepro.2020.123003
Zhang, D., & Vigne, S. A. (2021). How does innovation efficiency contribute to green productivity? A financial constraint perspective. *Journal of Cleaner Production*, *280*, 124000. https://doi.org/10.1016/j.jclepro.2020.124000
Zhou, Y., Shu, C., Jiang, W., & Gao, S. (2019). Green management, firm innovations, and environmental turbulence. *Business Strategy and the Environment*, *28*(4), 567-581. https://doi.org/10.1002/bse.2265