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Eco-innovations in Polish enterprises

Ekoinnowacje w polskich przedsiębiorstwach

SUMMARY

The aim of the article is to present the effects of implementing eco-innovations in enterprises. Eco-innovation is a fairly modern concept and can be a method of solving emerging environmental problems as a consequence of economic growth. As with innovation, eco-innovation has several types and can therefore result in a new or significantly improved product (good or service), process, new marketing or organizational methods. Eco-innovation should be seen as an integral part of innovative activities in all sectors of the economy.

Keywords: eco-innovation, environment, Central and Eastern European countries, economy, enterprise, environment.

STRESZCZENIE

Celem artykułu jest przedstawienie efektów wdrażania ekoinnowacji w przedsiębiorstwach. Ekoinnowacja jest pojęciem dość nowym. Może być rozumiana jako metoda rozwiązywania problemów środowiskowych pojawiających się jako konsekwencje wzrostu gospodarczego. Podobnie jak w wypadku innych innowacji, istnieje kilka typów innowacji ekologicznych. Mogą one skutkować nowym lub znacznie ulepszonym produktem (dobrem lub usługą), procesem, nową strategią marketingową lub metodami organizacyjnymi. Ekoinnowacje należy postrzegać jako integralną część działań innowacyjnych we wszystkich sektorach gospodarki.

Słowa kluczowe: ekoinnowacje, środowisko, kraje Europy Środkowo-Wschodniej, gospodarka, przedsiębiorstwo.

INTRODUCTION

In the beginning of the 1970s, in the 20th century, the global awareness of environmental problems increased and related with relationship between environmental policy and international trade (Bergh & Nijkamp, 1995). To date this relationship has been extensively studied in the literature to validate the pollution haven hypothesis. This hypothesis argues that high environmental performance negatively affects the comparative advantage of a country by setting up a stringent environmental policy for the production of a specific commodity. Consequently, strict environmental policy reduces the exports of this commodity and increases its imports to substitute local production. More importantly, although no international trade theory has considered the implications of institutional differences yet, institutions have received a great deal of attention in recent years in research related to comparative advantage and environmental performance. Such research reveals the effective role of institutional quality in enhancing comparative advantage and environmental performance (Elsalih, Sertoglu, & Besim, 2020) one of these environmental performances are eco-innovation.

Scholars investigate different aspects of eco-innovation performance from 90's. While eco-innovation has been measured as eco-product and eco-process innovation by Cheng & Shiu (2012), Horbach & Rennings (2013) and Yurdakul & Kazan (2020) it has been measured additionally as eco-organizational innovation by Cheng, Yang & Sheu (2014) and Rennings, Ziegler, Ankele, & Hoffmann (2006). To date, literature on eco-innovation is focused rather to product, process, and organization (Munodawafa & Johl, 2019) eco-innovation is a risky proposition for organiza-

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tions and their stakeholders, due to uncertainty of outcome. Despite the high investment risk of eco-innovation, the literature that assesses eco-innovation outcomes from an organizational performance perspective is scant. Thus, this paper uses a systematic approach to review eco-innovation and performance literature. The eco-innovation and performance literature reviewed in this paper is sourced from the Scopus and Web of Science WoS. We propose to enhance eco-innovation in terms of "eco-marketing". On the other hand, the impact of eco-innovation on financial and environmental performance has been hardly ever explored in CEE countries. A several eco-innovation studies have been conducted in less ecoinnovative countries (Cleff & Rennings, 2012; Horbach & Rennings, 2009; Pujari, 2006).

Thus, the aim of these research was to determine the impact of eco-innovation performance in a CEE countries. Both environmental and financial performance are analyzed to date in terms of pollution reduction, resource saving, cost performance, and economic performance. Thus, the study contributes to the existing literature by evaluating the current environmental situation companies are faced with. The remainder of the paper is organized as follows. Sections 2 and 3 provide the literature review and the Eco-Innovation Scoreboard, respectively. Then, the barriers, empirical results and discussion are elaborated in paragraph 4. Lastly, section Summary gives the conclusions and limitations of the study.

1. ECO-INNOVATION IN THE LITERATURE STUDIES

The definition of eco-innovation was originally proposed by Fussler and James in the 90's in the 20th century as the reduction of negative environmental impacts while providing new products and processes as a benefit to the customer and the business (Fussler & James, 1996). Eco-innovation contributes to sustainability goals through the realization of new ideas, behavior, products, and processes (Rennings, 2000). Other authors, Kemp (2007) understand eco-innovation as a new or significantly improved product, process, or business method that helps to reduce environmental risks, pollution, and the negative effects of resource use instead of traditional methods that do not take into account environmental impacts.

According to (Schumpeter, 2017) innovation is a new product, process, or method of production; a new market or source of supply; or a new form of commercial business or organization. Thus, eco-innovation is different from innovation practices because of the environmental perspective. The well-known concept of resource-based view (RBV) asserts that the maintaining of firms' competitive advantage lies in it having heterogeneous resources that are valuable, rare, inimitable, and not substitutable (Barney, 2001). RBV provides a valid theoretical basis for analyzing the relationship between resources, capabilities, and performance. This theory provides a holistic view of eco-innovation (Cheng et al., 2014). Hart (1995) developed the natural-resource-based view (NRBV) of the firm to overcome this shortcoming. He indicated that competitive advantage and strategy are rooted in capabilities that facilitate environmentally sustainable economic activity. Businesses that develop their skills toward addressing environmental problems in the face of natural environmental challenges will achieve a competitive advantage. This results in lower production costs. Along with pollution prevention and product stewardship capabilities, businesses should work on introducing cleaner production methods. Developing or using cleaner production technologies requires companies to have eco-innovation capability (Munodawafa & Johl, 2019) eco-innovation is a risky proposition for organizations and their stakeholders, due to uncertainty of outcome. Despite the high investment risk of eco-innovation, the literature that assesses eco-innovation outcomes from an organizational performance perspective is scant. Thus, this paper uses a systematic approach to review eco-innovation and performance literature. The eco-innovation and performance literature reviewed in this paper is sourced from the Scopus and Web of Science (WoS. Most OECD (Organization for Economic Co-operation and Development) countries recognize eco-innovation as an important solution for today's environmental challenges such as climate change and energy security (Machiba, 2009). In addition, many countries are convinced that eco-innovation are important source of competitive advantage in the market of rapidly growing environmental products and services (Reid & Miedziński, 2008). Eco-innovation is important to companies seeking for a way to reduce negative environmental impact whilst creating a positive competitive advantage. In this study, we analyzed eco-innovation as including the concepts of eco-product, eco-process, eco-organizational, and eco-marketing innovation perspective. Eco-product innovation refers to the reduction of environmental impacts through the significant improvement of new or existing products or services (Reid & Miedziński, 2008). This innovation aims to reduce environmental impact by improving environmental performance, meeting the market's environmental expectations, and increasing resource efficiency whilst achieving optimal environmental benefits in the whole product life cycle (Dong, Wang, Jin, Qiao, & Shi, 2014). Further, Horbach, Rammer, & Rennings (2012) illustrated that energy and cost savings are the main motivation of the eco-process innovations. Eco-organizational innovation refers to the business method, process redesign, and responsibilities within the company to reduce environmental impacts. The business method is the way of doing business in organizations and supports the emergence of product and process innovations; thus, it is important for creating a positive environmental impact. OECD and Eurostat defined eco-innovation as: 'implementation of a new or significantly improved product (good or service), process, new marketing method

or a new method of organization in business practice, in the workplace and in external relations' (Machiba, 2009).

2. THE ECO-INNOVATION SCOREBOARD

The Eco-Innovation Scoreboard (Eco-IS) and the Eco-Innovation Index illustrate eco-innovation performance across the EU Member States (*Ecoinnovation observatory*, b.d.). They aim at capturing the different aspects of eco-innovation by applying 16 indicators grouped into five dimensions: eco-innovation inputs, eco-innovation activities, eco-innovation outputs, resource efficiency and socio-economic outcomes. The Eco-Innovation Index shows how well individual Member States perform in different dimensions of eco-innovation compared to the EU average and presents their strengths and weaknesses. The Eco-IS and the Eco-Innovation Index complements other measurement approaches of innovativeness of EU countries and aims to promote a holistic view on economic, environmental and social performance (Fig. 1).

Leitner indicated the analysis of the German eco-innovation sample highlights that expected future demand, rising costs for energy and other resources or the wish to improve one's reputation and adhere to industry standards are important drivers of eco-innovation (Leitner, 2018). From a policy perspective, the strong role of demand emphasizes the need for effective demand-side policies to boost the demand for and occurrence of eco-innovations. In contrast, for the German sample, public policy plays a limited role only. In particular, only public financial support helps trigger eco-innovative activities while no evidence is found in support of the Porter hypothesis.

3. BARRIERS TO ECO-INNOVATION

The problem of barriers to eco-innovation is definitely and currently, important for Polish companies, the Polish economy and preferred by the EU. In the short term, the European Commission intends to intervene in sectors that have strong

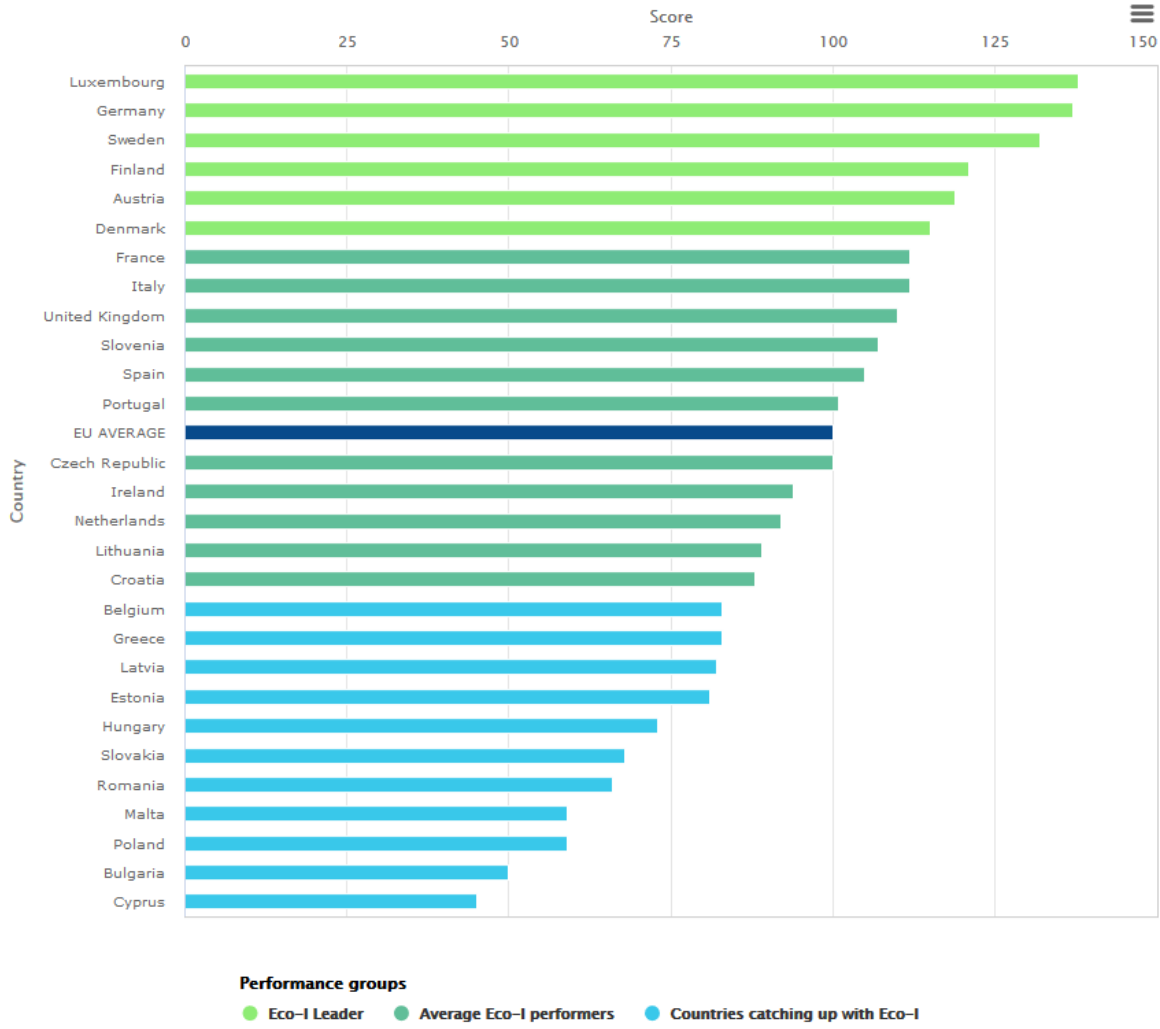

Fig. 1. The Eco-Innovation Scoreboard.
Source : (Eco-Innovation Observatory - Annual Reports - Annual Reports, n.d.; Ecoinnovation observatory, n.d.)

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potential to support the ‚green economy'. Research and innovation are a priority in the EU's Agenda for Growth and Jobs..

Compared to the leaders in terms of implementing eco-innovation, the experience of national economic operators has not yet been comprehensively analyzed and described in the literature. The authors of the report "Doped tiger, shackled eagle: The dilemmas of the Polish debate on innovation policy" emphasize that the current model of growth of Poland will soon run out (Bukowski, 2012). The way can be to compete with eco-innovations.

An important EU initiative dedicated to eco-innovation research is currently the Eco-Innovation Observatory (*Eco-innovation observatory*, n.d.). On the basis of these indicators, the Ecoinnovation scoreboard was created, in which Poland took the third last place among all 27 EU members.

Unfortunately, eco-innovations remain outside the orbit of politicians interests in Poland, determining the vision of the use of structural funds for development purposes. As a consequence, Polish policy insists on eliminating delays in civilisation, forgetting the future changes in the importance of economic sectors and the barriers to the old model of growth based on price (Bukowski, Kassenberg, & Śniegocki, 2016; Gallup, 2011; Rennings, 2004) competition. Eco-innovations affect the efficiency of the economy by introducing solutions to reduce process energy intensity and reduce material consumption per unit of production.

4. THE RESULTS OF THE EMPIRICAL STUDY - AN EXAMPLE

In the absence of broader data for European companies, data for companies from EU-27 countries collected by the Gallup Institute were used (Gallup, 2011). A multiple regression model was used to identify barriers to eco-innovation. In the different model variants, the different types of eco-innovation were measured as the percentage of companies that implemented the different types of eco-innovation (as dependent variable). Independent variables were used in models of barriers affecting companies' decisions, whether or not they should innovate ecologically. For the stated sites of our analysis, i.e. 27 groups of companies from EU countries, the values of independent variables were calculated as weighted averages, in which the scales were fractions of respondents assessing the given factors as very important and important. Product, process and organisational eco-innovations have been identified and barriers to such innovations have been recognized. The analysis used a reverse step regression model approach. The calculation identified statistically significant variables (tab. 1).

Table 1. Multiple regression model results

Independent variables	Dependent variables					
	eco--innovations	Se	process eco--innovations	Se	organisational eco-innovation	Se
Constant	11.18**	3.75	22.6**	4.06	-1.32	6.24
Limited access to knowledge and modern technologies	0.29*	0.08	0.36*	0.15		
Lack of suitable business partners			-0.24*	0.1	-0.31*	0.14
No external funding					0.32**	0.11
Lack of qualified personnel					0.32*	0.15
R^2	0.32		0.22		0.15	
F (p value)	12.11 (<0.001)		3.3 (<0.05)		4.75 (<0.01)	

*p<0.05 **p<0.01

It turns out that product eco-innovation is influenced by the variable: "limited access to knowledge and modern technologies". Contrary to our expectations, this variable did not constitute a barrier for, companies that are to enter into product eco-innovation. Other variables were not statistically significant. In the case of process eco-innovation, the "lack of suitable business partners" and "limited access to knowledge and modern technologies" were important, but they interact in different directions. While the "lack of suitable business partners" is not conducive to the introduction of process eco-innovation, as expected, the variable „limited access to knowledge and modern technologies" works in the opposite direction, incompatible with intuition. In the case of organisational eco-innovation, the "lack of relevant business partners" and the "lack of external funding" and the "lack of adequate staff" proved important. The variable "the lack of suitable business partners is statistically significant and reduces the introduction of organizational eco-innovation. Other variables, which are not expected, are not a barrier to organisational eco-innovation.

In the absence of detailed data, the results of calculations should be considered as an example. Accurate calculations will be carried out after obtaining more detailed data.

SUMMARY

The Polish companies can compete in the world's top markets in many markets for eco-innovative technologies. In contrast to the most complex energy technologies (nuclear power plants), there are opportunities for success in the field of renewable and distributed energy, taking into ac-

count both the required potential and the support currently provided to Polish innovators from national and EU funds

The current environmental measures in most companies are insufficient and are limited to removing the effects of pollution rather than using cleaner technologies. We seem to be seeing two distinctive barriers at the moment. On the one hand, the weak level of development of Poland, not enough to increase the demand for eco-innovation on the part of the business, and on the other hand, significant resources are not allocated, as they will not be used.

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