Journal of Cleaner Production 90 (2015) 253–263

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Relationships between eco-innovation and financial performance – evidence from publicly traded companies in Poland and Hungary

Justyna Przychodzen [a, *], Wojciech Przychodzen [b, 1]

[a] University of Deusto, Avenida de las Universidades 24, 48007 Bilbao, Spain
[b] Department of Finance, University of Deusto, Hermanos Aguirre 2, 48014 Bilbao, Spain

ARTICLE INFO

Article history:
Received 26 June 2014
Received in revised form
8 November 2014
Accepted 9 November 2014
Available online 18 November 2014

Keywords:
Eco-innovation
Environmental management
Financial performance
Sustainable development
Transition economies
Publicly traded companies

ABSTRACT

While the analysis of the linkages between eco-innovative activities and financial performance is a popular topic in the existing body of literature, many questions about these relationships, especially in transition economies in Central and Eastern Europe (CEE), remain unanswered. In this paper, we explore four types of eco-innovation (product, process, market and sources of supply) and their impact on accounting-based measurers of financial performance using the data on Polish and Hungarian publicly traded companies from the years 2006–2013. Our results indicated that eco-innovators were generally characterized by higher returns on assets and equity and lower earnings retention. Additionally, companies that introduce eco-innovation were also significantly larger, more likely to face lower financial risk exposure and more likely to possess greater free cash flow than conventional firms. The findings suggest that strong asset and financial capabilities are relevant pre-conditions for the development of eco-innovativeness and that there is a need for environmental policy to create clear incentives for SMEs to increase activities in that area. Overall, this study extends the understanding of financial performance implications of innovation by focussing on the area of environmental innovation.

1. Introduction

At the turn of the 21st century, when a number of ecological threats resulting from the rapid development of human civilisation have been identified, environmental issues are not only becoming part of politics, but also of business life (Pujari et al., 2003). The growing ecological awareness of the consumer, the increase in the significance of corporate social responsibility, including changes in the expectations of strategic pressure groups, the pro-environmental transformation of the international and national legal environment are among main drivers of eco-innovations (Esty and Winston, 2006). Apart from that, the development of pro-ecological technologies and the appearance of new "green" sources of capital are also considered as the most important reasons for businesses to restructure to become more eco-friendly (Laszlo, 2003). The pro-environmental transition of a company refers to the inclusion of environmental aspects in planning, organisation, manufacturing, leadership and member performance control processes that minimize ecological burdens (Przychodzen and Przychodzen, 2013).

For more than 70 years, the firm has been considered a basic source of innovation and knowledge creation (Schumpeter, 1939; Kirzner, 1973; Andersen, 2001). For the last several decades, the firm has been increasingly seen as an entity responsible for stewardship of the natural environment (Reinhardt, 1998; Majumdar and Marcus, 2001; Przychodzen and Przychodzen, 2013). This essence of a firm directly implies its ability in eco-innovative activity. A company's innovative activity should provide a competitive advantage (Nelson and Winter, 1982; Simon, 1996), but in the case of eco-innovations, competitive advantage should accompany environmental benefits (Carraro, 2000; Frondel et al., 2004). Eco-innovation is becoming a relevant area of competition between firms and directly influences financial gains, however their scale and achievability depend on the industry, legislation and norms, as well as consumer sensitiveness (Jansson, 2011).

Although numerous studies have empirically examined connections between eco-innovation and financial performance of companies from developed countries (Ghisetti and Rennings, 2014; Heras-Saizarbitoria et al., 2011; Semenova and Hassel,

* Corresponding author. Tel.: +34 944139000.
E-mail addresses: justyna.przychodzen@yahoo.com (J. Przychodzen), wojciech.przychodzen@yahoo.com (W. Przychodzen).
[1] Tel.: +34 944139000.

http://dx.doi.org/10.1016/j.jclepro.2014.11.034
0959-6526/

2008), only a few have addressed this issue for emerging economies (Cheng et al., 2014). The recent global financial crisis and its aftermath have brought increased attention to Central and Eastern Europe (CEE) and heightened the ability of the largest markets in the region to function effectively during times of economic turbulence (2006–2013) and institutional transition (IMF, 2013). This study can be seen as an attempt to advance the knowledge of eco-innovation and financial performance (Orlitzky et al., 2003; Boons and Wagner, 2009; Cheng et al., 2014) for firms in Poland and Hungary – two (out of three, together with Czech Republic) of the most advanced and successful transition economies in CEE (EBRD, 2013) and first and third largest economies in the region in terms of GDP in 2013, respectively (World Bank, 2014). This is particularly important in post-socialist countries such as Poland and Hungary, where, until the early 1990s, the isolated ecological activity of businesses stemmed from economic reality (e.g., excessively polluted soils, depletion of raw materials, lack of technology), rather than applicable law and voluntary choice of management (Kozlowski, 2000). Today, since joining the European Union in 2004, environmental protection has become a top priority for these national governments, and the voluntary implementation of pro-environmental activities is widely promoted. This makes a better understanding of the substance of eco-innovation and its major catalysts among leading companies even more desirable, especially in the face of the highly ambitious emissions reduction targets for 2020 set by the Polish and Hungarian governments.

This paper sets out to address this problem by examining the structure and scope of a number of eco-innovation activities among the leading publicly traded companies in Poland and Hungary. These activities will be analysed from the perspective of the 'target' for innovation, i.e., a new product, new process or way of organizing the business, a new market or new sources of supply. By creating such an overview of eco-innovation practices, researchers, policymakers and practitioners can better understand and operationally define the substance of eco-innovation, its current state and direction. This overview addresses if and how eco-innovation influences corporate financial performance. In particular, this paper address the question: does eco-innovation affect a company's returns on assets (ROA), returns on equity (ROE), and earnings retention ratios (ERR)?

This study examines the effects of eco-innovation activities on financial performance of firms, based upon a panel data sample of Warszawski Indeks Gieldowy (WIG) and Built Up eXport (BUX) stock exchange indices. The results consistently indicate that eco-innovative firms are generally characterized by higher average returns on assets and equity, and lower earnings retention ratios in the years 2006–2013. The results also show a higher probability of pro-activeness in environmental-oriented behaviour among firms that have stronger autonomy in financing their growth and are larger in size. To ensure that the results reported above are robust across different model specifications, a number of additional sensitivity analyses have been undertaken.

The paper is structured as follows: first an overview of eco-innovation will be presented. The aim of this section is to provide the background information about the innovation concept used in the analysis, as well as an overview of eco-innovation generally. Second, on the base of theory, hypotheses will be developed. Next, the results of the empirical study will be presented, including a description of the material used. The results will then be analysed from a broad perspective on eco-innovation, as well as how such innovation affects financial performance of leading corporations in the above area. Finally, the key findings will be discussed, and conclusions drawn on the usefulness and implications of the study, its limitations, and directions for future research.

2. Environmental innovation

In recent years, innovations are connected to the ecology more and more often. This is a result of rising demand for eco-innovation because of the urgent need to address today's pressing environmental challenges. Sustainable innovation, or eco-innovation, has been broadly defined as the process of developing new ideas, behaviours, products and processes that contribute to a reduction in environmental burdens or to ecologically specified sustainability targets (Rennings, 2000). Eco-innovation is also the combined improvement of economic performance and natural environment through "creation of novel and competitively priced goods, processes, systems, services and procedures, designed to satisfy human needs and provide the quality of life for everyone with life-cycle minimum use of natural resources (…) and minimal release of toxic substances" (Technopolis, 2008, p.2). Porter and van der Linde (1995) described eco-innovation as the environment-friendly design of product or service, marketing and promotion. Kemp (2000) defined eco-innovation as new or modified processes, technologies and products that enable companies to avoid or mitigate environmental damage. Andersen (2010) interpreted eco-innovations in economic terms and defined them as innovations that attract green rents on the market. The author pointed out two ways of attracting green rents for companies through eco-innovations – first by acquiring a premium price for its green reputation or product and second by reducing production costs to achieve greater resource efficiency. For the European Union, eco-innovative activity is "production, assimilation and use of products, creation or adoption of current production process and management organisation, which are new to [the] company and which result in environmental risk, pollution and extensive usage of natural resources (including energy) reduction compared to alternative solutions and technologies" (Kemp and Pearson 2007, p. 7). Most eco-innovation appears to build on repurposing, improving or renewing existing ideas and practices (Hines and Marin, 2004), with many different types of activities constituting it. A necessary condition to put these activities under the eco-innovation umbrella is demonstrable progress towards more value and welfare with less impact (WBCSD, 2000). The activities may be conceived on several broad levels: technological, social, institutional, political and economic (Hellström, 2007; Ekins, 2010). Thus, to succeed, eco-innovation must be supported by a corresponding evolution of social arrangements and institutional support structures (Freeman, 1996).

To achieve the ambitious emission and environmental targets set up by many national governments, technological products, systems and processes must be significantly reconstructed (Huesemann, 2003). However, radical innovation will not materialize without significant support from public opinion and consumer purchase decisions. Only then will eco-industries be able to counter the strong resistance of established industries that will lose out from the environmental transition towards a sustainable economy. Even so, most existing eco-industries are very largely the result of environmental public policies (Ekins, 2010). The implementation of eco-innovations may also have other social implications, such as possible employment reductions connected with usage of fewer materials and reductions in production costs (Sprinkle and Maines, 2010) or higher prices for consumers of eco-innovative products and services. In the second case, rather than finding ways to make customers pay more for environmentally sound products, the challenge for eco-innovation and governments is to stop environmental cost externalization in the value chain, lower customers' perceived initial cost and increase awareness of life cycle cost (Kaenzig and Wüstenhagen, 2010; Chouinard et al.,

2011). In today's market conditions, the prices of products with a significant negative ecological footprint are kept low while the true costs to the planet rack up; their manufacturers are still able to ignore them.

Since the beginning of modern capital structure research (Modigliani and Miller, 1958), many authors have examined firms' capital structure and its relationship to other firms' financial and non-financial characteristics (Harris and Raviv, 1991; Frank and Goyal, 2009; Mânescu, 2011). Numerous studies have empirically examined connections between eco-innovation and efficiency gains in terms of financial improvements, however there seems to be no consensus in the relevant literature in terms of direction. Two major opposite trends are identified.

The first trend indicates a positive link between corporate environmental performance and profitability (see Table 1).

The second trend expresses a negative link between corporate environmental performance and profitability (see Table 2).

On the other hand, financial performance may influence companies' environmental performance given that successful companies can spend more on environmentally friendly activity (Schaltegger and Synnestvedt, 2002). This view is in line with the contention that financial performance may influence environmental management because a company with a good financial performance can allocate more resources to environmental initiatives (Wagner, 2005). Accordingly, financial resource constraints may result in less support for creativity and innovation (Camison-Zornoza et al., 2004; Gassmann and von Zedtwitz, 2003). Some studies indicate that research teams facing financial inadequacy anticipate low performance from the outset and tend to disengage from the task given (Gibson et al., 2000; Katz-Navon and Erez, 2005).

Apart from that, numerous studies suggest, that financial issues are only one among many drivers of eco-innovative activities. These other drivers include: external pressures from environmental regulations, customers' green demands, green behaviour of competitors, external networks, firms' organisational capabilities, and implementation of voluntary quality management schemes certifications (Kesidou and Demirel, 2012; Cai and Zhou, 2014; Cuerva et al., 2014).

Different methodological approaches described above clearly lead to varying results about the linkage between firms' environmental and financial performance and thus make drawing general conclusions extremely difficult. One of the potential problems here is the issue of endogeneity – i.e., determining whether sound environmental performance is the source of superior financial performance or vice versa – and intensity – i.e., understanding whether more numerous and stronger environmental efforts are better or worse for profitability. Furthermore, several scholars suggest that the number of control variables may affect interconnections in that area. The most important of these variables are company financial risk exposure (leverage) (Waddock and Graves, 1997), firm size (Busch and Hoffmann, 2011), financial 'slack' resources in the form of free cash flow (Artiach et al., 2010) and the level of industry (Etzion, 2007). Finally, the linkage between firms' environmental and financial performance can be also affected by the used financial metrics. We can observe several different approaches in the above area (market-based indicators vs. accounting-based indicators), which are often not used consistently. Previous research has also found that accounting measures are more close financial performance indicators to actual environmental activities, which can be used both over the long term, as well as to value initiatives that are expected to generate value shortly after implementation (Peloza, 2009). Thus, they are better suited to address the question of causality.

Table 1
Summation of contributions on a positive link between corporate environmental and financial performance.

Findings	Source
The development of pro-environmental technologies is connected to an increase in the productivity and quality of companies' operating process.	Majumdar and Marcus (2001)
The reputational benefits of environmental preparedness mainly increase market value, while environmental performance can also bring operational benefits to financial performance.	Semenova and Hassel (2008)
A firm's environmental performance has a positive impact on its financial performance and vice versa.	Guoyou et al. (2012)
Better environmental performance can improve revenue through e.g. better access to certain markets; differentiating products; and selling pollution-control technologies and diminish costs aspects through e.g. better risk management and relations with external stakeholders; lower costs of material, energy, and service; lower cost of capital; and lower cost of labor.	Ambec and Lanoie (2008)
Firms integrating ISO 14001 standards into their daily operations improve their environmental and financial performance.	Yin and Schmeidler (2009)
Emissions reductions are positively and strongly related to return on sales (ROS), return on assets (ROA) and return on equity (ROE) for a sample of Standard & Poor's 500 (S&P) 500 firms.	Hart and Ahuja (1996)

Table 2
Summation of contributions on a negative link between corporate environmental and financial performance.

Findings	Source
An industry is facing decreasing marginal returns on its incremental eco-efficiency efforts in terms of sustainability and financial improvements and that it is therefore pertinent to regularly generate radical eco-innovation to push the technological system up to a new equilibrium.	Murphy and Gouldson (2000)
Green environmental strategies do not increase market valuation, but there is also not a statistically significant difference in performance between green and environmentally neutral firms. Only inappropriate environmental management is valued lower by the market.	Fernando et al. (2010)
The negative shareholder wealth effects of voluntary corporate environmental initiatives. Companies announcing membership in environmental programs experience significantly negative abnormal stock returns.	Fisher-Vanden and Thorburn (2008)
Environmental investments appear to conflict with shareholder value maximization. The registration of ISO 14001 environmental management systems has led to lower ROA.	Zaho (2008)
No causal mechanism between corporate environmental performance and accounting-based corporate financial performance measured by ROA and ROE.	Busch and Hoffmann (2011)

3. The structure of eco-innovation among publicly traded companies in Poland and Hungary

The study derived its empirical material from an investigation of all companies listed on the Warsaw Stock Exchange (WSE) and the Budapest Stock Exchange (BSE), which stocks remained continually quoted between 1 January, 2006 and 31 December, 2013. The sample included 439 firms – 426 from the Polish and 13 from the Hungarian capital market – that were evaluated between 2006 and 2013. Although BSE firms constituted just 3% of the total amount of firms examined, they were the biggest and most important companies in the Hungarian economy – their share in the market capitalization of the whole sample was almost four times higher and accounted for approximately 11%. The primary financial data source was the Infinancials Database, which provides detailed balance sheets, income statements and cash flow statements for the above mentioned firms. All environmental innovation data have been retrieved from firms' websites (we applied the technique of their content analysis), CSR reports and winning contributions of several national environmental innovation and green leadership competitions. The websites of the companies have been accessed separately by the authors in regular six-month intervals to obtain updated information on eco-innovativeness. The authors assessed possible eco-innovative activities individually and afterwards met for a final check of their choices' reliability. They agreed in almost 93% of the cases. If the information obtained was not easily interpretable, a panel of three additional peer experts from the world of academia was consulted. Internet presence has currently become one of the most important and widely used methods of communication using information technology, particularly for publicly listed companies which exhibit higher social and reputational scrutiny. When information on environmentally oriented innovations was not available online, we assumed that a selected company had not introduced such innovations.

The applied typology of eco-innovation is fully in line with the Oslo Manual (OECD and Eurostat, 2005), which distinguishes three different dimensions of eco-innovation: eco-product, eco-process and eco-organizational (Demirel and Kesidou, 2011; Triguero et al., 2013). We extend the three dimensional perspective to capture eco-innovations within the whole value chain and the creation of entirely new knowledge and to facilitate the diffusion of existing knowledge (Rogers, 1998). Ecological innovations were analysed according to four categories: new product, new way of organising the business, new market and new sources of supply. This typology enables greater depth in characterizing pro-activeness in environmental-oriented, innovative behaviour.

The category of new product includes bringing a new, environmentally friendly product to market. This category is characterized by higher energy efficiency, longer durability and easier recycling ability. Another innovation in this category is making existing products more eco-friendly, e.g., the replacement of environmentally harmful packaging or adding new environmental functions to products such as an “eco-time” button in a washing machine.

Eco-innovations in the category of new way of organising the business are aimed at increasing eco-efficiency in existing operations by introducing technological and non-technological changes. Typical technological innovations in this category include replacement of old equipment to save energy or limit waste output. Non-technological innovations are organisational or institutional in nature, keeping existing equipment intact. They include preparation of environmental reports, implementation of environmental management systems (EMSs), establishment of separate environmental divisions to monitor and improve overall environmental performance, green building or establishment of inter-sector or multi-stakeholder collaborative environmental networks.

New markets involve identifying new types of consumers with green expectations and meeting their demands. They also provide an opportunity for a corporation to differentiate itself. This can be achieved within an existing market or through development of an entirely new market. Another innovation in this category is the creation of novel conditions of doing business as a result of the pro-ecological transformation of the legal environment, which forces the corporate sector to enter a new area of the market it had not previously entered, regardless of whether this market existed before.

New sources of supply are connected with the environmental screening of contractors to extract or replace components of the value chain that are characterized by a high ecological burden. These innovations require active involvement of suppliers to meet or even exceed the environmental expectations of companies' stakeholders. They are usually connected with green certification of procurement, long-term agreements with non-governmental organisations and supplier environmental performance evaluations.

Distribution of eco-innovation activities among publicly traded companies in Poland and Hungary is presented in Table 3.

The category of new way of organising the business dominated the structure of eco-innovation activities among the leading publicly traded companies in Poland and Hungary. Such activities were implemented by 89 of the 439 analysed firms. Most of the process and organisational eco-innovations were non-technological, keeping equipment intact.

The second most popular category of eco-innovation was product innovation, which was introduced by 11.6% of analysed companies. This category was dominated by improvements to existing products rather than creation of completely new designs.

About 10.3% of publicly traded companies in Poland and Hungary implemented eco-innovation by entering new markets. This type of innovation was strongly connected with growing ecological awareness of the consumer, pro-environmental transformation of the international and national legal environment and changes in the expectations of strategic pressure groups.

The least popular category of eco-innovation was new sources of supply. This was implemented by only 28 of the 439 firms under consideration. This category involved mainly supplier environmental performance evaluation and extraction or replacement of those contractors whose components for production processes were considered too harmful to the natural environment.

The distribution of data on eco-innovation, introduced by 94 of all analysed companies, indicated that industries with quite obvious and significant environmental burden and generally higher levels of resource consumption (i.e., industrials, materials and energy) were more likely to innovate, without taking various possible levels of its adoption into consideration. Industries with lower levels of pollution and a lower environmental impact (i.e., telecommunication services, health care and financials) were much less represented. Table 4 summarizes these results.

Table 3
Distribution of eco-innovation activities among publicly traded companies in Poland and Hungary.

	Number of eco-innovations	Number of companies
New product	89 (28.0%)	51 (11.6%)
New process and new way of organizing the business	131 (41.2%)	89 (20.3%)
New market	70 (22.0%)	45 (10.3%)
New sources of supply	28 (8.8%)	28 (6.4%)
Total	318 (100%)	439 (100%)

Table 4
Distribution of publicly traded companies in Poland and Hungary that introduced eco-innovation by Global Industry Classification Standard (GICS) sectors ($n = 94$).

GICS sector	All companies	Percentage of all companies	94 sampled companies	Percentage of sample
Consumer discretionary	111	25.3%	14	14.7%
Consumer staples	36	8.2%	3	2.7%
Energy	15	3.4%	11	12.0%
Financials	77	17.5%	4	4.0%
Health care	15	3.4%	3	2.7%
Industrials	104	23.7%	41	44.0%
Information technology	54	12.3%	9	9.3%
Materials	17	3.9%	9	9.3%
Telecommunications services	5	1.1%	0	0.0%
Utilities	5	1.1%	1	1.3%

More than 94.7% of all eco-innovations in the categories of new product, new market and new sources of supply occurred in companies managing environmental health and safety risks and legal requirements using an environmental management system, usually ISO 14001 or EU Eco-Management and Audit Scheme (EMAS). These firms not only comply with applicable laws, regulations and other environmentally oriented requirements and minimize the negative effects of their operations on the environment (i.e., cause adverse changes to air, water or land), but they also continually improve in the above areas. This makes implementation of internationally accepted standards for environmental management systems (EMSs), such as ISO 14001 and EMAS, an important catalyst of eco-innovation in the corporate world. Such standards provide companies with general guidelines for EMS and help to avoid "reinventing the wheel" by developing a company-specific system. This approach is also perceived as the "gold standard" by analysts, non-governmental organisations (NGOs) and stakeholders. ISO 14001 complements other ISO standards (i.e., ISO 9000 quality standard) and has been employed by many multinational corporations (MNCs), including Toyota, Sony and Hewlett–Packard, to drive EMS into their supply chains.

Only 26 firms in the sample combined all categories of eco-innovation – new product, production processes, way of organising the business, market and sources of supply – in their operating activities. They were able to include ecological aspects in their main competencies, perceiving environmental factors as a matter of core business strategy. This means broadening planning, organisation, leadership and member performance control processes to minimize the ecological burden. This poor result suggests that the achievement of the highly ambitious environmental targets over the next eight years set up by Polish and Hungarian governments will probably not materialize.

The majority of sampled eco-innovation concepts among publicly traded companies in Poland and Hungary addresses incremental innovation. They were mostly connected with new ways of organising the business, new production processes and changes in existing products. National governments must find effective ways to stimulate radical eco-innovation among companies. This can be accomplished only through more diverse activities that combine product, process and social aspects of the system. Negotiated rule making, multiple stakeholder partnerships, positive agency relationships, best practices sharing schemes and effective environmental law enforcement are critical. Only then will companies see environmental regulation as an opportunity to differentiate themselves in the market and develop new products or services that comply with regulations and help to gain a competitive advantage. Legal requirements will become an increasingly significant source of risk that should be closely monitored and planned.

Radical eco-innovation in the corporate sector is most likely to succeed in realising macro-sustainable development goals. Gradual improvements in the area of production process, organisational structure and existing products are important starting points in the above journey. However, without proper incentives from national governments for technology innovation and environmental efficiency, fairness to sectors disproportionately affected by established law and rewards for early action exceeding imposed requirements, they will not lead to necessary radical changes.

All of the data on eco-innovative activities presented above are based on qualitative analyses of firms' web sites and contributions of several national environmental innovation competitions, which may present some threat to its validity and reliability. Thus, the results obtained may not be easily replicable.

4. Theoretical framework and development of hypotheses

In this paper, corporate financial performance is measured by the ROA, calculated by dividing companies' annual earnings before interest and taxes by total assets; ROE, defined as net income divided by shareholders' equity and ERR calculated by adding net income to (or subtracting any net losses from) beginning retained earnings and subtracting any dividends paid to shareholders and dividing the result by net income. All three selected metrics are common measures of business value creation at the end of the chain, enabling to judge potential environmental performance results not only at the initiative level, but also over longer time horizon (Peloza, 2009). This is very important for better understanding of causality in the relationships between eco-innovation and financial performance. Furthermore, ROA, ROE and ERR are also important metrics of managers' performance evaluation, reflecting the overall financial health of the firm.

Although traditional accounting measures of performance have long been criticized for their inadequacy in guiding strategic decisions, they are widely used in academic literature for analysing the impact of companies' environmental activities on its financial performance (King and Lenox, 2002; Watson et al., 2004; Wagner, 2005). While alternative measures of business performance such as economic or market value added have been attracting much attention during the last years (Semenova and Hassel, 2008; Fernando et al., 2010; Largani et al., 2012), anecdotal evidence suggests that accounting information has a potentially more important role to play – e.g., the case of Enron underscores the possible pitfalls of relying exclusively on market information (Das et al., 2009). Furthermore, accounting-based approaches such as return on assets and return on equity were also very widely used in the existing literature (Peloza, 2009).

As mentioned in the previous section, the relationship between eco-innovation and company profitability is a hot topic in the literature. According to the theoretical approach, firms that actively deal in eco-innovation should benefit through a greater likelihood of improved innovative and financial performance over time due to better usage of inputs and improved product yields (Hart, 1995; Porter and van der Linde, 1995; Trung and Kumar, 2005). When the concept of eco-innovation is tightly integrated into a core business strategy and decision-making process, both tangible and intangible targets become more easily achievable. Reinhardt (1998) argued that green strategies enhance firms' competitive advantage by attracting environmentally aware consumers. Kanter (2011) suggested that environmentally friendly corporations can guide strategies and actions, open new sources of innovation, help employees express corporate and personal values and build enduring success. A better use of resources, attraction of new consumers and diminished staff turnover should result in higher assets and a

greater ability to generate profits. This leads us to our first hypothesis:

Hypothesis 1. *Eco-innovative companies are characterized by different returns on assets than other companies.*

According to some theoretical models of ethical investing (Heinkel et al., 2001; Mackey et al., 2007), there are two types of investors in financial markets: traditional investors and socially responsible investors. The former consider only financial criteria in their investment decisions, whereas socially responsible investors consider also nonfinancial criteria. According to the model, there is an excess demand for socially responsible stocks which results in their overvaluation. This leads to higher risk and expected return because investors require additional premiums as compensation for the lack of risk-sharing opportunities.

According to Hart and Dowell (2011) and their natural resource-based view (NRBV), there are three key strategic capabilities of eco-innovators: *pollution prevention, product stewardship and sustainable development*. The first seeks to prevent waste and emissions rather than cleaning them up "at the end of the pipe" and is associated with lower costs. The second capability includes the engagement of environmentally concerned stakeholders in the entire value chain or "life cycle" of the firm's product systems. This creates the potential for competitive advantage through strategic preemption or by establishing advantageous standards. Finally, a sustainable development strategy means production processes that can be maintained indefinitely into the future. This third capability involves not only ecological but also economic and social concerns. According to NRBV, the appropriate use of the above listed capabilities should result in better financial performance through cost reduction, higher competitive advantage and profit increase. That may lead to excess returns on equity, especially when superior ability to manage environmental problems is difficult to imitate to others in the industry, not substitutable, rare, and valuable (Wernerfelt, 1984). As a result, an environmentally oriented company should generate higher profits with the money shareholders have invested. This leads us to our second hypothesis:

Hypothesis 2. *Eco-innovative companies are characterized by different returns on equity than other companies.*

Earnings management is a widespread topic in the academic literature. Some researchers believe that good or bad corporate governance as well as information asymmetry considering environmental uncertainty should affect earnings and earnings management (Cornett et al., 2009; Cormier et al., 2013). For others, innovative companies realise cost savings, improve product quality and have a more predictable earnings stream (Carnes et al., 2003). Earnings management is strictly connected with dividends policy. According to some theoretical models, dividends policy is inconsistent with wealth maximization of the shareholder and can be viewed as the socioeconomic repercussions of corporate evolution (Frankfurter and Lane, 1992). As a company's eco-innovative activity may influence its earnings management and dividend payouts, our third hypothesis has been formulated as follows:

Hypothesis 3. *Eco-innovative companies are characterized by a different earnings retention ratio than other companies.*

5. Test methods and control variables

Company financial risk exposure (leverage) can affect firms' environmentally oriented behaviour. Management's risk tolerance influences such activities as investment in new environmental friendly technologies, waste reduction efforts and greening supply chain. Strong financial capacity can be regarded as one of the necessary conditions for firms to be able to devote more resources to active engagement in environmental and social issues. The size of the company is also likely to be an important factor of intensity of eco-innovative behaviour. Larger firms attract more media attention, and because of the scale of their activities, they usually create proportionally larger environmental and social problems. Industry affiliation also matters – some industries have much more significant environmental footprints than others. Thus, "dirtier" industries will have generally stronger motivation to integrate environmental issues into their management strategies, especially that some of them face legislation pressure in the above area (i.e. chemical, automotive, energy). Finally, annual fixed effects have also been controlled, as engagement in eco-innovative activities may also be connected to certain economic periods. By examining the above mentioned variables at the same time, we offer a more holistic view of eco-innovation and its possible influence on financial performance that previous studies failed to achieve. In addition, our analysis of eco-innovators' characteristics provides valuable guidelines for developing crucial determinants of eco-innovation itself.

Comparisons of the financial performance of eco-innovative and conventional firms are conducted using *t*-test and Wilcoxon-signed ranks test. The main hypotheses are then tested by estimating the model specified in equation (1), which is constructed on the basis of work by Artiach et al. (2010) on the factors of corporate sustainability performance.

$$\begin{aligned}\mathrm{ECOINNOV}_{it} = {} & \alpha + \beta \mathrm{ROA}_{it} + \gamma \mathrm{ROE}_{it} + \theta \mathrm{ERR}_{it} + \mu \mathrm{LVR}_{it} \\ & + \rho \mathrm{FINCAP}_{it} + \sigma \ln \mathrm{TA}_{it} + \sum\nolimits_{r=1}^{10} \varphi \mathrm{IND} \\ & + \sum\nolimits_{t=1}^{8} \omega \mathrm{YEAR} + \varepsilon_{it} \end{aligned} \quad (1)$$

where $\mathrm{ECOINNOV}_{it}$ is a dummy variable representing eco-innovative activities of a given company, with 1 if firm i introduced at least one eco-innovation in a year t and 0 if not; ROA_{it} is return on assets for firm i in year t, measured as EBIT divided by total assets; ROE_{it} is return on equity for firm i in year t, measured as net income divided by common equity; ERR_{it} is earnings retention ratio for firm i in year t, measured as net income minus ordinary dividends divided by net income; LVR_{it} is financial leverage for firm i in year t, measured as total debt divided by total assets; FINCAP_{it} is financial capacity for firm i in year t, measured as free cash flow divided by net sales; $\ln \mathrm{TA}_{it}$ is size of firm i in year t, measured as natural logarithm of total assets; IND is a dummy variable representing given firm industry affiliation by GICS classification; and YEAR is a dummy variable representing given year of analysis.

We based our analysis of the relationships between eco-innovation and financial performance on the data from the same year. We did it in order to capture immediate effects of introducing environmentally oriented innovations and use the advantage of relying solely on accounting-based, end of the chain measurers of financial performance. Additional sensitivity analyses for lagged eco-innovativeness and financial performance have been also conducted in order to address the general issue of casualty, and judge possible eco-innovative performance effects and causes over longer time horizon. Above approach is widely used in the existing body of literature presented in Section 2.

6. Results: environmental innovation and financial performance

This section examines the effects of implementation of eco-innovation on financial performance. The experimental group

Table 5
Summary statistics for eco-innovators and conventional firms.

Variable	Mean	Median	SD	Min	Max	Skewness	Kurthosis
Eco-innovators (n = 632)							
ROA	0.0501	0.0472	0.0605	−0.3227	0.2923	0.0022	4.9275
ROE	0.1117	0.1089	0.1601	−0.5868	1.6066	2.6035	26.7843
IRR	0.8997	1.0000	0.2089	0.0000	1.0000	−2.1820	4.1379
LVR	1.2874	0.9813	1.0831	0.1307	10.4753	3.2260	17.2086
FINCAP	0.0183	0.1430	0.0856	−0.3387	0.3275	−0.2326	2.0217
ln TA	13.7790	13.4423	2.0327	8.9181	18.8814	0.6391	0.0198
Conventional companies (n = 2648)							
ROA	0.0233	0.0312	0.1152	−0.8079	0.4511	−1.7337	8.4954
ROE	0.0487	0.0726	0.3499	−5.9292	3.1653	−5.5705	81.5834
IRR	0.9241	1.0000	0.2205	−0.0301	2.1055	−2.7853	8.5954
LVR	1.4710	0.8618	2.2267	0.0000	31.2520	5.6565	48.7603
FINCAP	0.0088	0.1480	0.1345	−0.4940	1.4650	1.2869	11.0025
ln TA	12.0201	11.8171	2.0961	3.5264	19.1100	0.4526	1.1637

consisted of the 79 companies from the WIG and BUX that introduced at least one category of environmental innovation (out of 94 presented in Tables 3 and 4) and 331 firms that did not introduce any environmental innovation (out of 345 presented in Tables 3 and 4) for which eight years of financial data (2006 through 2013) were available. They first group is called eco-innovators and the second is referred to conventional companies.

If environmental innovation affects a firm's financial performance, then its implementation should lead to different ROA (Hypothesis 1), ROE (Hypothesis 2) and earnings retention ratio (ERR) (Hypothesis 3) for eco-innovators versus the matched control group (companies that did not implement any environmental innovation).

Table 5 presents a summary of descriptive statistics for our samples of eco-innovators-year and conventional firm-year observations listed in the WIG and BUX indexes. Analysed financial characteristics are particularly dispersed and skewed for the second group, however both display quite considerable intensity in the above matter. That is why, as an alternative to the parametric *t*-statistics test, the Wilcoxon signed rank test has also been used. The approach referenced above enabled us to further analyse the significance of the differences in means between our samples after allowing the existence of extreme observations in the distribution of the descriptive statistics. Table 6 presents the results for both procedures.

The *t*-test indicate that companies that introduced environmental innovation are significantly more profitable (higher ROA and ROE), retain more income to grow (lower ERR), face lower financial risk exposure (lower LVR), possess more cash resources (higher FINCAP) and are generally much larger (higher ln TA) than conventional firms. The Wilcoxon test produced similar results, with firms achieving high pro-activeness in environmental-oriented behaviour characterized by higher effectiveness in employment of capital and its retention, relying less heavily on debt in their capital structure, having stronger autonomy in financing their growth and bigger size. The above results provide initial support for all our hypotheses.

Before estimating the parameters of Eq. (1), to limit the threat of multicollinearity between independent variables, regression tests were run. Table 7 presents the Pearson Correlation Coefficients. The independent regressors have no pairwise correlation coefficients in excess of 68.3%, indicating limited threat of multicollinearity. Next, we estimated our model with the results summarized in Table 8.

The results of Eq. (1) parameters estimation (Table 8) indicate that the coefficient for return on assets is positive and significant. This finding provides further support for our initial finding for Hypothesis 1, indicating that eco-innovative activities and ROA are positively related. Companies that implemented environmental innovation in their day-to-day operations were characterized by higher efficiency of assets in producing income than their conventional counterparts. In contrast to our *t*-test finding that above activities are also connected with higher return on equity (Hypothesis 2), regression analyses did not support this observation after controlling for additional firm characteristics, as well as industry and temporal effects. The significant result for ROA but not ROE suggests that returns available to all of the financial stakeholders of eco-innovative firm (before considering capital structure and tax claimants) are more pronounced than to other social stakeholders. However, both groups still experience positive gains in that area. Finally, the model indicates strong support for our initial finding on the negative relation between eco-innovative activities and ERR (Hypothesis 3). What follows is that companies that introduced environmental innovation paid lower dividends to their shareholders and retained more income to finance growth. This result also shows that implementation of environmentally oriented activities introduces additional expenses for owners.

Overall, obtained results suggest that facilities that introduced environmental innovation in their day-to-day operations are more likely to report better financial performance than those characterized by no such activities. The above results were the same for

Table 6
Differences in mean values for eco-innovators and conventional firms.

Variable	Mean difference	Median difference	*t*-Test		Wilcoxon signed ranks test	
			t-Stat	*p*-Value	*z*-Stat	*p*-Value
ROA	0.0267532	0.0159531	7.449763	<0.001	3.8584639	<0.001
ROE	0.0629733	0.0363205	6.2315874	<0.001	3.458457	<0.001
ERR	−0.024423	0	−2.385244	0.01	−7.061619	<0.001
LVR	−0.183644	0.1194871	−3.527321	<0.001	−15.92817	<0.001
FINCAP	0.0095053	−0.005046	1.8772401	0.04	14.834528	<0.001
ln TA	1.7588458	1.6251554	17.878808	<0.001	13.491703	<0.001

Table 7
Correlation matrix.

Variable	ROA	ROE	ERR	LVR	FINCAP	ln TA
ROA	1					
ROE	**0.554416**	1				
ERR	0.00716	−0.00315	1			
LVR	**−0.09032**	**−0.08876**	**0.226101**	1		
FINCAP	**0.144977**	**0.062668**	**−0.03557**	**0.016227**	1	
ln TA	**0.124302**	**0.096916**	**0.682399**	**0.228736**	**0.067327**	1

Significance at $p \leq 0.05$ is highlighted.

Polish and Hungarian companies. These findings also indicate that firms and their shareholders generally benefit from investing in environmental innovation.

To ensure that the results reported above are robust across different model specifications, a number of additional sensitivity analyses were undertaken. First, to test if there is also a positive correlation between prior eco-innovativeness and subsequent financial performance, Eq. (1) parameters have been re-estimated using financial explanatory variables accelerated by one year. Table 9 presents results of the regression analysis in the above area. It provides support for the positive relationship between prior implementation of eco-innovations and subsequent financial performance – especially in the case of ROA, for which the correlation is statistically significant. Furthermore, the analysis indicates strong support for the negative relation between prior eco-innovative activities and subsequent ERR. Thus, companies that introduced environmental innovation paid lower dividends to their shareholders not only in the year of its introduction but also in the following year. Then, to address the question of whether prior high financial performance allows a firm to engage in higher intensity of future eco-innovative activities, Eq. (1) parameters have been re-estimated using financial explanatory variables delayed by one year. Results presented in Table 10 suggest that significant associations between implementation of environmental innovation and reported return on assets and return on equity ratios are not artefacts of previous high performance and active engagement in environmental and social issues is more closely associated with subsequent financial performance. There was only one exception, prior earnings retention ratio was a better predictor of integration of environmental issues into business strategy than the subsequent one.

The analysis has also been extended to examine whether obtained results are impacted by the intensity of eco-innovative activities – number of eco-innovations implemented in a given year by a given company. Although the amount of financial resources devoted to eco-innovation is a more widely used proxy in the above area, it must not automatically result in any real organizational changes or the development of a new product or service. The number of implemented innovations should therefore be more reliable measure of eco-innovativeness intensity and interactive aspects related to it (Parthasarthy and Hammond, 2002; Freel, 2003). If there is a definitive relation between implementation of environmental innovation and ROA, ROE and ERR, then it would have been expected that this relation would continue when employing an ordered environmentally oriented behaviour analysis. Hence, Eq. (1) has been re-examined with an ordering of $ECOINNOV_{it}$ variable, whereby 2 was given to a firm which introduced more than one eco-innovation in a year t, 1 to a firm which introduced one eco-innovation and 0 if it does not introduce any, respectively. The results of this analysis, after controlling for possible industry and year fixed effects, were generally consistent with those obtained for our original model without taking intensity of environmentally oriented innovative activities into account. Companies that introduced environmental innovation were still significantly more profitable, retained more income to grow, faced lower financial risk exposure, possessed more cash resources and were generally much larger than conventional firms.

Table 9
Eco-innovation model with lag eco-innovation effects.

Variable	Intercept	*t*-Stat	*p*-Value
ROA_{t+1}	**0.15748**	1.978234	<0.05
ROE_{t+1}	0.01985	0.777955	0.43666
ERR_{t+1}	**−0.14317**	−6.09693	<0.001
LVR_{t+1}	−0.00682	−1.95794	0.05033
$FINCAP_{t+1}$	−0.01896	−0.29869	0.76521
ln TA_{t+1}	**0.02132**	11.24078	<0.001
R^2	0.07109		

Significance at $p \leq 0.05$ is highlighted.

7. Discussion

Measurement of eco-innovation among leading corporations is of particular importance. Such measurement would help policy makers and industries grasp positive trends and current thinking on eco-innovation, provide insights on how such innovation can be stimulated, raise awareness of eco-innovation among stakeholders and make improvements achieved through eco-innovation more evident. There is a concomitant need to understand what drives companies' eco-innovation and what specifically characterizes these activities.

Eco-innovative activities were analysed from the perspective of the 'target' for innovation. The category of new way of organising the business dominated the structure of eco-innovation activities. It was implemented by 20.3% of analysed firms. The second most popular category of eco-innovation was product innovation. The least popular category was new sources of supply. New sources of supply was introduced by only 6.4% of the companies in the sample. Only 26 firms combined all categories of eco-innovation in their operating activities.

Most of the sampled eco-innovation concepts among publicly traded companies in Poland and Hungary address incremental innovation. The presence of an environmental management system

Table 8
Eco-innovation model parameters.

Variable	Intercept	*t*-Stat	*p*-Value
ROA	**0.178258**	2.601303	<0.001
ROE	0.019116	0.753775	0.451035
ERR	**−0.15522**	−7.16071	<0.001
LVR	**−0.0072**	−2.14983	0.031637
FINCAP	−0.00674	−0.11097	0.911649
ln TA	**0.020442**	11.53171	<0.001
R^2	0.116583943		

Significance at $p \leq 0.05$ is highlighted.

Table 10
Eco-innovation model with lag financial performance effects.

Variable	Intercept	*t*-Stat	*p*-Value
ROA_{t-1}	0.11092	1.423755	0.154619
ROE_{t-1}	0.01439	0.566984	0.570767
ERR_{t-1}	**−0.17236**	−7.16729	<0.001
LVR_{t-1}	−0.00659	−1.89007	0.058843
$FINCAP_{t-1}$	−0.01041	−0.16579	0.868332
ln TA_{t-1}	**0.019133**	10.61195	<0.001
R^2	0.0647839		

Significance at $p \leq 0.05$ is highlighted.

seems to play a fundamental role – almost 95% of all eco-innovations in the categories of new product, new market and new sources of supply occurred in companies managing environmental health and safety risks and legal requirements using ISO 14001 or EMAS. Sector-specific effects in the above area are also worth mentioning – industries with generally higher levels of resource consumption or ecological burden were more likely to innovate. This finding is in line with previous studies in the field of eco-innovation (Busch and Hoffmann, 2011).

This paper also examined the effects of implementation of eco-innovation on financial performance. Statistical analysis indicated that eco-innovators were characterized by higher average ROA (Hypothesis 1) and ROE (Hypothesis 2) and lower ERR (Hypothesis 3) in the years 2006–2013 than were conventional firms. However, when it comes to return on equity, the above finding was not supported after controlling for additional firm characteristics, as well as industry and temporal effects. In line with previous studies in the field of corporate environmental performance (Semenova and Hassel, 2008; Hart and Ahuja, 1996), the significant result for ROA (but not ROE) suggests that returns available to all of the financial stakeholders of eco-innovative firm (before considering capital structure and tax claimants) are more pronounced than those to other social stakeholders. Nonetheless, both groups still experience positive gains in that area. Obtained results were robust for lag eco-innovation, performance effects and intensity of eco-innovative activities in terms of the number of implemented eco-innovations.

Our results also suggest that larger companies exhibit more eco-innovative behaviour than smaller firms. Larger companies possess more free cash resources and are likely to face lower financial risk exposure. This results in their general greater ability to invest in environmentally oriented activities. Thus, it seems that companies are eco-innovative because they are more powerful (larger and assign lower importance to possible financial constraints) and generally better placed to achieve economies of scale from above actions. Previous studies also indicate that bigger size is a relevant pre-condition for developing proactive management of environmental and social issues (Aragón-Correa et al., 2008; Waddock and Graves, 1997).

8. Conclusions

This study contributes to the literature regarding the link between eco-innovation and financial performance for companies in emerging, post-socialist economies, an area relatively unaddressed in the existing research, and adds to the discussion about the possible effects of eco-innovative activities. The results, which indicate that eco-innovative firms are generally characterized by better financial performance, may be useful to investors and other stakeholders in their deliberations on ways to achieve additional returns by holding well diversified portfolios. Furthermore, the results have some implications for the management of firms, as well as environmental policy in post-socialist countries. First, reorientation of business strategy towards environmental responsibility is connected with both immediate and lag positive financial effects. Second, the implementation of an environmental management system is one of the most important accelerators of eco-innovation. Finally, because smaller firms tend to be less eco-innovative, there is a pressing need for environmental policy to create clear incentives for these firms to increase activities in that area. This should result in higher general eco-innovation intensity and its reorientation towards more radical changes. These results are especially pronounced for industries characterized by lower ecological burden. Moreover, Polish and Hungarian governments can promote certification for EMS, such as EMAS or ISO14001.

Our sample was restricted to publicly traded Polish and Hungarian firms. Therefore, future research is necessary to understand the extent to which these results and conclusions generalize to other markets, particularly developed ones. In addition, only a select group of eco-innovation activity aspects has been analysed. It is possible that obtained results are affected by some unobservable or overlooked company characteristics. Hence, future research is needed for understanding better what additional special firm characteristics may influence its eco-innovativeness. For instance, because eco-innovative companies tend to be larger, it would be interesting to examine if exporter status could be a determinant in the above area. Such an analysis would illuminate how conformity to international standards and the demands of global clients influence corporate eco-innovative activities. Additional qualitative analysis providing more in depth break down of companies by sectors or focused on specific cases should also be undertaken. Finally, the motivation of different types of eco-innovation in terms of environmental policy sensitivity (i.e., nature of existing regulations, its current burden, access to public financial incentives) should also be more deeply explored.

The method employed in this study has several limitations. First, because this research paper relies heavily on self-reported web disclosures of eco-innovative activities by the firms, there is a risk of their over- or understatement. Use of more direct objective measurements in the above area could add validity to the analysis presented. Second, this study focused only on four types of eco-innovation. It is necessary to include other types of innovation (i.e., marketing, technological) in the future studies. Third, financial performance was measured by subjective indicators driven by the accounting practices of firms. The true effects of eco-innovativeness on performance can be evaluated more efficiently by the usage of wider spectrum of data (i.e., market-based measures of performance) and different moderating effects (i.e., exporter status, market position, management's attitudes and behaviour). Finally, the findings may be peculiar to Polish and Hungarian firms and may be affected by the time frame of analysis (global financial crisis and its aftermath).

References

Aragón-Correa, J., Hurtado-Torres, N., Sharma, S., García-Morales, V.J., 2008. Environmental strategy and performance in small firms: a resource-based perspective. J. Environ. Manag. 86, 88–103.

Artiach, T., Lee, D., Nelson, D., Walker, J., 2010. The determinants of corporate sustainability performance. Acc. Finan. 50, 31–51.

Ambec, S., Lanoie, P., 2008. Does it pay to be green? A systematic overview. Acad. Manag. Perspect. 22 (4), 45–62.

Andersen, B., 2001. Technological Change and the Evolution of Corporate Innovation: the Structure of Patenting 1890-1990. Edward Elgar, Northampton, MA.

Andersen, M.M., 2010. On the Faces and Phases of Eco-innovation - on the Dynamics of the Greening of the Economy. Imperial College London Business School, London.

Boons, F., Wagner, M., 2009. Assessing the relationship between economic and ecological performance: distinguishing system levels and the role of innovation. Ecol. Econ. 68 (7), 1908–1914.

Busch, T., Hoffmann, V.H., 2011. How hot is your bottom line? Linking carbon and financial performance. Bus. Soc. 50 (2), 233–265.

Cai, W., Zhou, X., 2014. On the drivers of eco-innovation: empirical evidence from China. J. Clean. Prod. 79, 239–248.

Camison-Zornoza, C., Lapiedra-Alcami, R., Segarra-Cipres, M., Boronat-Navarro, M., 2004. A meta-analysis of innovation and organizational size. Organ. Stud. 25 (3), 331–361.

Carnes, T.A., Jones, J.P., Biggart, T.B., Barker, K.J., 2003. Just-in-time inventory systems innovation and the predictability of earnings. Int. J. Forecast 19 (4), 743–749.

Carraro, C., 2000. Environmental technological innovation and diffusion: model analysis. In: Hemmelskamp, J., Leone, F., Rennings, K. (Eds.), Innovation-oriented Environmental Regulation: Theoretical Approaches and Empirical Analysis. Physica Heidelberg, New York, pp. 269–297.

Cheng, C.C.,J., Yang, C., Sheu, C., 2014. The link between eco-innovation and business performance: a Taiwanese industry context. J. Clean. Prod. 64 (1), 81–90.

Chouinard, Y., Ellison, J., Ridgeway, R., 2011. The sustainable economy. Harv. Bus. Rev. 10, 52–62.
Cormier, D., Houle, S., Ledoux, M., 2013. The incidence of earnings management on information asymmetry in an uncertain environment: some Canadian evidence. J. Int. Acc. Audit. Tax. 22 (1), 26–38.
Cornett, M.M., McNutt, J.J., Tehranian, H., 2009. Corporate governance and earnings management at large U.S. bank holding companies. J. Corp. Finan. 15 (4), 412–430.
Cuerva, M.C., Triguero-Cano, A., Córcoles, D., 2014. Drivers of green and non-green innovation: empirical evidence in Low-Tech SMEs. J. Clean. Prod. 68 (4), 104–113.
Das, S.R., Hanouna, P., Sarin, A., 2009. Accounting – based versus market – based cross – sectional models of CDS spread. J. Bank. Financ. 33 (4), 719–730.
Demirel, P., Kesidou, E., 2011. Stimulating different types of eco-innovation in the UK: government policies and firm motivations. Ecol. Econ. 70, 1546–1557.
EBRD, 2013. Transition Report 2013. Stuck in Transition? European Bank of Reconstruction and Development, London.
Esty, D., Winston, A., 2006. Green to Gold: How Smart Companies Use Environmental Strategy to Innovate, Create Value, and Build Competitive Advantage. Yale University Press, New Haven and London.
Ekins, P., 2010. Eco-innovation for environmental sustainability: concepts, progress and policies. Int. Econ. Econ. Policy 7, 267–290.
Etzion, D., 2007. Research on organizations and the natural environment, 1992-present: a review. J. Manag. 33 (4), 637–664.
Fernando, C., Sharfman, M., Uysal, V., 2010. Does Greenness Matter? The Effect of Corporate Environmental Performance on Ownership Structure, Analyst Coverage and Firm Value. University of Oklahoma working paper. http://www.fma.org/NY/Papers/Environmental_Performance_OU_FMA.pdf (accessed 20.03.14.).
Fisher-Vanden, K., Thorburn, K., 2008. Voluntary Corporate Environmental Initiatives and Shareholder Wealth. CEPR Discussion Paper, No. DP6698. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1141020 (accessed 18.03.14.).
Frank, M., Goyal, V., 2009. Capital structure decisions: which factors are reliably important? Financ. Manag. 38 (1), 1–37.
Frankfurter, G.M., Lane, W.R., 1992. The rationality of dividends. Int. Rev. Finan. Anal. 1, 115–129.
Freel, M.S., 2003. Sectoral patterns of small firm innovation, networking, and proximity. Res. Policy 32, 751–770.
Freeman, C., 1996. Green technology and models of innovation. Technol. Forecast. Soc. Change 53, 27–39.
Frondel, M., Horbach, J., Rennings, K., 2004. What Triggers Environmental Management and Innovation? Empirical Evidence for Germany. RWI: Discussion Papers No. 15. http://papers.ssrn.com/soL3/papers.cfm?abstract_id=556945 (accessed 15.03.14.).
Gassmann, O., von Zedtwitz, M., 2003. Trends and determinants of managing virtual R&D teams. R&D Manag. 33 (3), 243–262.
Ghisetti, C., Rennings, K., 2014. Environmental innovations and profitability: how does it pay to be green? An empirical analysis on the German innovation survey. J. Clean. Prod. 75, 106–117.
Gibson, C.B., Randel, A.E., Early, P.C., 2000. Understanding group efficacy: an empirical test of multiple assessment methods. Group Organ. Manag. 25 (1), 67–97.
Guoyou, Q., Saixing, Z., Xiaodong, L., Chiming, T., 2012. Role of internalization process in defining the relationship between ISO 14001 certification and corporate environmental performance. Corp. Soc. Responsib. Environ. Manag. 19 (3), 129–140. http://dx.doi.org/10.1002/csr.258.
Hart, S.L., Dowell, G., 2011. A natural-resource-based view of the firm: fifteen years after. J. Manag. 37 (5), 1464–1479.
Harris, M., Raviv, A., 1991. The theory of capital structure. J. Finan. 46 (1), 297–355.
Hart, S.L., 1995. A natural-resource-based-view of the firm. Acad. Manag. Rev. 20, 986–1014.
Hart, S.L., Ahuja, G., 1996. Does it pay to be green? An empirical examination of the relationship between emission reduction and firm performance. Bus. Strategy Environ. 5 (1), 30–37.
Heinkel, R., Kraus, A., Zechner, J., 2001. The effect of green investment on corporate behavior. J. Finan. Quant. Anal. 36, 431–449.
Hellström, T., 2007. Dimensions of environmentally sustainable innovation: the structure of eco-innovation concepts. Sustain. Dev. 15, 148–159.
Heras-Saizarbitoria, I., Molina-Azorín, J., Dick, G.M.P., 2011. ISO 14001 certification and financial performance: selection-effect versus treatment-effect. J. Clean. Prod. 19 (1), 1–12.
Hines, F., Marin, O., 2004. Building innovations for sustainability. Bus. Strategy Environ. 13 (4), 201–208.
Huesemann, M., 2003. The limits of technological solutions to sustainable development. Clean. Technol. Environ. Policy 5, 21–34.
IMF, 2013. World Economic Outlook. Transitions and Tensions. International Monetary Fund, Washington. http://www.imf.org/external/pubs/ft/weo/2013/02/pdf/text.pdf (accessed 27.08.14.).
Jansson, J., 2011. Consumer eco-innovation adoption: assessing attitudinal factors and perceived product characteristics. Bus. Strategy Environ. 20 (3), 192–210.
Kaenzig, J., Wüstenhagen, R., 2010. The effect of life cycle cost information on consumer investment decisions regarding eco-innovation. J. Ind. Ecol. 14, 121–136.
Kanter, R., 2011. How Great companies think differently. Harv. Bus. Rev. 11, 66–76.
Katz-Navon, T.Y., Erez, M., 2005. When collective- and self-efficacy affect team performance: the role of task interdependence. Small Group Res. 36 (4), 437–465.
Kemp, R., Pearson, P., 2007. Final Report of Measuring Ecoinnovation (MEI Project). Bruxelles. http://www.oecd.org/environment/consumption-innovation/43960830.pdf (accessed 11.03.14.).
Kesidou, E., Demirel, P., 2012. On the drivers of eco-innovations: empirical evidence from the UK. Res. Policy 5, 862–870.
King, A., Lenox, M., 2002. Exploring the locus of profitable pollution reduction. Manag. Sci. 48, 289–299.
Kirzner, I.M., 1973. Competition and Entrepreneurship. Chicago University Press, Chicago.
Kemp, R., 2000. Technology and environmental policy - innovation effects of past policies and suggestions for improvement. Paper for OECD Workshop on Innovation and Environment, Paris. http://www.oecd.org/sti/inno/2108491.pdf (accessed 10.03.14.).
Kozlowski, S., 2000. Ekorozwój - Wyzwanie XXI wieku (Sustainable Development – XXI Century Challenge). PWN, Warsaw.
Largani, M.S., Kaviani, M., Abdollahpour, A., 2012. A review of the application of the Shareholder Value (SVA) in financial decisions. Proc. – Soc. Behav. Sci. 40, 490–497.
Laszlo, C., 2003. The Sustainable Company: How to Create Lasting Value through Social and Environmental Performance. Island Press, Washington, DC.
Mackey, A., Mackey, T.B., Barney, J.B., 2007. Corporate social responsibility and firm performance: investor preferences and corporate strategies. Acad. Manag. Rev. 32, 817–835.
Majumdar, S., Marcus, A., 2001. Rules versus discretion: the productivity consequences of flexible regulations. Acad. Manag. J. 44, 170–179.
Mânescu, C., 2011. Stock returns in relation to environmental, social and governance performance: mispricing or compensation for risk? Sustain. Dev. 19, 95–118.
Modigliani, F., Miller, M., 1958. The cost of capital, corporation finance, and the theory of investment. Am. Econ. Rev. 48 (3), 261–297.
Murphy, J., Gouldson, A., 2000. Environmental policy and industrial innovation: integrating environment and economy through ecological modernization. Geoforum 31, 33–44.
Nelson, R., Winter, G., 1982. An Evolutionary Theory of Economic Change. Belknap Press/Harvard University Press, Cambridge (Mass.).
OECD, Eurostat, 2005. Oslo Manual Guidelines for Collecting and Interpreting Innovation Data, third ed. OECD (Organization of Economic Cooperation and Development) and EUROSTAT (European Statistical Office), Paris, Luxemburg.
Orlitzky, M., Schmidt, F.,L., Rynes, S.,L., 2003. Corporate social and financial performance: a meta-analysis. Organ. Stud. 24 (3), 403–441.
Parthasarthy, R., Hammond, J., 2002. Product innovation input and outcome: moderating effects of the innovation process. J. Eng. Technol. Manag. 19 (1), 75–91.
Peloza, J., 2009. The challenge of measuring financial impacts from investments in corporate social performance. J. Manag. 35 (6), 1518–1541.
Porter, M.E., van der Linde, C., 1995. Toward a new conception of the environment-competitiveness relationship. J. Econ. Perspect. 9 (4), 97–118.
Przychodzen, J., Przychodzen, W., 2013. Corporate sustainability and shareholder wealth. J. Environ. Plan. Manag. 56 (4), 474–493.
Pujari, D., Wright, G., Peattie, K., 2003. Green and competitive: influences on environmental new product development performance. J. Bus. Res. 56 (8), 657–671.
Reinhardt, F., 1998. Environmental product differentiation: implications for corporate strategy. Calif. Manag. Rev. 40, 43–73.
Rennings, K., 2000. Redefining innovation – eco-innovation research and the contribution from ecological economics. Ecol. Econ. 32, 319–332.
Rogers, M., 1998. The Definition and Measurement of Innovation. Malbourne Institute of Applied Economic and Social Research. University of Melbourne. Working Paper no. 10798. https://www.melbourneinstitute.com/downloads/working_paper_series/wp1998n10.pdf (accessed 20.03.14.).
Schaltegger, S., Synnestvedt, T., 2002. The link between 'green' and economic success: environmental management as the crucial trigger between environmental and economic performance. J. Environ. Manag. 65, 339–346.
Schumpeter, J.A., 1939. Business Cycles: a Theoretical, Historical and Statistical Analysis of Capitalist Process. McGraw-Hill, New York – London.
Semenova, N., Hassel, L., 2008. Financial outcomes of environmental risk and opportunity for US companies. Sustain. Dev. 16, 195–212.
Simon, H., 1996. Hidden Champions: Lessons from 500 of the World's Best Unknown Companies. Harvard Business School Press, Boston, MA.
Sprinkle, G.,B., Maines, L.A., 2010. The benefits and costs of corporate social responsibility. Bus. Horiz. 53 (5), 445–453.
Technopolis, 2008. Sectoral Innovation Watch in Europe. Eco-Innovation. Final Report. http://www.technopolis-group.com/resources/downloads/661_report_final.pdf (accessed 13.03.14.).
Triguero, A., Moreno-Mondejar, L., Davia, M.A., 2013. Drivers of different types of eco-innovation in European SMEs. Ecol. Econ. 92, 25–33.
Trung, D.S., Kumar, S., 2005. Resource use and waste management in Vietnam hotel industry. J. Clean. Prod. 13, 109–116.
Waddock, S.A., Graves, S.B., 1997. The corporate social performance—financial performance link. Strateg. Manag. J. 18, 303–319.
Wagner, M., 2005. How to reconcile environmental and economic performance to improve corporate sustainability: corporate environmental strategies in the European paper industry. J. Environ. Manag. 76, 105–118.
Watson, K., Klingenberg, B., Polito, T., Geurts, T.G., 2004. Impact of EMS implementation on financial performance. Manag. Environ. Qual. 15, 622–628.

WB, 2014. Statistical Database. World Bank. http://data.worldbank.org/ (accessed 27.08.14.).
WBCSD, 2000. Eco-efficiency. Creating More Value with Less Impact. World Business Council for Sustainable Development. http://www.wbcsd.org/web/publications/eco_efficiency_creating_more_value.pdf (accessed 27.08.14.).
Wernerfelt, B., 1984. A resource-based view of the firm. Strateg. Manag. J. 9, 441–454.
Yin, H., Schmeidler, P., 2009. Why do Standardized ISO 14001 environmental management systems lead to heterogeneous. Environmental outcomes? Bus. Strateg. Environ. 18, 469–486.
Zaho, J., 2008. The effect of the ISO 14001 environmental management system on corporate financial performance. Int. J. Bus. Excell. 1, 210–230.