The Impact of Technological Green New Product Introductions on Firm Profitability

The Impact of Technological Green New Product Introductions on Firm Profitability

1. INTRODUCTION

Accelerating Product Life Cycles (PLC) due to changing customer preferences are putting increasing pressures on firms to introduce new products continuously to maintain market share and sustain corporate growth (Chien, Chen, & Peng, 2010). For example, according to a Forrester report (2015), smartphone owners in OECD countries renew their devices every year on average, as reflected by the annual introductions of a new version of successful smartphones at the World Mobile Congress in Barcelona. Yet, the heat-resistant tantalum powder needed for such smartphone devices – Coltan (columbite–tantalite) – has significantly depleted natural environments such as the Kivu provinces (North and South), near the border of Rwanda, and also greatly intensified the violence there by encouraging multiple groups and nation-states to implicate themselves in conflicts. Product replacement becomes even more severe when built-in obsolescence limits the life cycle of devices: A recent study from Öko-Institut found that built-in obsolescence grew from 3.5% in 2004 to 8.3 % 2012 (Prakash, Dehoust, Gsell, Schleicher, & Stamminger, 2015). Taken together, these frequent New Product Introductions (NPI) harm the environment because they increase the consumption of often finite raw materials for production and create additional challenges for recycling older products (Pujari, 2006). In the case of mineral-based economies, such as Eastern Congo, moreover, it intensifies the violence and conflict in such environments. Harming and destabilizing the environment is not only detrimental to the planet but it can also jeopardize peace in regions as well as undermining the legitimate existence of any firm because it creates

a negative attitude from stakeholders expecting socially responsible behaviors from corporations (Bansal & Clelland, 2004; Bansal & Roth, 2000; Hart, 1995). Consequently, sustaining corporate growth with NPIs and protecting the environment seem to be competing and contradictory goals.

Since firms are naturally interested in pursuing economic goals even at the expense of resource depletion (King & Toffel, 2007), scholars have directed their attention to building a business case that encourages sustainable practices among firms (Pujari, 2006). The underlying argument – 'it pays to be green' – that firms can be *both* green and competitive has been particularly forceful (Hart & Ahuja, 1996; Porter & van der Linde, 1995; Pujari, Wright, & Peattie, 2003). That is, environmental stewardship can help the greening firm gain competitive advantage through higher price premiums, increased market share, and lower the cost of production (Ambec & Lanoie, 2008). Nonetheless, while a number of studies have determined and examined the linkage between environmental performance and firm economic performance, the results are not yet sufficiently robust to claim a positive link, leaving the debate of whether 'it pays to be green' unresolved (Horváthová, 2010; Margolis, Elfenbein, & Walsh, 2007).

In this study, we aim to contribute to that debate by examining the relationship between the introduction of new products based on green technologies and firm profitability. Following previous studies on environmental technologies (Klassen and Whybark, 1999; Shrivastava, 1995), we define "new technological green product" as any new product that builds on technological advances to limit or lower its environmental footprint or that of other products, for instance, through improved energy efficiency or waste management.

Our focus on green technologies is well-supported in the environmental literature. From an organizational point of view, green technologies can help firms lower the impact of

production activities on the environment by preventing pollution and enhancing internal green capabilities (Klassen & Whybark, 1999). From a stakeholder point of view, such as customers, green technologies can improve a product's energy efficiency, material utilization, and recycling (Dangelico & Pujari, 2010). Besides the direct benefits, green technologies also produce numerous spillovers which improve the firm's capabilities and competitive position (Berrone, Fosfuri, Gelabert, & Gomez-Mejia, 2013; Shrivastava, 1995). In this sense, green technologies can play an important role at reconciling a firm's economic goals and the necessity to protect the natural environment.

Our study makes three contributions to the environmental literature. First, to the best of our knowledge, insufficient research attention has been paid to understanding of how green technology upgrades can build both a viable business and environmental case, leading to more profitability for firms. Moreover, our approach differs from previous approaches by examining the environmental activities that are directed toward market actors such as customers and investors (Hawn & Ioannou, 2015). Second, there is limited empirical understanding of whether or not green NPIs can bring short term benefits because of external market-oriented logics, rather than internal efficiency oriented gains. Indeed, existing studies seem to suggest that environmental activities are beneficial to a firm's competitive position only in the long-run (Horváthová, 2012). Finally, while past studies have mostly used survey-based questionnaires to capture firms' new green products, we used the press releases of actual NPIs as a measure instead of relying on respondents' reporting which may be less reliable and less objective. Overall, our sample consists of 1020 technological green new product introductions emanating from 79 global firms between 2007 and 2012.

2. THEORETICAL BACKGROUND

2.1 Environmental actions and firm performance

A traditional study focus of environmental scholars is the linkage between environmental performance and firm performance, partly following the well-known Porter hypothesis which suggests that firms can be both green and competitive (Porter & van der Linde, 1995). An exhaustive review of the literature linking environmental performance and financial performance is beyond the scope of this paper but can be found in previous research (see Horváthová, 2010; Horváthová, 2012 for a useful overview and summary). Overall, however, the results from a comprehensive meta-analysis by Horváthová (2010) concluded that the evidence on the direct relationship between environmental performance and financial performance is, at least, equivocal and inconclusive: it was positive in only about 55% of the past studies, while it was either neutral (30%) or even negative (15%) in the remaining studies. Despite the substantial insights from research at the linkage between environmental performance and firm performance, it is fair to characterize this linkage as a complex issue that requires a more nuanced understanding of the relationships.

One general observation from this work is the way that many studies measure environmental performance through emissions (e.g. Hart & Ahuja, 1996; King & Lenox, 2001) or ratings by external audit agencies (e.g. Guenster, Bauer, Derwall, & Koedijk, 2011; Russo & Fouts, 1997). Such measures are oriented towards the internal efficiency of a firm's environmental management. It follows that existing evidence mainly favors internal efficiency-oriented gains arguments, based on long-term benefits, rather than understanding the external market-oriented logics when firms face pressures relating to changing customer preferences and volatile economic-technological environments, and where firms have to accelerate the rate of new product introductions to sustain corporate growth. A further issue; little evidence exists

as to whether being green can yield short-term benefits to the firm. This may be due to the predominant use of internal green efficiency as a measure of environmental performance, which by its nature needs more time – the long-run perspective – to translate into corporate advantage. In contrast, green NPIs are market-oriented environmental activities hold commercial value, thus yielding a greater potential for short-term benefits to the firm. By paying attention to the environmental activities that are directed toward market actors such as customers (Hawn & Ioannou, 2015), environmental theorists can expand what they study and develop more complete models of environmental performance, while also demonstrating how firms can simultaneously be both green and competitive.

2.2 New product introductions and firm performance

New product introduction, which is defined as any change in a product's design (Katila & Ahuja, 2002), is often used as a proxy for firm innovative performance and represent the commercial outcome of a firm's R&D activities. Because new products help a firm gain market share and ensure its survival in the long run, the contribution of NPIs to financial performance is commonly accepted in both the strategy and marketing literature (Banbury & Mitchell, 1995; Chaney & Devinney, 1992; Damanpour, 1991; Pauwels, Silva-Risso, Srinivasan, & Hanssens, 2004). The role of NPI has become even more critical in the digital environment not least because customers have become more connected, knowledgeable and unpredictable; with accelerating and shortening product life cycles and converging industries requiring firms to develop ambidextrous capabilities (McGrath, 2013). When combined, these conditions are making competitive advantages more temporary and less sustainable even in the medium run. In such competitive conditions, a firm's capability to introduce new products that are based on innovative features has become decisive in sustaining long-term

corporate growth (Katila & Ahuja, 2002; Smith, Collins, & Clark, 2005). Nowhere is this NPI more evident than in the digitally interconnected world where firms ranging from Apple and Samsung in the smartphone industry, Google and Facebook in online advertising, and Salesforce.com and Amazon in software-as-a-service, frequently launch new products to sustain corporate growth. Yet such NPIs also lead to environmental degradation through the increasing extraction of natural resources to produce new products and the potential challenge to recycling the hazardous waste of older versions (Norberg-Bohm, 2000).

Rather than focusing on market-oriented environmental activities and measures such as NPIs, scholarly attention linking environmental performance and financial performance has mostly used internal-oriented measures of environmental performance. Such measures indicate the impact of a firm's business activities on the natural environment rather than its market capabilities for adopting and using green technologies to improve firm profitability. The most common measures have been pollution emissions (e.g. Hart & Ahuja, 1996; Iwata & Okada, 2011; King & Lenox, 2001; Stanwick & Stanwick, 1998), toxic releases (e.g. Horváthová, 2012; Konar & Cohen, 2001; Patten, 1992), and internal environmental management policies (e.g. Darnall & Edwards Jr., 2006; Lo, Yeung, & Cheng, 2012; Yang, Hong, & Modi, 2011). Although these measures have been very useful in assessing how internal green efficiency can lead to financial performance in the long-run, they do not capture a firm's market capabilities which can affect both its short-term and long-term financial performance.

Consideration of the linkage between green product development and firm performance has offered a range of interesting insights. For example, how eco-innovation activities improve a firm's market performance (Przychodzen & Przychodzen, 2015; Pujari, 2006) and competitive positioning (Chen, Lai, & Wen, 2006). More specifically, how green product development leads to market performance (Jabbour, Jugend, de Sousa Jabbour, Gunasekaran, & Latan, 2015), new market and product opportunities (Dangelico, Pontrandolfo, & Pujari, 2013), and

product development effectiveness (Katsikeas, Leonidou, & Zeriti, 2016). While such studies have helpfully begun to draw attention to the potential importance of green NPIs to improve both environmental performance and firm performance (for a thorough review, see Dangelico, 2015), nonetheless there remains two noteworthy shortcomings. First, this work rarely focused on technology-based green products and how these are linked to short-term profitability. Second, studies mostly adopt survey-based methods instead of actual NPI data to investigate how this impacts financial performance. Addressing these gaps will bring further valuable insights into how green NPIs contribute to firm profitability.

2.3 Green technologies and profitability

In recent years the environmental literature has paid more concern to matters of green practice adoption and competitive advantage. Greater public scrutiny for environmental wrongdoing (Berrone et al., 2013) and growing concerns of stakeholders with respect to corporate environmental practices (Harrison, Newholm, & Shaw, 2005) have put firms and governments under more pressure to conform to social expectations and environmental standards (Bansal & Roth, 2000). Two streams of the environmental literature have suggested that adopting green practices can lead to competitive advantages. First, the resource-based view and resource-dependency theory explain that because stakeholders provide critical resources that ensure long-term survival (Barney, 1996; Mackey, Mackey, & Barney, 2007), firms must conform to the environmental and social expectations of stakeholders in order to access resources (Bansal, 2005; Bansal & Clelland, 2004; Bansal & Roth, 2000; Buysse & Verbeke, 2003; Kassinis & Vafeas, 2006). The second stream of the literature supports the argument that environmental performance can lead to financial performance (Gilley, Worrell, Davidson, & El–Jelly, 2000; King & Lenox, 2001; Klassen & McLaughlin, 1996; Klassen &

Whybark, 1999; Russo & Fouts, 1997). The underlying assumption is that proactive environmental practices can lead to higher price premiums, more market share and new markets for the firm (for a review, see Ambec & Lanoie, 2008).

With the increasing pressure for NPIs and sustainability, some academic researchers have argued that green new products can help limit, or off-set, the negative impact of NPIs on the environment (Dangelico & Pujari, 2010; Hekkert & Negro, 2009; Porter & van der Linde, 1995; Pujari, 2006; Pujari et al., 2003). Extending this argument, technological green NPIs tend to provide firms with greater leverage than non-technological green NPIs in improving both environmental and financial performance. First, green technologies build on scientific advances to develop more radical innovations with greater environmental capabilities (Klassen & Whybark, 1999; Shrivastava, 1995; Sun, Lu, Wang, Ma, & He, 2008), and thus tend to be geared toward pollution prevention rather than merely pollution control (Berrone et al., 2013). Second, technological green products have higher rent potential than non-technological green products because they result from long-term R&D plans with substantial resource allocation (Grant, 1991; Porter, 1985; Shrivastava, 1995).

These arguments suggest that the greater capabilities of green technologies in preventing pollution may enable firms to experience a significant improvement in relative environmental performance (Lai, Wong, & Cheng, 2012). Numerous examples of green technologies also support this view: Thin-films can dramatically lower the cost of capturing solar energy and can be seamlessly installed on windows instead of sunroof; Fuel cells will one day produce unlimited electricity with far less carbon footprint than conventional utilities; Biotechnologies will be able to exploit renewable biological organisms to produce artificial blood that is universally accepted by any receiver, thereby solving one of the greatest problems in blood transfusion. As a consequence, new products that incorporate powerful green technologies can not only offset the environmental impact of current consumption trends (Shapira, Gök,

Klochikhin, & Sensier, 2014), but also transform market structures, create opportunities for new markets with associated green business models and overall improve human existence. However, the extent of this is arguably not explored to its full potential, particularly given the external market-oriented conditions in which firms are dealing with.

2.4 Hypothesis

In summary, according to our review of the literature above, despite several studies linking environmental management to financial performance, there is still little evidence on the impact of technological green NPIs on firm profitability. Furthermore, although several studies have looked at the link between environmental and financial performance, scholars have typically used rating scores, emissions or toxic release indicators as a measures of firm environmental performance. Such measures, however, are mostly driven by the motivation to improve a firm's internal efficiency rather than gaining direct external advantages such as market premiums (Hawn & Ioannou, 2015), and, consequently, are limited in capturing the commercial value of the firm's green efforts. In contrast, technological green NPIs are a more visible form or indicator of a firm's environmental stewardship (Dangelico & Pujari, 2010; Pujari, 2006), and thus can capture more efficiently the direct market advantages that the firm can derive from its green efforts.

Our aim in this research is to investigate the relationship between the introduction of new products based on green technologies and firm profitability. We argue that new products that are based on green technologies lead to higher profitability for firms because: 1) they are more visible to market actors than internally-driven green activities (Dangelico & Pujari, 2010; Pujari, 2006), and thus, hold higher commercial value; 2) they result from a long-term investment plan in research and development (Berrone et al., 2013), which helps attract more

customers at higher premiums, and are more difficult to imitate by the competition. Therefore, new green products may hold higher rent potential when they are coupled with new technologies, and should lead to higher profitability for firms. We hypothesize that:

H1: Technological green NPIs have a positive influence on firm profitability

3. METHODS

This study utilized data on a sample of 1020 technological green NPIs from 79 global firms over the period 2007-2012 to test the relationship between this type of NPIs and firm profitability. The size of the sample was determined by two criteria: 1) all the press releases of new green products which were technological in nature were collected over a six-year period; 2) the new green products of firms that operated in the institutional context of the most polluting industries were retained. The most polluting industries[1] were selected because firms tend to be subject to dense institutional constraints such as higher regulative and social pressures for environmental conformance and, as a consequence, are more incentivized to develop green technologies (Berrone et al., 2013; Berrone, Gelabert, & Fosfuri, 2009). Firms operating in polluting industries were identified from the Standard Industrial Classification database (SIC codes) according to the average carbon emissions of the industry (Berrone et al., 2013).

In formulating this study, a single hypothesis was worked on because of the complexity of collecting sufficient data on the dependent variable (net income and return on total capital), the independent variable (NPIs with green technologies), and equally important, the numerous control variables (size, R&D intensity, advertising intensity, stakeholder relations,

[1] Including airfreight and logistics and airlines, automotive, construction and machineries, chemicals, electric power and electric utilities and components, agri-food, industrial heavy machineries, oil and gas, metals and mining, steel, paper and forestry, and pharmaceuticals.

diversification, reputation, and visibility). Previous studies linking corporate social responsibility and firm financial performance have also focused on a single main hypothesis, with a growing number of researchers arguing that research would benefit from the greater use of this single hypothesis approach (e.g. Barnett & Salomon, 2006; McWilliams & Siegel, 2000; Waddock & Graves, 1997).

3.1 Dependent variable

In contrast to previous studies linking environmental performance to financial performance, we used an operational profitability-based measure rather than a capital market-based measure of financial performance. The literature on NPIs suggest that new products are associated with price premiums and increased market share (Cooper, 1994; Cooper & Kleinschmidt, 1987; Porter & van der Linde, 1995; Shapiro, 1983), both of which have substantial short-term effects on a firm's operational profits. As such, it is argued that profitability captures more efficiently the commercial value of new technological green products than market-based financial indicators which have longer-term perspectives. Accordingly, profitability was measured through the natural logarithm of "Net Income" (Joh, 2003; McGuire, Sundgren, & Schneeweis, 1988) rather than Tobin's Q, Return-On-Assets (ROA), Return-On-Equity (ROE), and Return-On-Sales (ROS).

3.2 Independent variable

In the current environmental literature, green technologies (Klassen & Whybark, 1999; Shrivastava, 1995), environmental innovation (Berrone et al., 2013; Brunnermeier & Cohen, 2003; Horbach, 2008), eco-innovation (Horbach, Rammer, & Rennings, 2012; Przychodzen &

Przychodzen, 2015; Pujari, 2006; Rennings, 2000), and green new products (Dangelico, 2015; Dangelico et al., 2013; Dangelico & Pujari, 2010; Jabbour et al., 2015; Katsikeas et al., 2016) may refer to overlapping concepts. For example, green technologies may be defined as any equipment, method, product design, structure, practice, and delivery system that limits or reduces the impact of products or services on the environment (Klassen and Whybark, 1999; Shrivastava, 1995). Environmental innovation (sometimes referred to as eco-innovation) may be new products, process, or designs that reduce environmental harm (Berrone et al., 2013; Brunnermeier & Cohen, 2003). Finally, new green products may be any new product designed to reduce its impact on the environment (Albino, Balice, & Dangelico, 2009; Dangelico et al., 2013). As such, new green products may be both technological and non-technological while environmental innovation is often technological in nature.

Although there may be a potential confusion around the conceptual boundary between new green non-technological products and technological products in previous studies, clarifying the overlapping definitions is beyond the scope of this research (for a good review, see Kuehr, 2007). Simply, we decided to combine previous research on green technologies (Klassen & Whybark, 1999; Shrivastava, 1995), technological innovation (Garcia & Calantone, 2002), and green products (Dangelico & Pontrandolfo, 2010) to define new green technological products as any product which incorporates technological innovations to limit or lower its impact on the natural environment or the impact of other products. Technological innovations are those that embody inventions from scientific advances and engineering (Garcia & Calantone, 2002).

Lexis-Nexis was used to collect data on 1020 press releases of technological green NPIs from 2007 to 2012. Lexis-Nexis was used as the only source of press releases in order to avoid potential duplication (Bansal & Clelland, 2004). Each press release of a NPI was read by the authors in order to verify that the new green product incorporates an environmental-friendly

technological innovation, and emanates from a firm that operates in a polluting industry (Berrone et al., 2013). Our verification process consisted of three steps. The first step consisted in identifying technological innovations. We identified the term "technology" in the text. The use of such term would normally ensure that the new product is technological in nature, and most firms launching innovative products based on technologies will most likely include this term in press releases. When the term "technology" was absent in the press release, we searched for technical components that may refer to a scientific application (e.g. solar, hydraulic, physics, etc.) or engineering (e.g. combustion, propulsion, engine, etc.). Out of the 1020 press releases in our final sample, nearly 90% of them contained the term "technology" either in the text or keywords. In the second step, we reviewed the press releases of technological innovations to identify the green ones. The technological innovation was classified as “green” if it focused on reducing or limiting the environmental impact of the new product or that of other products in the three areas of energy, materials and pollution (Dangelico & Pontrandolfo, 2010). We expected that if a particular technological innovation had green capabilities, the press release would mention this feature in the text not least because such a feature would be the main purpose, feature or a major selling point of the new product. Specifically, we used the following terms to identify these press releases: energy, materials, pollution, green, environmental, toxic and waste. In the third step, once the press releases were correctly identified as technological and green, two different researchers in the field of technology management read a sample of 50 press releases to ensure intercoder reliability. The agreement rate was 98%. Table 1 shows examples of the press releases.

Insert Table 1 about here

3.3 Control variables

Since firm profitability can be influenced by other organizational factors, we controlled for firm size (log of total assets), advertising intensity (log of advertising expenditures), industry (SIC codes), and research and development intensity (log of R&D expenditures). A firm's diversification strategy can also impact its financial performance (Hitt, Hoskisson, & Kim, 1997), and was controlled through the number of SIC codes in which it operated. Firm visibility can be associated with organizational power and thus influence performance. This was captured through the number of press articles about the focal firm in the Wall Street Journal (King & Toffel, 2007). Finally, a control was made for the impact of intangible assets on firm performance (Surroca, Tribó, & Waddock, 2010). Organizational legitimacy was measured through stakeholder relations scores from the MSCI corporate and social performance database and the number of litigations from the Law360 database. Firm reputation was measured using the within-industry rank of the firm according to the Fortune Magazine ranking of the Most Admired Companies (Philippe & Durand, 2011).

Since we are concerned with the impact of technological green NPIs on firm profitability, a control for the total number of NPIs was also made. Nonetheless, the high correlation between technological green NPIs and NPIs may raise multicollinearity issues. Therefore, a robustness check was ran using the ratio of technological green NPIs to the total number of NPIs.

4. ANALYSIS OF RESULTS

Following Berrone et al. (2010), we used the average number of the variables. We followed the same procedure for the control variables. Using averages has been shown to be an

efficient means of avoiding spurious effects and data variability in cross-sectional data (Balkin, Markman, & Gomez-Mejia, 2000; Tabachnick & Fidell, 2001), and is well supported in the management literature as an appropriate approach to handle shorter periods of data (e.g. Houthoofd & Heene, 1997; Johnson, Hoskisson, & Hitt, 1993; Myles Shaver, 2011; Waddock & Graves, 1997). We used Ordinary Least Square (OLS) regression for model estimation. Table 2 shows the descriptive statistics while Table 3 reports the results of the regression models.

After controlling for the major determinants of firm profitability including industry, size, R&D intensity, advertising intensity, past litigations, diversification, reputation, stakeholder relations, and firm visibility, we found a positive and significant relationship (model 2: 0.04, $p<0.05$) between technological green NPIs (GNPI in Table 2) and firm profitability (Net Income). We also found that R&D intensity (0.19, $p<0.05$) and reputation (0.09, $p<0.05$) positively influence firm profitability, which confirms the importance of these two determinants of firm performance in past research (Capon, Farley, & Hoenig, 1990; Roberts & Dowling, 2002; Surroca et al., 2010; Uotila, Maula, Keil, & Zahra, 2009).

While using net income as a proxy for profitability, we ran a robustness check using an alternative measure of profitability relative to a firm's capital instead of its absolute net income. We ran the same regressions models using Return on Total Capital (ROTC) which measures the net earnings of a firm divided by its total capital, and has often been used in the strategy literature as a measure of firm profitability (Chakravarthy, 1986; Kudla, 1980; Ramanujam, 1987). Using ROTC as a robustness check allows us to understand whether green NPIs contributes to a firm's profits given its capital investment. After controlling for the same variables as in model 2, we found similar results for the contribution of green NPIson ROTC (model 5: 0.02, $p<0.10$). As a second robustness check, we used the ratio of the number of green NPIs of a firm divided by the total number of new product introductions of

the firm for the same period of time. The objective was to control for the effect of the total number of NPIs on profitability. After controlling for the same variables, we found that the relationship remained positive and significant (model 3: 0.05, $p<0.10$). A final robustness check was related to a possible endogeneity issue between green NPI and profitability. Since environmental actions require substantial resource allocation, it may be that a firm introduces more green products because it is financially profitable (Surroca et al., 2010), thus creating a feedback loop between green NPIs and net income. Therefore, we attempted to address the simultaneity issue by lagging net income by one year and two years. We still found a positive and significant relationship with the lagged net income variable. For completeness, we included a final model using both alternative measures as the dependent (ROTC) and the independent (ratio of GNPI/Total NPI), and still found a significant relationship (model 6: 0.03, $p<0.10$).

Insert Table 2 about here

Insert Table 3 about here

---

5. DISCUSSION

Examining the relationship between the introduction of new products and firm profitability is an important subject for scholarly environmental analysis. The traditional approach to the study of the linkage between environmental and financial performance has been based on internally-driven indicators as a measures of firm environmental performance. This study

sought to extend and build on this analysis by bringing market orientated logics– technological green NPIs – into the environmental analysis. Arguably, this adds to a more nuanced understanding of this complex debate.

The nature of the commercial work by firms is central to this debate - they are responsible for a large portion of the global greenhouse gas emission through the business activity of firms. The commercial pressure on firms to maintain market share and sustain corporate growth is accelerating the introduction of new products. However, any acceleration in the number of new product introductions imposes further costs for firms as well as for the natural environment. That accelerating production in terms of increasing the number of new products invariably depletes natural resources and creates pollution hazards through toxic materials.

Central to this debate is the question of "whether it pays to be green", or in other words, how we can incentivize firms to adopt pro-environmental practices (Ambec & Lanoie, 2008; Porter & van der Linde, 1995; Pujari et al., 2003). In this paper, we argue that this 'question' is complex and requires academic studies to bring commercial logics into environmental analysis, and also to build a more nuanced understanding of this the linkage between environmental and financial performance. Some business groups have argued along similar lines. In an address, the President the World Business Council for Sustainable Development (WBCSD), Peter Bakker (2012), recently argued: "In Vision 2050 we firmly believe that business can be the major provider of solutions for this multi-facetted crisis we face". Adopting a reconciliatory economic-environmental preservation perspective, this study posits incentives for firms to use green technologies to offset the negative impact of new products on the environment. The results from a data sample of 1020 technological green NPIs

originating from 79 global firms between 2007 and 2012 point to a positive link between technology-based green new products and firm short-term profitability.

This study makes a number of important contributions to the environmental literature. First, we focused on the particular case of technological green NPIs because they are more tangible outcomes of a firm's environmental efforts than the more commonly used environmental performance indicators such as emissions and external ratings. Such market orientated logics– technological green NPIs – have been limited in past studies on environmental analysis. Moreover, we used net income as a measure of short-term profitability to capture the operational benefits of a firm's green activities. To the best of our knowledge, we are not aware of any previous study which has investigated such a link. Taken together, this study provides a more fine-grained analysis of the question of whether introducing environmental beneficial new products would be profitable for a firm that operates in a polluting industry. Second, the limited existing studies linking environmental performance to financial performance seem to suggest that being green can only be beneficial in the long run (Ambec & Lanoie, 2008; Horváthová, 2012). This finding may seem intuitive if one measures environmental performance through internal green efficiency because internal green capabilities may take more time to - or even never convert into firm advantage—a phenomenon known as means-ends decoupling (Wijen, 2014). This study shows that a firm's green efforts can bring short-term financial benefits when it introduces technological green products. Technological green NPIs are different from internally-oriented environmental activities because they are market-oriented, and thus hold immediate commercial value that can improve a firm's short-term and long-term profitability. Finally, we exclusively studied green NPIs that incorporate green technologies. The rationale justifying this decision is based upon the greater capabilities of technological and scientific advances to bring radical

alternatives to solving current polluting practices (Klassen & Whybark, 1999; Shrivastava, 1995). Although some academics have studied green technologies as a determinant of firm performance, empirical studies in this area is still limited.

From this paper we identify three potential practical implications. From the evidence, we suggest that managers need to be aware of the business case for companies to develop green new products. We believe there are many competitive advantages to using green technologies to develop new products. First, we suggest that managers need to understand that technological green NPIs can help them to sustain both short-term and long-term growth. That short-term financial advantage for firms does not exclude or preclude win–win situations in terms of reducing the adverse impacts of NPIs on the environment. Financial short-term goals and environmental agendas are not mutually exclusive –managers can do both at the same time and benefit. Specifically it can benefit both by helping to attract new customers who are environmentally conscious, but also helping to retain current customers who care about the firm's current green practices. According to a BCG (2014) report, green products are expected to drive up to 70 percent of new product growth in the US, therefore showing substantial potential for corporate growth in this area. Second, it also opens new markets for the firm as any firm can develop a green version of its current product lines or build on its existing capabilities to develop an entirely new green product. Numerous examples span from the Hybrid versions of existing car models (e.g. Toyota Auris) to the new-to-the-world electrical sport cars (e.g. Tesla and Fisker). Third, managers need to understand that green products call a higher price premium (therefore margins) than conventional products not least because consumers tend to have a positive attitude toward environmental issues (Lin & Chang, 2012). Studies also show that environmentally conscious consumers have higher purchasing power than non-conscious consumers (Davies, Titterington, & Cochrane, 1995). Therefore, we

suggest that managers need to understand the commercial basis for introducing technological green product as a source of competitive advantage as well as the factors that lead to the dynamic changes in these bases that allow them develop, maintain, hedge, or defend against new entrants and compete where there are deflationary pressures and hyper competition. Finally, managers need to be aware that green technology investment can generate higher rent potential from new products. They might therefore wish to think about green technology strategies not least because such products tend to be more difficult to imitate by copy-cat competitors and hold higher commercial value than simple product innovations.

6. LIMITATIONS AND FUTURE RESEARCH

As with any empirical study, our study is not exempt from limitations. A primary limitation relates to the relatively smaller sample of NPIs. Nonetheless, it should be recognized that we focused exclusively on technological green products, which naturally limited the number of press releases of this type of products in the population within the specific time period. Future studies might focus on more general new products, which then can include non-polluting industries as the role of technology tends to be less critical in these industries. Furthermore, future NPIs studies might consider the related boundary condition pressures of planned built-in obsolescence on the environment. A second limitation is our focus on large corporations. This was justified by our motivation to control for a larger number of variables in our study; some of them are typically difficult to measure for smaller firms (e.g. reputation and stakeholder relations). An interesting direction for future studies would be to investigate the link between green new products and profitability for small/medium companies. Some scholars have already examined at the motivations of small/medium companies for investing in green products (Dangelico & Pujari, 2010), but few, if any, have linked new green products to firm performance. Another limitation is our use of average scores as an alternative to

handle shorter period of data. We encourage future studies to collect NPIs over a longer period of time to assess the link between green NPIs and financial performance using fixed effects models to control for time-invariant characteristic. Finally, a potential limitation is the focus on the relationship between green NPIs and profitability as the sole hypothesis. However, past studies have adopted this approach in the field of environmental analysis and firm financial performance because of the complexity of linking these two variables (e.g. Barnett & Salomon, 2006; McWilliams & Siegel, 2000; Waddock & Graves, 1997). We certainly encourage scholars to include moderating conditions to the green NPI-profitability link: market orientation, industry dynamics, and institutional factors are some of the most prominent examples. Only then can we begin to understand, control and account for the different measures and boundary conditions that enable firms to be simultaneously green and competitive in both the short and long-term. Another promising avenue for research is to evaluate more specifically the effect of new green products that have a positive net impact on the environment by helping to reduce or limit the impact of other products (Dangelico & Pontrandolfo, 2010). Given the potential positive net impact, this type of green product may have a greater financial leverage for firms than other types of green product.

Table 1 Examples of new products with green technologies

Industry	New product description
Automotive	The system displayed is powered by a removable lithium battery that provides a quick charge enough for 3 to 15 miles of driving to reach a charging location
Electric power	These new components will help transform solar-generated electricity into useable power for residential and commercial installations by enabling integrators to design smarter and more flexible systems
Oil and gas	The product is a breakthrough technology that improves fuel combustion, thus reducing harmful emissions and improving fuel efficiency
Chemicals	These bottles have a bonded durable external clear coating that resists glass breakage on normal impact, where uncoated glass would normally break
Construction	A breakthrough technology platform that enables production of next generation building and construction materials with outstanding physical properties, lower life-cycle cost and lowest environmental footprint
Agrofood	These connected captors will allow farmers to remotely perform real-time monitoring of the level of water, therefore, helping farm owners save water over the year
Airfreight and logistics and airline	The new aircraft components will be lighter and more resistant to high temperature and pressure. They can significantly lower fuel consumption
Metals, mining and steel	The new dry processing machines enable iron ore producers to avoid using a single drop of water in ore tailing
Pharmaceuticals	The new manufacturing process uses green chemistry or lean chemistry to make drug manufacturing less hazardous and more resource-efficient
Heavy machineries	This tire is lighter, lasts longer than normal tires and can be recycled multiple times to manufacture new tires

Table 2 Descriptive statistics

	Min	Max	Mean	StandDev	NI	ROTC	Size	R&D	Ad.	Lit.	Div.	Rep.	Stake.	Vis.	GNPI
NI	16.90	24.43	21.59	1.33	1.00										
ROTC	-6.90	-1.03	-2.51	0.92	0.51***	1.00									
Size	0.30	3.35	3.17	0.31	0.14	0.02	1.00								
R&D	-12.89	5.64	-4.17	2.38	0.43***	0.05	0.07	1.00							
Ad.	-5.59	6.61	-2.06	1.42	0.22**	-0.21*	0.02	0.06***	1.00						
Lit.	48	8175	2039.47	2545.35	0.02	-0.29**	0.04	-0.05	0.08	1.00					
Div.	1	15	5.28	2.20	0.27**	-0.00	0.14	0.23**	-0.03	0.19*	1.00				
Rep.	1	15	5.35	3.66	0.33**	0.25**	0.09	0.06	-0.15	0.09	0.15	1.00			
Stake.	1	15	5.35	3.66	0.10	0.22*	0.11	0.05	-0.17	0.06	0.11	0.44***	1.00		
Vis.	-230.21	383.79	0.00	192.02	0.12	-0.00	-0.13	-0.12	-0.08	0.14	0.00	0.29**	0.17	1.00	
GNPI	1	42	10.82	8.16	0.01	0.06	0.11	-0.03	-0.21*	-0.15	0.04	-0.01	0.11	0.11	1.00

***p<.001
**p<.05
*p<0.10

Table 3 Results of OLS regressions

Dependent Variable	**Net Income**			**ROTC**		
	1	2	3	4	5	6
	OLS	OLS	OLS	OLS	OLS	OLS
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Size	0.49	0.41	0.42	0.21	0.14	0.15
	(0.40)	(0.40)	(0.40)	(0.32)	(0.32)	(0.32)
R&D	0.20**	0.19**	0.20**	0.06	0.05	0.06
	(.0.10)	(0.09)	(0.09)	(0.08)	(0.07)	(0.07)
Advertising	-.08	-003	-0.04	-0.18	-0.15	-0.15
	(0.13)	(0.13)	(0.13)	(0.10)	(0.10)	(0.10)
Litigations	0.00**	0.00**	0.00**	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Diversification	0.05	0.04	0.04	-0.02	-0.03	-0.03
	(0.06)	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)
Reputation	0.08**	0.09**	0.09**	0.03	0.03	0.03
	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)
Stakeholder	-0.06	-0.06	-0.06	0.02	0.02	0.02
	(0.04)	(0.04)	(0.04)	(0.03	(0.03)	(0.03)
Visibility	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
GNPI		0.04**			0.02*	
		(0.01)			(0.01)	
Ratio of GNPI/Total NPI			0.05*			0.03*
			(0.02)			(0.02)
Observations	79	79	79	79	79	79
F-score / χ**2**	3.42	3.62	3.56	1.91	2.03	2.03
$\mathbf{R^2}$	0.50	0.53	0.53	0.37	0.40	0.40

***p<.001
**p<.05
*p<0.10
Standard errors in parenthesis

References

Albino, V., Balice, A., & Dangelico, R. M. (2009). Environmental strategies and green product development: an overview on sustainability-driven companies. *Business Strategy and the Environment, 18*(2), 83-96.

Ambec, S., & Lanoie, P. (2008). Does it pay to be green? A systematic overview. *The Academy of Management Perspectives, 22*(4), 45-62.

Balkin, D. B., Markman, G. D., & Gomez-Mejia, L. R. (2000). Is CEO pay in high-technology firms related to innovation? *Academy of Management Journal, 43*(6), 1118-1129.

Banbury, C. M., & Mitchell, W. (1995). The effect of introducing important incremental innovations on market share and business survival. *Strategic Management Journal, 16*(S1), 161-182.

Bansal, P. (2005). Evolving sustainably: A longitudinal study of corporate sustainable development. *Strategic Management Journal, 26*(3), 197-218.

Bansal, P., & Clelland, I. (2004). Talking trash: Legitimacy, impression management, and unsystematic risk in the context of the natural environment. *Academy of Management Journal, 47*(1), 93-103.

Bansal, P., & Roth, K. (2000). Why companies go green: A model of ecological responsiveness. *Academy of Management Journal, 43*(4), 717-736.

Barnett, M. L., & Salomon, R. M. (2006). Beyond dichotomy: The curvilinear relationship between social responsibility and financial performance. *Strategic Management Journal, 27*(11), 1101-1122.

Barney, J. B. (1996). The Resource-Based Theory of the Firm. *Organization Science, 7*(5), 469.

Berrone, P., Cruz, C., Gomez-Mejia, L., & Larraza-Kintana, M. (2010). Socioemotional wealth and corporate responses to institutional pressures: Do family-controlled firms pollute less? *Administrative Science Quarterly, 55*, 82–113.

Berrone, P., Fosfuri, A., Gelabert, L., & Gomez-Mejia, L. R. (2013). Necessity as the mother of 'green' inventions: Institutional pressures and environmental innovations. *Strategic Management Journal, 34*(8), 891–909.

Berrone, P., Gelabert, L., & Fosfuri, A. (2009). The impact of symbolic and substantive actions on environmental legitimacy. *IESE Working Paper Series, WP-778*.

Brunnermeier, S. B., & Cohen, M. A. (2003). Determinants of environmental innovation in US manufacturing industries. *Journal of Environmental Economics and Management, 45*, 278-293.

Buysse, K., & Verbeke, A. (2003). Proactive environmental strategies: a stakeholder management perspective. *Strategic Management Journal, 24*(5), 453-470.

Capon, N., Farley, J. U., & Hoenig, S. (1990). Determinants of financial performance: a meta-analysis. *Management Science, 36*(10), 1143-1159.

Chakravarthy, B. S. (1986). Measuring strategic performance. *Strategic Management Journal, 7*(5), 437-458.

Chaney, P. K., & Devinney, T. M. (1992). New product innovations and stock price performance. *Journal of Business Finance & Accounting, 19*(5), 677-695.

Chen, Y.-S., Lai, S.-B., & Wen, C.-T. (2006). The influence of green innovation performance on corporate advantage in Taiwan. *Journal of Business Ethics, 67*(4), 331-339.

Chien, C.-F., Chen, Y.-J., & Peng, J.-T. (2010). Manufacturing intelligence for semiconductor demand forecast based on technology diffusion and product life cycle. *International Journal of Production Economics, 128*(2), 496-509.

Cooper, R. G. (1994). New products: the factors that drive success. *International Marketing Review, 11*(1), 60-76.

Cooper, R. G., & Kleinschmidt, E. J. (1987). New products: what separates winners from losers? *Journal of Product Innovation Management, 4*(3), 169-184.

Damanpour, F. (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of Management Journal, 34*(3), 555-590.

Dangelico, R. M. (2015). Green product innovation: where we are and where we are going. *Business Strategy and the Environment*.

Dangelico, R. M., & Pontrandolfo, P. (2010). From green product definitions and classifications to the Green Option Matrix. *Journal of Cleaner Production, 18*(16), 1608-1628.

Dangelico, R. M., Pontrandolfo, P., & Pujari, D. (2013). Developing sustainable new products in the textile and upholstered furniture industries: role of external integrative capabilities. *Journal of Product Innovation Management, 30*(4), 642-658.

Dangelico, R. M., & Pujari, D. (2010). Mainstreaming green product innovation: Why and how companies integrate environmental sustainability. *Journal of Business Ethics, 95*(3), 471-486.

Darnall, N., & Edwards Jr., D. (2006). Predicting the cost of environmental management system adoption: the role of capabilities, resources and ownership structure. *Strategic Management Journal, 27*(4), 301-320.

Davies, A., Titterington, A. J., & Cochrane, C. (1995). Who buys organic food? A profile of the purchasers of organic food in Northern Ireland. *British Food Journal, 97*(10), 17-23.

Garcia, R., & Calantone, R. (2002). A critical look at technological innovation typology and innovativeness terminology: a literature review. *Journal of Product Innovation Management, 19*(2), 110-132.

Gilley, K. M., Worrell, D. L., Davidson, W. N., & El–Jelly, A. (2000). Corporate environmental initiatives and anticipated firm performance: the differential effects of process-driven versus product-driven greening initiatives. *Journal of Management, 26*(6), 1199-1216.

Grant, R. M. (1991). The resource-based theory of competitive advantage: implications for strategy formulation. *California Management Review, 33*(3), 114-135.

Guenster, N., Bauer, R., Derwall, J., & Koedijk, K. (2011). The economic value of corporate eco-efficiency. *European Financial Management, 17*(4), 679-704.

Harrison, R., Newholm, T., & Shaw, D. (2005). *The ethical consumer*. Thousand Oaks, CA: Sage Publications Ltd.

Hart, S. L. (1995). A natural-resource-based view of the firm. *Academy of Management Review, 20*(4), 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. *Business Strategy and the Environment, 5*(1), 30-37.

Hawn, O., & Ioannou, I. (2015). Mind the gap: The interplay between external and internal actions in the case of corporate social responsibility. *Strategic Management Journal*.

Hekkert, M. P., & Negro, S. O. (2009). Functions of innovation systems as a framework to understand sustainable technological change: Empirical evidence for earlier claims. *Technological Forecasting and Social Change, 76*(4), 584-594.

Hitt, M. A., Hoskisson, R. E., & Kim, H. (1997). International diversification: Effects on innovation and firm performance in product-diversified firms. *Academy of Management Journal, 40*(4), 767-798.

Horbach, J. (2008). Determinants of environmental innovation—new evidence from German panel data sources. *Research policy, 37*(1), 163-173.

Horbach, J., Rammer, C., & Rennings, K. (2012). Determinants of eco-innovations by type of environmental impact—The role of regulatory push/pull, technology push and market pull. *Ecological Economics, 78*, 112-122.

Horváthová, E. (2010). Does environmental performance affect financial performance? A meta-analysis. *Ecological Economics, 70*(1), 52-59.

Horváthová, E. (2012). The impact of environmental performance on firm performance: Short-term costs and long-term benefits? *Ecological Economics, 84*, 91-97.

Houthoofd, N., & Heene, A. (1997). Strategic groups as subsets of strategic scope groups in the Belgian brewing industry. *Strategic Management Journal, 18*(8), 653-666.

Iwata, H., & Okada, K. (2011). How does environmental performance affect financial performance? Evidence from Japanese manufacturing firms. *Ecological Economics, 70*(9), 1691-1700.

Jabbour, C. J. C., Jugend, D., de Sousa Jabbour, A. B. L., Gunasekaran, A., & Latan, H. (2015). Green product development and performance of Brazilian firms: measuring the role of human and technical aspects. *Journal of Cleaner Production, 87*, 442-451.

Joh, S. W. (2003). Corporate governance and firm profitability: evidence from Korea before the economic crisis. *Journal of financial Economics, 68*(2), 287-322.

Johnson, R. A., Hoskisson, R. E., & Hitt, M. A. (1993). Board of director involvement in restructuring: The effects of board versus managerial controls and characteristics. *Strategic Management Journal, 14*(S1), 33-50.

Kassinis, G., & Vafeas, N. (2006). Stakeholder pressures and environmental performance. *Academy of Management Journal, 49*(1), 145-159.

Katila, R., & Ahuja, G. (2002). Something old, something new: A longitudinal study of search behavior and new product introduction. *Academy of Management Journal, 45*(6), 1183-1194.

Katsikeas, C. S., Leonidou, C. N., & Zeriti, A. (2016). Eco-friendly product development strategy: antecedents, outcomes, and contingent effects. *Journal of the Academy of Marketing Science*, 1-25.

King, A. A., & Lenox, M. J. (2001). Does it really pay to be green? An empirical study of firm environmental and financial performance: An empirical study of firm environmental and financial performance. *Journal of Industrial Ecology, 5*(1), 105-116.

King, A. A., & Toffel, M. W. (2007). Self-regulatory institutions for solving environmental problems: Perspectives and contributions from the management literature. *HBS Technology & Operations Mgt. Unit Research Paper*(07-089).

Klassen, R. D., & McLaughlin, C. P. (1996). The impact of environmental management on firm performance. *Management Science, 42*(8), 1199-1214.

Klassen, R. D., & Whybark, D. C. (1999). The impact of environmental technologies on manufacturing performance. *Academy of Management Journal, 42*(6), 599-615.

Konar, S., & Cohen, M. A. (2001). Does the market value environmental performance? *Review of Economics and Statistics, 83*(2), 281-289.

Kudla, R. J. (1980). The effects of strategic planning on common stock returns. *Academy of Management Journal, 23*(1), 5-20.

Kuehr, R. (2007). Environmental technologies–from misleading interpretations to an operational categorisation & definition. *Journal of Cleaner Production, 15*(13), 1316-1320.

Lai, K.-h., Wong, C. W., & Cheng, T. (2012). Ecological modernisation of Chinese export manufacturing via green logistics management and its regional implications. *Technological Forecasting and Social Change, 79*(4), 766-770.

Lin, Y.-C., & Chang, C.-C. A. (2012). Double standard: The role of environmental consciousness in green product usage. *Journal of Marketing, 76*(5), 125-134.

Lo, C. K., Yeung, A. C., & Cheng, T. (2012). The impact of environmental management systems on financial performance in fashion and textiles industries. *International Journal of Production Economics, 135*(2), 561-567.

Mackey, A., Mackey, T. B., & Barney, J. B. (2007). Corporate social responsibility and firm performance: Investor preferences and corporate strategies. *Academy of Management Review, 32*(3), 817-835.

Margolis, J. D., Elfenbein, H. A., & Walsh, J. P. (2007). Does it pay to be good? A meta-analysis and redirection of research on the relationship between corporate social and financial performance. *Ann Arbor, 1001*, 48109-41234.

McGrath, R. G. (2013). Transient advantage. *Harvard Business Review, 91*(6), 62-70.

McGuire, J. B., Sundgren, A., & Schneeweis, T. (1988). Corporate social responsibility and firm financial performance. *Academy of Management Journal, 31*(4), 854-872.

McWilliams, A., & Siegel, D. (2000). Corporate social responsibility and financial performance: correlation or misspecification? *Strategic Management Journal, 21*(5), 603–617.

Myles Shaver, J. (2011). The benefits of geographic sales diversification: How exporting facilitates capital investment. *Strategic Management Journal, 32*(10), 1046-1060.

Norberg-Bohm, V. (2000). Creating incentives for environmentally enhancing technological change: lessons from 30 years of US energy technology policy. *Technological Forecasting and Social Change, 65*(2), 125-148.

Patten, D. M. (1992). Intra-industry environmental disclosures in response to the Alaskan oil spill: a note on legitimacy theory. *Accounting, Organizations and Society, 17*(5), 471-475.

Pauwels, K., Silva-Risso, J., Srinivasan, S., & Hanssens, D. M. (2004). New products, sales promotions, and firm value: The case of the automobile industry. *Journal of Marketing, 68*(4), 142-156.

Philippe, D., & Durand, R. (2011). The impact of norm-conforming behaviors on firm reputation. *Strategic Management Journal, 32*(9), 969–993.
Porter, M. E. (1985). Technology and competitive advantage. *Journal of business strategy, 5*(3), 60-78.
Porter, M. E., & van der Linde, C. (1995). Green and competitive: Ending the stalemate. *Harvard Business Review, 73*(5), 120-134.
Prakash, S., Dehoust, G., Gsell, M., Schleicher, T., & Stamminger, R. (2015). Reality check: obsolescence. Berlin: Oeko Institut.
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.
Pujari, D. (2006). Eco-innovation and new product development: understanding the influences on market performance. *Technovation, 26*(1), 76-85.
Pujari, D., Wright, G., & Peattie, K. (2003). Green and competitive: influences on environmental new product development performance. *Journal of Business Research, 56*(8), 657-671.
Ramanujam, V. (1987). Diversification and performance: A reexamination using a new two-dimensional conceptualization of diversity in firms. *Academy of Management Journal, 30*(2), 380-393.
Rennings, K. (2000). Redefining innovation—eco-innovation research and the contribution from ecological economics. *Ecological Economics, 32*(2), 319-332.
Roberts, P. W., & Dowling, G. R. (2002). Corporate reputation and sustained superior financial performance. *Strategic Management Journal, 23*(12), 1077-1093.
Russo, M. V., & Fouts, P. A. (1997). A resource-based perspective on corporate environmental performance and profitability. *Academy of Management Journal, 40*(3), 534-559.
Shapira, P., Gök, A., Klochikhin, E., & Sensier, M. (2014). Probing "green" industry enterprises in the UK: A new identification approach. *Technological Forecasting and Social Change, 85*, 93-104.
Shapiro, C. (1983). Premiums for high quality products as returns to reputations. *The Quarterly Journal of Economics*, 659-679.
Shrivastava, P. (1995). Environmental technologies and competitive advantage. *Strategic Management Journal, 16*(S1), 183-200.
Smith, K. G., Collins, C. J., & Clark, K. D. (2005). Existing knowledge, knowledge creation capability, and the rate of new product introduction in high-technology firms. *Academy of Management Journal, 48*(2), 346-357.
Stanwick, P. A., & Stanwick, S. D. (1998). The relationship between corporate social performance, and organizational size, financial performance, and environmental performance: An empirical examination. *Journal of Business Ethics, 17*(2), 195-204.
Sun, Y., Lu, Y., Wang, T., Ma, H., & He, G. (2008). Pattern of patent-based environmental technology innovation in China. *Technological Forecasting and Social Change, 75*(7), 1032-1042.
Surroca, J., Tribó, J. A., & Waddock, S. (2010). Corporate responsibility and financial performance: The role of intangible resources. *Strategic Management Journal, 31*(5), 463-490.
Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics*. New York: Pearson.
Uotila, J., Maula, M., Keil, T., & Zahra, S. A. (2009). Exploration, exploitation, and financial performance: analysis of S&P 500 corporations. *Strategic Management Journal, 30*(2), 221-231.
Waddock, S. A., & Graves, S. B. (1997). The corporate social performance-financial performance link. *Strategic Management Journal, 18*(4), 303-319.
Wijen, F. (2014). Means versus ends in opaque institutional fields: Trading off compliance and achievement in sustainability standard adoption. *Academy of Management Review, 39*(3), 302-323.
Yang, M. G. M., Hong, P., & Modi, S. B. (2011). Impact of lean manufacturing and environmental management on business performance: An empirical study of manufacturing firms. *International Journal of Production Economics, 129*(2), 251-261.