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Stakeholder Pressures, EMS Implementation, and Green Innovation in MNC Overseas Subsidiaries

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ABSTRACT

In this paper, we address the issue of green innovation in the overseas subsidiaries of multinational corporations (MNCs). Drawing upon institutional theory and stakeholder theory, we argue that MNC subsidiaries need to embrace local stakeholders' expectations in order to achieve social legitimacy, and that this prompts them to undertake green (product and process) innovation. We test our hypotheses using primary questionnaire data from a sample of 123 North American and European subsidiaries of Japanese MNCs, and confirm that regulatory stakeholder pressures do lead to green innovation, but that these pressures are mediated by the implementation of local EMS initiatives.

Keywords: green innovation; MNC subsidiary autonomy; stakeholder theory; institutional theory; environmental management systems.

Stakeholder Pressures, EMS Implementation, and Green Innovation in MNC Overseas Subsidiaries

INTRODUCTION

Much attention has recently been devoted in the International Business (IB) and strategy literatures to the increasing autonomy assumed by many overseas subsidiaries of multinational corporations (MNCs). This has been ascribed to the considerable size of many overseas subsidiaries, and to their accumulation of distinctive resources and capabilities, thus rendering direct hierarchical control by the parent company both less feasible and less desirable (Taggart & Hood, 1999; Birkinshaw & Hood, 2001). This phenomenon has been investigated in the context of a range of subsidiary strategic behaviors and outcomes including *inter alia* HRM practices (Fenton-O'Creevy et al, 2008), marketing strategy (Birkinshaw et al, 2009) and performance (Gammelgaard et al, 2012). Furthermore, as Zanfei (2000: 515) reported, 'a transition is taking place towards new modes of organising transnational corporations' innovative activities … [and] different units of multinational firms, including foreign-based subsidiaries, are increasingly involved in the generation, use and transmission of knowledge.' However, only a few studies (Choi & Park, 2014; Peng & Lin, 2008; Yang & Rivers, 2009; Tatoglu et al, 2014) have considered the issue of environmental management and green innovation in overseas subsidiaries.

This paper focuses on the antecedents of green innovation in a sample of US and European subsidiaries of Japanese MNCs. The classic definition of green innovation offered by Dangelico & Pujari (2010: 472) is "a multi-faceted process wherein three key types of environmental focus – material, energy, and pollution – are highlighted based on their major impact on the environment at different stages of the product's physical life cycle." Green innovations can broadly be categorized into two forms: green product innovations and green process innovations (Chen, 2008; Chen et al., 2006). Green product innovations are those that

create new products that have a considerable positive impact on environmental management improvement (Dangelico & Pujari, 2010; Pujari et al, 2006). Green process innovations are those that constantly develop processes needed to facilitate the efficient use of natural resources and prevent pollution (Chen et al., 2006).

Now green (product and process) innovations may potentially yield a range of benefits to the innovating firm. First, the firm has the opportunity to develop a positive image, differentiate itself from its rivals, and then pursue premium pricing (Hart, 1995; Porter & Van der Linde, 1995). Second, Chang (2011) argues that reinforcing the capacity of a firm to create new environmental products and processes results in improvements in product design and production methods. In a similar vein, Hart (1995) and Frondel et al (2008) suggest that green product and process innovations counterweigh the financial costs involved in overcoming environmental challenges. Third, Porter & Van der Linde (1995: 132) emphasize that pioneering green product and process innovations enables firms to mobilize their strategic and organizational resources more efficiently. They suggest that the early adoption of strict environmental standards may give the firm first-mover advantages, and lead to net benefits. In short, many commentators argue that integrating environmental considerations into corporate strategies may provide a source of sustained competitive advantage (Christmann, 2000; Hart, 1995; McWilliams & Siegel, 2001; Porter & Kramer, 2006).

But there are also costs/obstacles to green innovation. First, green innovations (like all innovations) are costly and the returns are uncertain, so positive net returns are not guaranteed (Walley & Whitehead, 1994). Second, new green innovations will still face competition from existing (dirtier) products/processes which may enjoy an installed-base cost advantage at least in the short-term (Aghion et al, 2009). Third, customers may be reluctant initially to accept the new green products, and thus the innovating firms may experience

significant additional marketing costs (Aghion et al, 2009). Finally, and most importantly, many of the benefits from green innovation are public, and firms may be reluctant to engage in innovation when they are not able to appropriate fully the resultant benefits.

This consideration of the costs and benefits of green innovation highlights the fact that the social benefits often outweigh the private benefits to the innovating firm, and thus outside stakeholders have incentives to exert pressure on firms to undertake more innovation. Rugman & Verbeke (1998) note that, whilst many MNCs may diffuse environmental practices to their overseas subsidiaries, the subsidiaries must also respond to local pressures exerted by governments, consumers, and other stakeholders to develop local solutions.

The main objective of this paper is to throw light on the pathways through which these pressures stimulate green innovation within the MNC subsidiaries. We argue that firms with proactive environmental approaches are more sensitive to stakeholder influences than firms with reactive environmental approaches (Buysse & Verbeke, 2003). The adoption of advanced stakeholder issue identification techniques - such as regular monitoring, complaints screening, and dialogues with special interest groups - will lead to enhanced green innovation performance (Driessen & Hillebrand, 2013). Hence we hypothesize that the implementation of formal environmental management system (EMS) [1] initiatives will facilitate green innovation within MNC subsidiaries. EMS may be viewed as a standardized process of cross-functional transfer of knowledge about how to reduce environmental burdens (Florida & Davion, 2001) but also, independent of economic objectives, essential for getting ahead of changing environmental requirements (Morrow & Rondinelli, 2002) and obtaining greater

[1] Characterized as a bundle of standardized environmental practices or procedures, an EMS can be viewed as "a novel type of environmental policy instrument that is based on voluntary action of private firms which can be independently verified and certified" (Wagner, 2007: 1588). EMS-based environmental management is a well-recognized and complex mechanism for quantifying requirements, processes, and practices, evaluating whether targets are met, and establishing an action plan regarding the allocation of necessary resources. Typical environmental practices include environmental accounting, environmental auditing, environmental disclosures, environmental training programs, ISO 14000 certification, and environmental benchmarking (Henriques & Sadorsky, 1996; Darnall et al, 2008, 2010).

social legitimacy (Berrone et al., 2013). Such strategically-proactive firms that monitor stakeholder demands are more likely to devote their attention, capital, and time to formalizing and structuring their environmental practices, which will, in turn, create incentives for product and process innovations (Bocquet et al., 2013). In short, we argue that green innovation within MNC subsidiaries is stimulated by a range of local stakeholder pressures (regulatory, market and societal) but that these pressures are mediated by the implementation of local EMS initiatives.

This paper makes several contributions to the literature. First and foremost, we identify the key role of EMS implementation in facilitating green innovation within MNC subsidiaries. Second, we focus on the MNC subsidiary as an entity which responds to local stakeholder pressures, and not just take directions from its parent company. The subsidiaries in our empirical analysis are located in twenty three different host countries, and are thus subject to a wide variety of stakeholder pressures. Third, we consider green process innovation and green product innovation as separate constructs, whereas most of the extant literature treats green innovation as a unitary concept.

The paper is structured as follows. In the next section, we review the empirical literatures on the determinants of green innovation and on corporate environmental initiatives in MNC subsidiaries. Drawing upon institutional theory and stakeholder theory, we then develop various hypotheses related to EMS implementation and green innovation in MNC subsidiaries. Our empirical analysis is based upon the primary data obtained from a questionnaire survey of Japanese MNC subsidiaries, and the following section contains information about the administration of the survey, the measurement of key variables, and the estimation methodology. We then present and discuss the empirical results. The final section discusses the implications of our findings, and suggests avenues for future work.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

There is a sizeable empirical literature on the determinants of green innovation, though much of it focuses on domestic firms in single-country settings - see Egri & Ralston (2008 and Holtbrügge & Dögl (2012) for excellent reviews. The empirical literature on the relationship between stakeholder pressures and green innovation shows mixed results. Berrone et al (2008) found that institutional pressures from regulatory bodies and normative actors were a crucial determinant of green innovation in US firms. Similarly, Frondel et al (2008) showed that regulatory stakeholder pressures bolstered green innovation and abatement activities. In contrast, Lin et al (2014) observed that stakeholder pressures from customers had a negative impact on green process innovation. Other studies were inconclusive. Jaffe & Palmer (1997) reported that regulatory stakeholder pressures had no bearing upon environmental innovation. Wagner (2007) reported that three separate groups of environmentally-concerned stakeholders had no discernible impact on green process and product innovations. And Wagner (2009) found no link between regulation and the creation of environmentally-beneficial product and process innovations

But there are only a few studies where MNC subsidiaries are the unit of analysis, and which focus on corporate environmental initiatives. Peng & Lin (2008) highlighted the effects of local stakeholder pressures on green management adoption in the Chinese subsidiaries of Taiwanese firms. Muller (2006) observed that the Mexican subsidiaries of four European MNCs (Scania, Volvo, Mercedes, and Volkswagen) had the freedom to develop and execute proactive environmental strategies aligned with the local institutional contexts. Tatoglu et al (2014) considered the adoption of voluntary environmental practices by MNC subsidiaries in Turkey. In addition, Yang & Rivers (2009) advanced various propositions about the adoption of CSR practices in overseas subsidiaries, but did not provide any empirical analysis.

This study thus fills a sizeable gap in the literature by focusing on the determinants of green innovation in MNC subsidiaries across a variety of host countries, and in highlighting the mediating role of EMS implementation. Our theoretical model of green innovation draws upon institutional theory and stakeholder theory. Institutional theory posits that firms' actions are influenced not just by their corporate objectives and competitive pressures, but also by their institutional/social environments – such environments embrace both formal rules and laws set by governments and other regulatory authorities (North, 1990) and informal constraints (norms of behavior, shared values, beliefs) supported by society at large (Di Maggio & Powell, 1983). Firms are obliged to conform to these rules and constraints in order to obtain acceptance from local society – failure to do may jeopardize the success of the firm (Scott, 2014). In particular, MNC subsidiaries need to understand and adapt to their foreign institutional environments if they are to achieve social acceptance and legitimacy (Rosenzweig & Singh, 1991; Westney, 1993; Kostova & Zaheer, 1999; Kostova et al, 2008). Thus, in the context of this paper, MNC subsidiaries need to recognize the importance of meeting local stakeholders' expectations (Zhao et al, 2014) in order to achieve financial success (Barnett & Salamon, 2012).

Stakeholder theory asserts that maintaining trust-based cooperation with a broad set of stakeholders is an inevitable part of organizational decision-making with respect to corporate strategy, corporate governance, and social and environmental management (Freeman, 1984; Hart, 1995). A stakeholder refers to "any group or individual who can affect or is affected by the achievement of the organization's objectives" (Freeman, 1984: 46). Following Delmas & Toffel (2004), Darnell et al (2008, 2010) identify the various stakeholder groups who are most likely to exert pressure on firms and thus influence their environmental practices, notably regulatory, market, and social actors. Darnall et al (2008: 366-7) suggest that regulatory pressures involve legal mandates for firms to attend to environmental issues and to

implement proactive environmental policies. Market pressures arise as industrial customers, household consumers and suppliers become increasingly aware of the natural environment, and exercise their power to encourage firms to adopt environmentally-friendly practices and/or eschew polluting activities. Social actors include environmental organizations, community groups, trade associations, and labor unions. These actors are able to mobilize public opinion, and thus instigate societal pressures on firms to reduce the adverse impact of their activities upon the natural environment. In practice, managers may need to balance heterogeneous and conflicting stakeholder interests.

Regulatory Stakeholder Pressures & EMS Implementation

The stakeholder management literature proposes that regulatory authorities enforce laws and rules that minimize the effect of negative externalities resulting from environmental pollution on the co-evolution of business organizations, markets, and society (Henriques & Sadorsky, 1996; Berchicci & King, 2007). Stakeholder pressures from regulatory authorities are considered to enhance environmental performance (Eiadat et al, 2008) and self-regulation of environmental compliance (Christmann & Taylor, 2006) as environmental regulations appear as a crucial factor for developing proprietary pollution prevention capabilities. Furthermore, Berrone et al (2013) and Menguc et al (2010) note that firms formulate and implement environmental management policies to improve their social legitimacy and acceptance in the eyes of public authorities. In a survey of more than 580 US manufacturing plants, Florida & Davison (2001) found that over 80% of the respondents considered state and federal regulations as the most important pressures to undertake innovative environmental actions. Similar results were reported by Florida (1996) and Henriques & Sadorsky (1996).

There are several reasons to expect a positive association between regulatory stakeholder pressure and EMS implementation. First and foremost, regulatory stakeholders may have the power to impose sanctions, legal penalties, taxation, and litigation costs on firms violating regulatory requirements regarding environmental protection (Darnall, 2008, 2010; Fraj-Andrés et al., 2009; Markus et al, 2011). Second, Sharma et al. (2007) note that changing regulatory demands associated with environmental sustainability increase both the complexity and the uncertainty of firms' business environments and thus prompt managers to constantly cultivate new resources and innovative strategies in a more timely fashion. Berry & Rondinelli (1998) argue that the cost of devising, developing, and executing proactive environmental strategies that meet environmental protection expectations in a self-fulfilling manner is considerably lower than with the cost involved in overcoming the complexity of regulatory demands by public authorities. Third, McWilliams & Siegel (2001) argue that various regulatory bodies have the ability to reward firms with proven environmental awareness by stimulating demand through consumption of environmentally-friendly products. Fourth, Porter & Van der Linde (1995) suggest that strict environmental regulations may improve firms' resource productivity by prompting them to engage in the continuous development of new green competencies. Furthermore, firms with specific green technologies will tend to lobby for higher regulatory standards to raise the costs and block the entry of rivals who do not possess similar resources and capabilities (Puller, 2006).

Past empirical studies confirm that regulatory stakeholder pressures are associated with EMS implementation (Darnall et al, 2008). Frondel et al (2008) found that strict environmental regulations advanced management's decision to adopt EMS in a sample of 899 German manufacturing firms. And Darnall et al (2010) showed that regulatory stakeholder pressures increased the degree of environmental proactivity in a study of 907 firms in six

Organization for Economic Cooperation and Development (OECD) countries. We thus put forward the following hypothesis:

H1: Regulatory stakeholder pressures are positively associated with EMS implementation in MNC subsidiaries

Market Stakeholder Pressures & EMS Implementation

The growth of market stakeholders who are environmentally conscientious stems from the enhanced availability of environmental information (Darnall et al, 2008). Further, with increased environmental awareness, customers have been exerting increasing pressure on companies to undertake a series of environmentally responsible actions (Buysse & Verbeke, 2003; Christmann, 2004; Darnall et al, 2008, 2010; Menguc et al, 2010). It is widely recognized that such customer requirements act as forces coercing firms to adopt appropriate environmental behavior (Delmas & Toffel, 2004). Furthermore, industrial clients and commercial buyers are key agents in terms of the diffusion of environmental management practices (Delmas & Toffel, 2004) and close cooperation with these market actors further facilitates organizational imitation on environmental issues (Lie et al, 2010).

There are four main reasons to expect a positive association between market stakeholder pressures and EMS implementation. First, the environmental management literature highlights that customers are very likely to reward firms' environmental proactivity by renewing their selling agreements and "buy-cotting" green products and services (Darnall et al, 2010). In contrast, when firms use polluting technologies and fail to reduce physical waste, they may be subjected to high levels of public boycotts directly resulting in decreased sales volume and competitiveness (Henriques & Sadorsky, 1999). Second, customers may even go further and punish polluting firms through initiating legal actions (Menguc et al, 2010: 9). Third, industrial customers often exploit their resource interdependencies to exert

direct influence over firms' resource allocation decisions (Frooman, 1999). Fourth, corporate reputations are important intangible resources, and so firms must ensure that they meet the expectations and claims of market stakeholders (Branco & Rodrigues, 2006) to increase moral capital (Kane, 2001).

Past empirical studies confirm that market stakeholder pressures are associated with EMS implementation. According to the UN Global Compact-Accenture Study (Accenture, 2010), 58% of CEOs recognize that customers shape firms' management of environmental demands. Similarly, Florida (1996) reported that serving key customers was as important an important factor as conforming to environmental regulations. Menguc et al (2010) report that New Zealand manufacturing firms operating in a variety of industries adopt more environmental practices when they face greater customer sensitivity to environmental issues. Fraj-Andrés et al (2009) showed that customers' awareness regarding the relevance of environmental initiatives has influenced the corporate environmental strategies of Spanish industrial firms. We thus put forward the following hypothesis:

H2: Market stakeholder pressures are positively associated with EMS implementation in MNC subsidiaries

Societal Stakeholder Pressures & EMS Implementation

Social actors such as environmental organizations, community groups, trade associations and labour unions play important roles in monitoring the ways in which firms implement and promote environmental policies. Both Henriques & Sadorsky (1999) and Darnall et al (2008) emphasize the rising coercive power of such social actors as a major source of pressure on the environmental conduct of firms, whilst Delmas & Toffel (2004) point out that the need to promote good corporate citizenship and dedicated community relations fosters firms' decisions to implement environmental sustainable practices.

There are several reasons to expect a positive association between societal stakeholder pressures and EMS implementation. First, environmental-concerned NGOs act as catalysts for shaping and introducing codes of conduct and international environmental standards (Doh & Guay, 2004). Second, such NGOs affect the public awareness of environmental issues through the dissemination of green information (Hoffman, 2000) and the establishment of stakeholder forums that inspire participants to notice the importance of environmental sustainability (Sharma et al., 2007). Third, NGOs may also directly punish firms with polluting activities by filing lawsuits (Henriques & Sadorsky, 1996) or by mobilizing people to participate in protest campaigns (Darnall et al, 2008; Sharma & Henriques, 2005). Fourth, social groups may directly influence patterns of resource flows toward firms, particularly when firms' environmental actions are detrimental to public welfare (Kassinis & Vafeas, 2006). In short, firms are obliged to implement environmental management policies to improve their social legitimacy (Berrone et al, 2013).

These societal pressures will be all the stronger for MNC subsidiaries. MNC subsidiaries must meet higher environmental management standards than their local counterparts as their visibility frequently tends to capture the attention of the media and social groups (Peng & Lin, 2008; Tatoglu et al, 2014). Furthermore, corporate involvement in environmental protection at the subsidiary level may affect not only the subsidiary involved but the entire MNC; an MNC's environmental negligence in one country may be detrimental to the reputation and image of the MNC as a whole as well as of subsidiaries in other countries (Christmann, 2004). Two distinctive examples of this phenomenon were Shell's critical confrontation with Greenpeace over the Brent Spar case in 1995 (Yang & Rivers, 2009), and the BP oil spill disaster in the Gulf of Mexico in 2010 (Freudenburg & Gramling, 2011).

Past empirical studies confirm that societal stakeholder pressures are associated with EMS implementation. It is empirically recognized that societal stakeholder influences have a positive impact on a company's environmental proactivity (Freeman, 1984; Darnall et al, 2008, 2010; Fraj-Andrés et al, 2009). Henriques & Sadorsky (1996) showed that social group pressures increased in the likelihood of firms adopting a comprehensive environmental plans, and that the perceived importance of societal stakeholders was highest for managers in firms proactively addressing environmental issues. Perez-Batres et al (2012) found that community pressures exerted positive impacts on firms' intentions to pursue both substantive CSR and symbolic CSR policies. We thus put forward the following hypothesis:

H3: Societal stakeholder pressures are positively associated with EMS implementation in MNC subsidiaries

EMS Implementation & Green Innovation

In this section, we develop two hypotheses linking EMS implementation by MNC subsidiaries directly to green product and green process innovation. Many scholars have argued that EMS implementation fosters a firm's organizational capabilities such as continuous innovation, stakeholder integration and high-order learning (Demirel & Kesidou, 2011; Kesidou & Demirel, 2012; Sharma & Vredenburg, 1998). When firms design and develop corporate environmental policies, they are more likely to strive to get ahead of minimum requirements through proactively improving technological innovations with high environmental benefits such as end-of-pipeline pollution control technologies and integrated cleaner production technologies (Demirel & Kesidou, 2011; Kesidou & Demirel, 2012; Hart, 1995). Furthermore, the systemic nature of EMS implementation is likely to assist organizations in consistently instructing employees to run operations in line with environmental requirements (Vidal-Salazar et al, 2012). Florida & Davison (2001), suggest that firms with high EMS adoption are innovative as they implement advanced quality

management programs, foster environmental information sharing, and attach importance to reducing community environmental risk. Moreover, proactivity in environmental management leads firms to identify potential sources of pollutant emissions and chemical spills, and, in turn, respond to negative environmental effects more innovatively.

The empirical literature provides evidence that green innovations are driven by the organizational capabilities associated with EMSs (Horbach, 2008; Wagner, 2007, 2008). Dangelico & Pujari (2010) found that the development of green products and processes in a sample of Canadian and Italian SMEs was determined by formalizing a firm's environmental value and targets into official documents. Kesidou & Demirel (2012) identify the positive effects of EMS on investments in environmental research and development. Likewise, Rehfeld el al (2007) showed that (ISO14001 or EMA) certification triggered environmental product innovations in a sample of German manufacturing firms. We thus propose the following hypotheses:

H4a: EMS implementation is positively associated with green product innovation in MNC subsidiaries

H4b: EMS implementation is positively associated with green process innovation in MNC subsidiaries

Our theoretical model is as shown in Figure 1.

***** Figure 1 about here *****

DATA AND METHODOLOGY

The dataset used for the empirical analyses was constructed from the responses obtained from 123 North American and European subsidiaries of Japanese manufacturing MNCs. Notwithstanding the fact that some environmental laws and regulations are common both within and between the two host regions, the quality of the environmental institutions

still varies considerably (Aguilera-Caracuel et al, 2012). We focus on manufacturing subsidiaries as manufacturing activities typically generate more contaminants than other (e.g. service) activities (Stites & Michael, 2011), and hence such subsidiaries should be more sensitive to stakeholder pressures. We have also limited the sample to MNCs from one home country (Japan) to avoid potential country-of-origin effects, and effects due to variations in cultural/institutional distances between home and host countries, that might impact upon subsidiary decision-making. The choice of Japanese MNCs was motivated in part by data availability, but also because Japanese MNCs are noted for their greater attention to environmentally-benign manufacturing, energy conservation and post-industrial recycling than their US and European counterparts (Gutowski et al, 2005).

In this section, we first detail how the questionnaire survey was administered. We then explain how the constructed variables and the control variables were measured, and also outline the measures taken to avoid common method bias. The estimation methodology is then briefly discussed, and the section concludes with some descriptive and diagnostic statistics.

Administration of the Questionnaire Survey

The questionnaire was designed following a careful review of the extant literature in international business and environmental management. English and Japanese versions of the questionnaire were prepared by the first author. The English-based survey was translated by a professional translation company into Japanese. Two native speakers with fluency in both Japanese and English then proof-read the Japanese version of the questionnaire and back-translated it into English (Dawson & Dickinson, 1988). No significant differences were observed in terms of the accuracy of the back-translated sentences. Before mailing the survey

to the respondents, three Japanese subsidiary managers were contacted in April 2013 and requested to verify the validity and clarity of a draft version.

A random sample of 1000 Japanese MNC subsidiaries in North America and Europe was identified from the 2013 version of *The Tôyô Keizai Kaigai Shinshutsu Kigyô Sôran* (Toyo Keizai, 2013), and the same publication was also used as the source for the names of directors who had been involved in strategic choices regarding the environmental initiatives undertaken by their subsidiaries. Questionnaires were mailed to these 1000 directors in mid-May 2013, but 20 were undeliverable. Non-respondents were reminded by e-mail or telephone one month after the mailing. 123 completed questionnaires were received, equivalent to an effective response rate of 12.6%. This response rate was similar to those obtained in comparable studies (e.g. Ben Brik et al., 2011: 13%; De Giovanni & Esposito Vinzi, 2012: 10%), and in line with typical response rates (6% - 16%) in international mail surveys (Harzing, 1997). Bansal & Roth (2000) have also commented on the difficulties of obtaining data from Japanese firms regarding managerial perceptions of corporate environmental responsiveness.

Comparisons of early and late respondents with regard to subsidiary size and subsidiary age were made to check for non-response bias (Armstrong & Overton, 1977), but t-tests revealed no statistically significant differences. Non-response bias was thus not deemed a serious issue. Some questions were unanswered on nine of the 123 questionnaires. As the sample size was not large, we decided not to delete these cases but instead to use an expectation maximization (EM) algorithm to impute missing values (Roth, 1994). This technique is superior to alternative approaches such as mean substitution, pairwise deletion, and non-stochastic imputation (Schafer & Graham, 2002).

The Constructed Variables

Three groups of questions related to stakeholder pressures were included in the questionnaire – see the Appendix. *Regulatory stakeholder pressures* were assessed by asking the respondents to indicate the extent of their agreement with eight statements, adapted from a survey by Menguc et al (2010). Each statement was rated using a 5-point Likert scale ranging from 1 ("completely disagree") to 5 ("completely agree"). The average score for the eight statements was calculated to obtain a composite measure: the average was 3.36 (sd = 0.72). *Market stakeholder pressures* were measured by asking the respondents to respond to nine items assessing the degree to which customers are sensitive to a set of company environmental practices (Menguc et al, 2010) using a 5-point Likert scale ranging from 1 ("customers do not care") to 5 ("customers are very concerned"). The average was 3.42 (sd = 0.88). *Societal stakeholder pressures* were measured by asking the respondents to answer the three questions used in the study of Darnall et al (2010) regarding the importance of environmental groups, community organizations, and labor unions on the process of designing, developing, and executing firm environmental policies. A 3-point Likert scale, where 1 is "not important" and 3 is "very important", was used for measurement. The average was 1.97 (sd = 0.47).

Subsidiary-level data on the implementation of environment management systems are not publicly available (Delmas & Toffel, 2004), hence this outcome was assessed in the survey by a set of six statements – see the Appendix – based on Darnall et al. (2010). A 5-point Likert scale, where 1 is "completely disagree" and 5 is "completely agree", was used for measurement. The average was 3.31 (sd = 0.90). Several previous studies (e.g., Frondel et al, 2008; Horbach et al, 2012; Ortiz-de-Mandojana et al, 2012; Ziegler & Nogareda, 2009) have measured EMS implementation using a dichotomous variable based on ISO14001 or EMAS certification, but we believe our multi-dimensional measure is more comprehensive and more attuned to the notion of environmental management (Amores-Salvadó et al, 2015).

Finally there were two groups of questions related to green innovation – see the Appendix. Past research has relied largely on the use of a single indicator to assess the level of green innovation strategies (e.g., Dangelico & Pujari, 2010; Eiadat et al, 2008), but here we distinguish between green product innovation and green process innovation. Drawing on the survey by Chen et al (2006), *green product innovation* was measured by asking the respondents to assess their perceptions of an environmental strategy using a five-point Likert scale ranging from 1 ("completely disagree") to 5 ("completely agree"). The average score was 3.70 (sd = 0.82). Also based upon Chen et al (2006), *green process innovation* was measured by asking the respondents to assess the extent to which they agreed with four statements, based on a five-point Likert-type scale ranging from 1 ("completely disagree") to 5 ("completely agree"). The average was 3.75 (sd = 0.73).

Common Method Variance

The questionnaire items were based upon perceptual evaluations, so it is necessary to consider common method variance. We minimized *ex ante* the possibility of common method bias in several ways. First, we guaranteed the confidentiality and anonymity of all data in a personalized cover letter to each respondent so as to reduce social desirability bias (Chang et al, 2010). Second, as proposed by Chang et al (2010), the order of the questions was randomized so that the respondents could not perceive the detailed content of each construct. Third, following Podsakoff & Organ (1986) and Podsakoff et al. (2003), we carefully trimmed our questionnaire items to promote clarity and increase respondents' comprehension. In addition, we adopted the marker variable technique as a *post hoc* statistical remedy (Conway & Lance, 2010; Lindell & Whitney, 2001; Malhotra et al, 2006). We included employee performance as a theoretically-unrelated marker variable in our model: none of the statistically significant partial correlations between the constructs lost significance after the

adjustment, hence common method bias was not a serious issue. We also checked *ex post* for common method bias by Harman's (1967) single factor test (Podsakoff & Organ, 1986; Podsakoff et al, 2003). All the items underpinning the independent and dependent variables were loaded on a one-factor model: the proportion of the variance explained by the first factor did not exceed 50% indicating again that common method variance was not a major issue.

The Control Variables

Three additional control variables were included in the model. First, we included the size of the MNC subsidiary, measured by the natural logarithm of the total number of local employees. From the resource-based perspective, subsidiary size can be taken as a proxy for resource availability and indicates the extent to which subsidiaries have the ability to implement comprehensive environmental policies (Aragón-Correa, 1998). Our second control variable is a subsidiary's *innovation capabilities*. Existing research provides evidence that innovation capabilities are related positively to proactive environmental strategy (Cole et al, 2006; Sharma et al., 2007) and eco-innovations (Berrone et al., 2013). We used Wang and Bansal's (2012) four-item 5-point Likert scale – see the Appendix - to measure innovation capabilities ($\alpha = 0.846$) The third control variable was the subsidiary's long-term orientation (LTO). We expect that subsidiaries with long-term orientations are able to obtain strategic resources and social legitimacy from internal and external stakeholders through CSR activities (Wang & Bansal, 2012), and are thus more likely to undertake green innovations. Following Wang and Bansal (2012), we measured LTO by asking respondents to state their agreement with four statements – see the Appendix - based on a 5-point Likert scale ($\alpha = 0.718$).

Estimation Methodology

The hypotheses were tested using partial least squares (PLS) regression[2], a variance-based approach more suitable for structural measurement models than covariance-based structural equation modelling (SEM) methods (Hair et al., 2011). The use of PLS regression is advantageous for three reasons: First, PLS regression does not require the application of restrictive assumptions in terms of sample size and multivariate normality distribution (Wold, 1982). Second, PLS regression yields more accurate and rigorous parameter estimates, particularly when models are complex because of the inclusion of many measurement items per variable (Hair et al, 2011; Hair et al, 2012). Third, PLS regression enables simultaneous assessment of statistical significance when multiple dependent variables exist in the model. All the PLS regression analyses were performed using SmartPLS 2.0 software (Ringle et al, 2005).

Descriptive & Diagnostic Statistics

The 143 subsidiaries in the sample operated in 23 host countries: the most popular countries were the United States (21), the Czech Republic (18), the United Kingdom (17), Germany (10), Hungary (7) and Poland (7) – see Table 1. The subsidiaries were generally large firms (673.7 employees on average) with long histories of business operations in their host economies (21.6 years on average).

***** Table 1 about here *****

The Cronbach's alpha values for all six constructed variables were deemed acceptable as they all exceed the 0.60 criteria (Morrison, 1976; Nunnally, 1978) – see Table 2. The means and partial correlation coefficients are shown in Table 3. Clearly the subsidiaries have been active in green innovation, with mean values of 3.70 and 3.75 for product and process innovation respectively. The variance inflation factor (VIF) values for all explanatory

[2] See Ciabuschi et al (2014) and Fey et al (2009) for other examples of the use of PLS regression in IB research.

variables were all lower than ten, confirming that multicollinearity was not likely to be a problem (Myers, 1990). Appropriate discriminant validity exists when the correlation between a construct and the square root of the average variance extracted (AVE) value is greater than the correlation between a construct and any other construct (Fornell & Larcker, 1981). As shown in Table 2, the convergent validity of the measures was observed to be satisfactory, as the AVE values of all the constructs exceeded the cut-off value of 0.50 (Fornell & Larcker, 1981). Moreover, internal reliability was assured as the composite reliability values of the constructs were higher than the threshold of 0.70. The PLS analysis revealed that the standardized factor loadings were all above the 0.50 threshold (Falk & Miller, 1992) suggesting that convergent validity was assured for all constructs.

***** Tables 2 & 3 about here *****

In addition, we also conducted confirmatory factor analyses using LISREL 9.1 to assess the overall model fit (Jöreskog & Sörbom, 2012). The chi-square for the model was statistically significant (χ^2=1092.99, p-value < 0.01). Other goodness-of-fit statistics also met the acceptable values suggested by MacCallum et al (1996) and Hu & Bentler (1999): the comparative fit index [CFI] = 0.941; the incremental fit index [IFI] = 0.941; the root mean square error of approximation [RMSEA] = 0.0796; and the non-normed fit index [NNFI] = 0.936. These indices confirm that the model is consistent with the data. The R^2 values are used to assess the goodness-of-fit of the three sets of relationships within the model (Hulland, 1999) – see Table 3. The value of R^2 for the link between stakeholder pressures and EMS implementation was 0.402; the value of R^2 for the link between EMS implementation and green product innovation was 0.260; and the value of R^2 for the link between EMS implementation and green process innovation was 0.336. The average R^2 was 0.333, suggesting that our path model was acceptable (Chin, 1998), and that the explanatory variables account for a large percentage of the variance in the dependent variables.

EMPIRICAL RESULTS

Table 4 shows the path coefficients estimated from the PLS structural model using a bootstrapping method. All path coefficients can be interpreted in the same way as β-statistics from Ordinary Least Squares (OLS) regression. The results demonstrate that regulatory stakeholder pressures are positively and very significantly related to EMS implementation ($\beta = + 0.632$, $p < 0.01$). Thus, hypothesis H1 is strongly supported. Societal stakeholder pressures are also positively associated with EMS implementation ($\beta = + 0.067$, $p < 0.1$), but the coefficient is small and is not statistically significant so hypothesis H3 is not supported. There is some evidence in the literature (e.g. Frooman, 1999; Sharma & Henriques, 2005) that societal stakeholders exert their influence on firms more indirectly through lobbying governments to exercise regulatory threats and enact legislation (Frooman, 1999; Sharma & Henriques, 2005). Our results are consistent with this supposition, though they clearly do not confirm it. The most surprising result is that market stakeholder pressures are negatively associated with EMS implementation ($\beta = - 0.032$, $p < 0.1$), but the coefficient was very small and not statistically significant. Hypothesis H2 was not supported. We can advance two possible reasons for this unexpected finding. First, many contemporary manufacturing processes are carried out within global value chains (Lin & Ho, 2011), and it is likely that the final customers are located in countries other than those in which at least some of the processes took place. Thus the links between the market stakeholders and the manufacturing firms are likely to be spatially-dispersed and may involve the use of independent subcontractors, hence market stakeholder pressures may be difficult to focus appropriately. The second reason is that our questionnaire does not distinguish between different types of customers. Industrial customers may be less concerned with environmental initiatives and more concerned with reducing costs, whilst household customers may have a greater interest

in green innovations. Future work should try and differentiate between these two sets of market stakeholder pressures.

***** Table 4 about here *****

EMS implementation has a positive and statistically significant effect upon green product innovation (β = + 0.277, $p < 0.01$): hypothesis H4a is strongly supported. Furthermore EMS implementation also has an even more positive and statistically significant effect upon green process innovation (β = + 0.440, $p < 0.01$), thus lending strong support to hypothesis H4b.

These results thus lend support to our contention that green innovation within MNC subsidiaries is stimulated by local (notably regulatory) stakeholder pressures but that these pressures are mediated by the implementation of local EMS initiatives. We also performed a Sobel test (Sobel, 1982) to verify whether our mediated model provides better explanatory power than an alternative model that envisages the stakeholder pressures having direct impacts on green innovation. The results of this test confirm that EMS implementation does indeed have a very significant ($p < 0.01$) mediating effect upon the relationship between regulatory stakeholder pressures in the host countries and green (product and process) innovation by MNC subsidiaries. Finally, with regard to the control variables, we found that long-term orientation has a strong and significant effect on green process innovation (β = + 0.185, $p < 0.05$), whilst subsidiary innovative capabilities had a strong but weakly significant influence on green product innovation (β = + 0.207, $p < 0.1$).

DISCUSSION AND CONCLUSIONS

Multinational corporations and their subsidiaries are often viewed not just as the cause of, but also as potential solutions to, global environmental challenges (Christmann & Taylor, 2002; Tatoglu et al, 2014). In many host countries, MNC subsidiaries are considered as key

sources of the technical and financial capital required to respond to environmental problems in the local economy (Christmann & Taylor, 2002). Furthermore, MNCs may stimulate the social and environmental awareness of the indigenous population, influencing public organizations to implement stringent environmental requirements in host countries (Aguilera-Caracuel et al, 2012; Kolk & van Tulder, 2010) and to promote more ecologically-sustainable development (Kolk & van Tulder, 2010; Peng & Lin, 2008). Yet, notwithstanding the increased scrutiny of the environmental management practices of MNC subsidiaries, the academic literature on these issues is relatively scarce (Kolk & Van Tulder, 2010; Rodriguez et al, 2006).

This paper addresses the issue of how MNC subsidiaries react to these pressures and how they respond in terms of green (product and process) innovation. We contribute to the international business and environmental management literatures by providing the first analysis of the determinants of green innovation in MNC subsidiaries, demonstrating how this innovation is influenced by local host country stakeholder pressures, and showing how these effects are mediated by the implementation of subsidiary EMS initiatives. Findings suggest that no matter how rigorous stakeholder pressures a subsidiary is subject to, without highly developed environmental systems, the subsidiary's superior green innovative performance is less likely to be achieved.

The findings of this study have implications both for MNC subsidiary managers and for policy-makers in host countries. The MNC subsidiary managers need to be aware that environmental proactivity may not only be "good business" (even after taking account of the additional costs outlined in the Introduction) but can also be a means to gain social legitimacy in host countries. Meeting a wide range of stakeholder expectations regarding environmental protection in host countries is an essential component of corporate strategy. For their part, policy-makers wishing to address environmental challenges in their host countries should

recognize the potential contribution of MNC subsidiaries, and not just mobilize relevant local stakeholders to exert pressure on the subsidiaries but also promote green innovation by those subsidiaries through encouraging the implementation of formal EMS initiatives. This might be effected by encouraging cooperation between local niche players and leading global MNCs to spur the invention of more advanced green technologies. Another possibility might be the implementation of legislation to embed not only local firms but also local scientists in green and global value chain systems governed by large MNCs.

The analysis in this paper suffers from a number of limitations which highlight potential avenues for future research. First, the sample size (n = 123) is relatively small which limits the power of the statistical tests, and rules out estimations of the model for sub-samples. The data have been obtained through primary research and the questionnaire response rate is in line with similar prior studies, but a larger sample of respondents would be welcome. Second, the data come from the North American and European subsidiaries of Japanese MNCs. There were good reasons (explained above in the Data & Methodology section) for choosing the sample in this way, but there are inevitable questions about the generalizability of the results. Future researchers might consider undertaking a survey of subsidiaries in other (possibly less advanced) host country settings, considering MNCs from a range of home countries, and incorporating explicitly measures of cultural/institutional distance in the empirical analysis. Third, the data came from a cross-section of MNC subsidiaries at one point in time. As Freeman (1984) suggests, managerial perceptions of stakeholders' salience changes over time, and it would be interesting to explore the dynamic nature of the stakeholder pressure – green innovation nexus through longitudinal research designs. This would also enable consideration of endogeneity and reverse causation. EMS implementation may lead to more green innovation, but it is possible that more eco-innovations shape subsidiaries' implementation of EMS.

Fourth, our analysis has focused on the impact that host country stakeholder pressures have on the green innovation performance of MNC subsidiaries. There is plenty of anecdotal evidence that the overseas subsidiaries of Japanese MNCs do have considerable autonomy with regard to their environmental policies and initiatives. For example, Daikin Europe (DENV) is famous for taking the lead in the development of eco-friendly heat pump systems (Daikin, 2015). DENV now functions as a center of excellence and its knowledge pertaining to renewable energy is transferred to other subsidiary units in North America and Asia (Watanabe, 2015). Denso Manufacturing Hungary (DMHU) becomes a green pioneer in cutting the amount of its waste sent to landfill to zero within Denso Corporation's global network and received the 2004 Management Award for Sustainable Development (European Commission, 2004). Yazaki Saltano de Ovar Productos Eléctricos Lda (YSP) autonomously implemented operations to collect and recycle organic solvent, with the result that their waste disposal costs were reduced to zero (Yazaki, 2004). And Toyota Motor Manufacturing (UK) installed in 2010 Britain's largest solar photovoltaic panels to enhance energy performance (Toyota Motor Corporation, 2012). Furthermore, our empirical findings confirm that green (product and process) innovation in MNC subsidiaries is associated with local EMS implementation which is in turn associated with local regulatory stakeholder pressures. These findings confirm that the MNC subsidiaries are indeed responsive to their local institutional environments. Nevertheless future work might also consider any simultaneous diffusion of green initiatives from the parent companies (and/or from sister subsidiaries, as in the Daikin example above). Fifth, we have highlighted green product and process innovation, but similar analyses could focus on green marketing (Pin & Lin, 2008) or green managerial innovations (Chiou et al, 2011).

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Table 1: The Host Countries of the Japanese MNC Subsidiaries

Host Country	Frequency	Percentage
United States of America	21	17.1
Czech Republic	18	14.6
United Kingdom	17	13.8
Germany	10	8.1
Hungary	7	5.7
Poland	7	5.7
France	6	4.9
Netherlands	6	4.9
Canada	4	3.3
Belgium	3	2.4
Portugal	3	2.4
Spain	3	2.4
Turkey	3	2.4
Italy	2	1.6
Mexico	2	1.6
Romania	2	1.6
Russia	2	1.6
Sweden	2	1.6
Denmark	1	0.8
Ireland	1	0.8
Montenegro	1	0.8
Slovakia	1	0.8
Switzerland	1	0.8
Total	123	100.0

Table 2: The Constructed Variables

Variable	Number of items	Range of loadings	AVE	Composite reliability	Cronbachs alpha	R-squared
Regulatory stakeholder pressures	8	0.457-0.844	0.514	0.892	0.864	-
Market stakeholder pressures	9	0.763-0.905	0.681	0.950	0.941	-
Socetal stakeholder pressures	3	0.581-0.848	0.555	0.785	0.610	-
EMS implementation	9	0.503-0.812	0.498	0.897	0.870	0.402
Green product innovation	4	0.762-0.901	0.666	0.888	0.831	0.260
Green process innovation	4	0.630-0.834	0.548	0.828	0.727	0.336

Notes: (1) Sample size N = 123
(2) AVE = Average Variance Extracted

Table 3: The Correlation Matrix

Variable	Mean	SD	1	2	3	4	5	6	7	8	9
1 Regulatory stakeholder pressures	3.36	0.72	**0.717**								
2 Market stakeholder pressures	3.42	0.88	0.637	**0.825**							
3 Societal stakeholder pressure	1.97	0.47	0.299	0.236	**0.745**						
4 EMS implementation	3.31	0.90	0.582	0.329	0.214	**0.706**					
5 Green product innovation	3.70	0.82	0.422	0.408	0.118	0.378	**0.816**				
6 Green process innovation	3.75	0.73	0.439	0.366	0.024	0.477	0.671	**0.741**			
7 Subsidiary size (log)	2.39	0.57	0.206	0.012	0.238	0.322	0.264	0.211	**1.000**		
8 Subsidiary innovative capabilities	2.98	0.75	0.380	0.323	-0.055	0.184	0.340	0.279	0.056	**0.827**	
9 Subsidiary long-term orientation	3.44	0.78	0.419	0.299	0.134	0.240	0.325	0.326	0.139	0.607	**0.739**

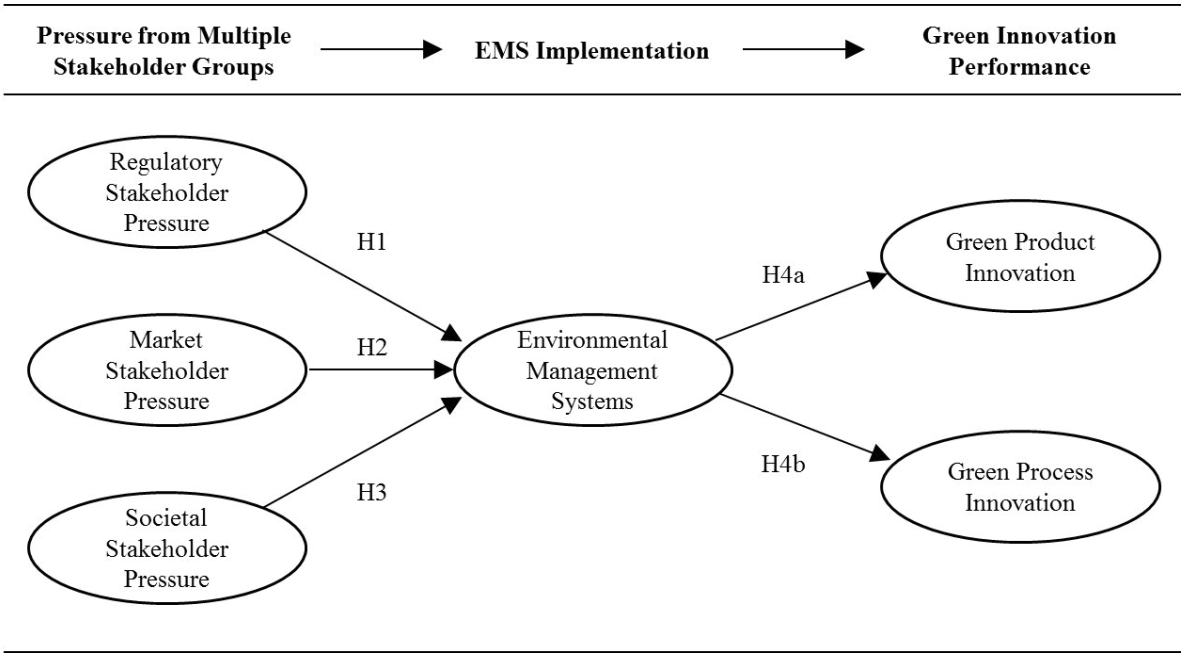
Notes: (1) Sample size N = 123
(2) The figures in bold type indicate the square root of the average value extracted (AVE)
(3) All variables are measured using 5-point Likert scales except for societal stakeholder pressures (3-point Likert scale) and subsidiary size (number of employees).

Table 4: Partial Least Squares (PLS) Parameter Estimation

Path from			To	Path coefficient	T-statistics	Significance
H1	Regulatory stakeholder pressure	→	EMS implementation	0.632	6.662	***
H2	Market stakeholder pressure	→	EMS implementation	-0.032	0.335	
H3	Societal stakeholder pressure	→	EMS implementation	0.067	0.866	
H4a	EMS implementation	→	Green product innovation	0.277	2.682	***
H4b	EMS implementation	→	Green process innovation	0.440	5.817	***

Notes: (1) Sample size N = 123
(2) Levels of significance: * = 10%; ** = 5%; *** = 1%.

Figure 1: The Proposed Theoretical Model



APPENDIX: The Survey Questionnaire

Green product innovation (4 items; 5-point Likert scale: 1 = strongly disagree, 5 = strongly agree)

1. The company chooses the materials of the product that produce the least amount of pollution for conducting the product development or design.
2. The company chooses the materials of the product that consume the least amount of energy and resources for conducting the product development or design.
3. The company uses the fewest amounts of materials to comprise the product for conducting the product development or design.
4. The company would circumspectly deliberate whether the product is easy to recycle, reuse, and decompose for conducting the product development or design

Green process innovation (4 items; 5-point Likert scale: 1 = strongly disagree, 5 = strongly agree)

1. The manufacturing process of the company effectively reduces the emission of hazardous substances or waste.
2. The manufacturing process of the company recycles waste and emission that allow them to be treated and re-used.
3. The manufacturing process of the company reduces the consumption of water, electricity, coal, or oil.
4. The manufacturing process of the company reduces the use of raw materials.

Regulatory stakeholder pressures (8 items; 5-point Likert scale: 1 = strongly disagree, 5 = strongly agree)

1. The release of substances into the environment is very intensely regulated.
2. The protection of natural habitats is very intensely regulated.
3. The use of renewable natural resources is very intensely regulated.
4. The use of non-renewable natural resources is very intensely regulated.
5. The elimination of physical waste is very intensely regulated.
6. The environmentally safe disposal of physical waste is very intensely regulated.
7. The disclosure of environmental information is very intensely regulated.
8. The clean-up of environmental accidents is very intensely regulated.

Market stakeholder pressures (9 items; 5-point Likert scale: 1 = customers do not care, 5 = customers are very concerned)

How concerned are customers about the:

1. The release of substances into the environment?
2. The protection of natural habitats?
3. The sustainable use of renewable natural resources?
4. The conservation of non-renewable natural resources?
5. The elimination of physical waste?
6. The reduction of physical waste?
7. The environmentally safe disposal of physical waste?
8. Purchasing environmentally safe products?
9. Understanding the environmental impacts of the products they use or purchase?

Societal stakeholder pressures (3 items; 3-point Likert scale: 1 = not important, 2 = moderately important, 3 = very important)

How influential are:

1. Environmental groups in the process of designing, developing and executing your environmental policies?
2. Community organizations in the process of designing, developing and executing your environmental policies?
3. Labor unions in the process of designing, developing and executing your environmental policies?

EMS implementation (9 items; 5-point Likert scale: 1 = strongly disagree, 5 = strongly agree)

1. The firm has a written environmental policy.
2. The firm benchmarks environmental performance.
3. The firm uses environmental accounting.
4. The firm has a public environmental report.
5. The firm has environmental performance indicators/goals.
6. The firm carries out external environmental audits.

7. The firm carries out internal environmental audits.
8. The firm has environmental training programmes.
9. The firm uses environmental criteria in the evaluation and/or compensation of employees.

Subsidiary innovation capabilities (4 items; 5-point Likert scale; 1 = strongly disagree, 5 = strongly agree)
Compared with our major competitors:

1. Our subsidiary introduced much more new lines of products/services in the past three years.
2. The products/services our subsidiary introduced were much newer.
3. Our subsidiary introduced more new processes /operating technologies in the past three years.
4. The processes/operating technologies our subsidiary introduced were much newer.

Subsidiary long-term orientation (4 items; 5-point Likert scale; 1 = strongly disagree, 5 = strongly agree)

1. Our subsidiary's criteria for resource allocation largely reflect long-term considerations
2. Our subsidiary emphasizes basic research to build future competitive edge
3. As our subsidiary defines strategies, we generally emphasize long-term (over 5 years) goals and strategies.
4. As our subsidiary defines strategies, our major concern is how to build future competitive advantage.