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Ha, Yoo Jung and Wei, Yingqi (2019) Dual isomorphic mechanisms and the role of a transnational agent: How foreign MNEs affect environmental innovation in domestic firms. *Multinational Business Review*. pp. 266-284. ISSN: 1525-383x

<https://doi.org/10.1108/MBR-06-2017-0035>

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Dual isomorphic mechanisms and the role of a transnational agent: How foreign MNEs affect environmental innovation in domestic firms¹

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Abstract

Purpose - Corporate environmental innovation (CEI) is a proactive type of response to increasing public scrutiny regarding firms' environmental performance. Whilst past studies have overwhelmingly focused on coercive mechanisms and assumed a closed national institutional field, less attention has been given to non-coercive and transnational inter-firm mimetic mechanisms. This paper investigates the joint effect of coercive isomorphic mechanisms from domestic institutions and mimetic isomorphic mechanisms from foreign multinational enterprises (MNE) on corporate environmental innovation (CEI) adoption in domestic firms.

Design/methodology/approach - Our empirical analysis is based on data from 1,967 firms from the 2010 Korean Innovation Survey (KIS), as well as other official statistics.

Findings - This study reports the following results: 1) the direct effects of domestic institutions on CEI adoption in domestic firms vary according to institution type, 2) Foreign MNEs have a positive effect, whether using global or local CEI strategies, and 3) the positive effect of foreign MNEs strengthens when the stringency of domestic environmental regulation increases.

Originality/value - This paper shows that CEI diffusion is driven by both coercive institutional pressures and inter-firm mimetic mechanisms, including their joint effects. Foreign MNEs act as boundary-spanners that activate a dual isomorphic mechanism, affecting social as well as economic development in host countries. Finally, evidence of interaction between domestic coercive and transnational mimetic mechanisms supports the authors' contention that national institutional fields are increasingly interconnected.

Keywords Corporate environmental innovation (CEI), MNE, Coercive isomorphism, Mimetic isomorphism, Boundary-spanner, South Korea

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¹ This paper is forthcoming in *Multinational Business Review*.

² Yoo Jung Ha is grateful to The York Management School for awarding Pump Priming fund in 2015 and British Academy for BA/Leverhulm Small Research Grant in 2016-2017 (Ref. SG153087).

Introduction

Growing public concern about environmental protection has spurred increasing scrutiny of firm behaviour among external stakeholders (Holtbrügge and Dögl, 2012). While some firms take a reactive approach targeting immediate compliance, others adopt more proactive measures to exceed stakeholder demands. Corporate environmental innovation (CEI) is a proactive type of response to such scrutiny. It differs from general innovation strategy in that the objective of CEI is to move from an extant resource-intensive regime to a technological mode sustainable in the long term (Kesidou and Demirel, 2012).

To date, studies have confirmed the positive effect of coercive pressures from stakeholders on environmental strategy formulation (González-Benito and González-Benito, 2005; Murillo-Luna *et al.*, 2008; Rueda-Manzanares *et al.*, 2008). However, increased stakeholder pressure can have mixed effects on the choice of proactive rather than passive responses (Delmas and Montes-Sancho, 2010). This arises because externally-imposed pressures often suggest ambiguous goals where the relationship between means and ends is uncertain (Hoffman, 2001). To address such challenges and make a proactive response, a firm can not only refer to coercive pressures, but also mimic the decisions of other firms, such as foreign multinational enterprises (MNEs) (Lieberman and Asaba, 2006). So far, few studies have examined how different types of industry peer can be a role model and how both non-coercive types of pressure, such as inter-firm mimetic isomorphism, and coercive isomorphism may jointly influence a firm's decision to adopt CEI.

This study examines the extent to which the presence of foreign MNEs influences the propensity of local firms to adopt CEI. Based on institutional theory, we understand the effects of foreign MNEs as a mimetic mechanism. We argue that a local firm can overcome path dependency on existing resource-intensive technologies and offset uncertainty in CEI adoption and implementation by observing how MNEs implement a proactive environmental

strategy despite being foreign and lacking foundation in the local community. We focus on the mimetic effect from foreign MNEs, as MNEs adopt a global or local environmental strategy to acquire local legitimacy in the host country. About 40% of global inward FDI carried out by MNEs is potentially relevant to environmental management (Golub *et al.*, 2011). If so, benchmarking proactive responses by foreign MNEs may offer an opportunity for local firms to observe international environmental strategy templates. Against this background, there has been a call for research into interactions between foreign MNEs and domestic firms that lead to cross-border diffusion of environmental strategies, either proactive or passive (Guler *et al.*, 2002; Holtbrügge and Dögl, 2012; Tatoglu *et al.*, 2014). Finally, we argue that the diffusion of an environmental practice results from a combination of the two different isomorphic mechanisms. We explore whether the inter-firm mimetic effect is contingent on existing domestic institutions, and thus whether the extent of the foreign-induced mimetic mechanism depends upon domestic institutional pressures.

The hypotheses are tested by firm-level data based on the South Korean Innovation Survey of 2010, complemented by industry-level data. South Korea (hereafter Korea) introduced Green Growth as its key economic agenda in 2008 and promoted CEI in the private sector (OECD, 2010). The policy changes have raised individual firms' sensitivity to stakeholder demands for environmental responsibility. Thus, Korea provides an appropriate context for empirical examination of the roles of FDI, domestic institutions and their interactions in influencing domestic firms' CEI.

This study makes the following contributions. Firstly, it analyses dual isomorphic mechanisms in CEI diffusion. We propose that both coercive and mimetic isomorphic mechanisms simultaneously drive the diffusion of CEI, a proactive environmental strategy. Secondly, the study identifies foreign MNEs as drivers in reinforcing the dual isomorphic mechanism. We suggest that MNEs are boundary-spanners, contributing to changes in

national institutional fields in countries hosting their activities. Furthermore, evidence of interaction between domestic coercive and transnational mimetic mechanisms identifies increasing interconnection between national institutional fields. This result is in line with a recent focus in sociological studies, which have shifted from isolated isomorphic mechanisms to complementarity between isomorphic mechanisms and the potential for transnational institutional convergence (Beckert, 2010; Villadsen, 2013).

The paper is structured as follows. Section 2 briefly reviews the literature, discussing how dual effects of coercive and mimetic mechanisms may explain a firm's CEI adoption and how FDI by foreign MNEs offers a specific source of mimetic mechanism. Section 3 develops hypotheses, followed by data and methodology in Section 4. Empirical results are presented in Section 5. The final section concludes with further discussion of findings, highlighting knowledge contribution and avenues for future research.

Theory and literature

CEI and coercive isomorphism

CEI refers to innovation activities taken up by a firm to develop new products, processes or services that address environmental issues (Brunnermeier and Cohen, 2003). Examples include improved fuel efficiency using cleaner energy sources, emissions treatments, and waste recycling or reuse. While some researchers focus on conventional economic factors such as development costs, market uncertainty and achieving competitive advantage as determinants of CEI, others see CEI as a reaction to institutional factors (Young and Makhija, 2014).

In institutional theory, firms make decisions under the constraint of socially-constructed values that stakeholders recognise (DiMaggio and Powell, 1983; Hoffman, 2001; Levitt and March, 1988). Stakeholder attitudes on corporate environmental responsibility are articulated

and imposed through coercive mechanisms such as environmental regulations, government policies and downstream customers' requirements. Compliance with these coercive mechanisms is important, as social acceptance among stakeholders can affect a firm's access to critical resources (Guler *et al.*, 2002). Empirical evidence has confirmed how increased pressures through coercive mechanisms result in higher CEI take-up in a firm (De Marchi, 2012). An expectation of such stakeholder demands continuing can motivate firms to exceed current performance standards and pre-emptively signal socially-desirable traits (Frank, 1985).

However, the role of coercive mechanisms in CEI adoption has been overstated. Coercive mechanisms do not provide sufficient information about how a firm can satisfy stakeholder demands (DiMaggio and Powell, 1983; Lieberman and Asaba, 2006). Organisation members may internally dispute the interpretation of such demands (DiMaggio and Powell, 1983). Firm-specific organisational learning may not fully inform how the firm may formulate strategic goals and methods (Delmas and Montes-Sancho, 2010). Scarcity of information and uncertainty can add to the cost of a proactive strategy and propel a firm to take a pragmatic approach for short-term compliance, such as gaining environmental certification and acquisition of external environmental technologies through licensing rather than innovation (Aravind and Christmann, 2011; Poisson-de Haro and Bitektine, 2015).

To look beyond coercive mechanisms, we turn to non-coercive, inter-firm mimetic mechanisms. Firms follow other firms that have already adopted proactive environmental strategies. Delmas and Toffel (2004) and Young and Makhija (2014) reported the influence of competitors on other firms' responsiveness to coercive pressures, although their studies did not identify specific types of practice benchmarked between peers or test such effects on CEI adoption cases. Thus, our next section explores how mimetic and coercive mechanisms can combine to facilitate CEI.

Inter-firm mimetic mechanism and foreign MNEs

Mimetic mechanism refers to the diffusion of management practices through imitation between peers (DiMaggio and Powell, 1983). When a firm has difficulty in optimal strategy formulation due to information scarcity and uncertainty, it can refer to choices made by other firms which have successfully implemented socially-desirable strategies (Levitt and March, 1988). Inter-firm mimetic mechanisms can offset a firm's inability to make rational decisions independently, and can protect proponents of proactive strategies such as CEI from organisational resistance and fears of failure (Beckert, 2010). Thus, the availability of benchmarkable peers demonstrating proactive environmental strategies such as CEI can cause other peers to follow suit.

In inter-firm mimetic mechanisms, peers from both domestic and transnational settings can interact, unlike coercive mechanisms, which primarily focus on country-bound factors. The literature review by Hartmann and Uhlenbruck (2015) revealed that many studies of social and environmental strategies make implicit assumptions that institutional fields are strictly demarcated by national boundaries and that these boundaries are closed in nature. Such assumptions are however challenged by more recent institutional-field studies (Davis and Marquis, 2005). The open institutional field concept now accepts the active role of transnational agents in reconstructing the boundaries of institutional fields (Fligstein and McAdam, 2011). Thus, inter-firm mimetic mechanisms are relevant to environmental strategies in an inter-connected business environment.

Given this background, we identify foreign MNEs as benchmarkable firms in the local mimetic process. Path dependency can be widespread within a single country, hindering a firm switching from an old to a new technological regime (Aulakh and Kotabe, 2008; Un, 2015). This phenomenon of 'liabilities of localness' is a common obstacle in a firm's decision

to adopt a proactive strategy such as CEI. Thus, we identify foreign MNEs rather than local counterparts as benchmarkable peers. MNEs are boundary-spanners whose presence can provide local firms with opportunities to break out of collective path dependency and inertia (Crescenzi *et al.*, 2015; Irsova and Havranek, 2013). Their boundary-spanning status builds on their organisational capability to create, retain, and transfer knowledge across national innovation systems through social and technical knowledge-management mechanisms (Argote *et al.*, 2003; Frenz and Ietto-Gillies, 2007; Gupta and Govindarajan, 2000).

In summary, MNEs play a boundary-spanning role and contribute to increasing the openness of national institutional fields. So far, empirical support for the effect of MNEs' cross-border non-technological activities on a host country has been limited. CEI literature has been slow in adopting the latest theoretical developments concerning institutional fields. Despite a lacuna of empirical evidence, studies have shown that MNEs can incorporate environmental management and innovation into their global strategy and construct an industry-leading role in a local context (Child and Tsai, 2005; Christmann, 2004; Pinkse *et al.*, 2010; Tatoglu *et al.*, 2014). Building on the above, the next section develops hypotheses, as shown in Figure 1.

Insert Figure 1 about here

Hypothesis development

Coercive effect of domestic institutions

Coercive pressures are typically exerted by environmental regulations (DiMaggio and Powell, 1983). As a binding rule, environmental regulations impose penalties that increase a firm's private costs for environmentally-harmful activities. Non-regulatory stakeholders, such as NGOs or professional groups within the industry, can impose non-binding rules on

environmental performance and pressurise firms to conform (Berrone *et al.*, 2013). To control compliance costs in the long term and prepare for competition in environmentally-friendly markets, firms can undertake CEI (Porter and Linde, 1995).

Another source of coercive pressure is policy support promoting self-regulation (Sinclair, 1997). Governments may recognise good practices in the industry, such as by publishing a list of environmentally-friendly firms and awarding eco-labels to firms (Nesta *et al.*, 2014), or they may introduce green-procurement initiatives, integrating sustainability standards into public procurement (De Marchi, 2012). This means that firms violating environmental regulations may become ineligible for public contracts (Brunnermeier and Cohen, 2003). Hence, firms receiving policy support, whether monetary or non-monetary, are more likely to adopt a proactive environmental strategy.

Furthermore, transactional linkages are a channel of domestic coercive pressure from downstream customers to suppliers within a value chain. Many downstream customers are visible to regulators and NGOs due to their size and focal position in the value chain (Darnall *et al.*, 2010). Stakeholders increasingly demand focal firms to be more fully responsible for environmental impacts in their production network. In response, a growing number of downstream customers adopt stringent mechanisms to control the sustainability performance of their suppliers in terms of resource efficiency, emissions reduction and waste reduction (Christmann, 2004; Wiengarten *et al.*, 2013). In response, suppliers who are dependent on sales from downstream customers, are more likely to proactively signal their appeal to customers by adopting CEI (Horbach *et al.*, 2012; Young and Makhija, 2014).

Accordingly, we propose the effect of various domestic institutions as follows:

Hypothesis 1a. *Stringency of environmental regulations has a positive effect on CEI adoption in a domestic firm.*

Hypothesis 1b. *Policy support from the government has a positive effect on CEI adoption in a domestic firm.*

Hypothesis 1c. *Transactional linkages with downstream customers has a positive effect on CEI adoption in a domestic firm.*

Mimetic effect of foreign MNEs

In the global context, MNEs are exposed to institutional pressures in multiple institutional fields (Marano and Kostova, 2016). In home countries, the salience of environmental issues raises expectations about a firm's environmental behavior. In host countries, MNEs are under more stringent public scrutiny than domestic firms, because of public suspicion of MNEs as footloose investors lacking concern for their impact on a host country (King and Shaver, 2001). This means MNEs are more sensitive to institutional pressures than a single-country firm and have a higher propensity to adopt proactive environmental strategies such as CEI, which increases in line with the extent of their international expansion (Christmann, 2004).

We argue that indigenous firms take foreign MNEs as a global benchmark when they formulate CEI strategy. Local firms can use two criteria in selecting potential benchmarks to affirm trans-national benchmarks (Lieberman and Asaba, 2006). They may imitate MNE practices whose efficacy has been validated across multiple foreign locations, or those practices regarded as features of successful global organisations (ritualistic imitation based on frequency and trait); or they may selectively replicate MNE practices on the grounds that their CEI has previously generated positive performance records (rational imitation based on actual outcome).

The presence of MNEs is likely to speed up CEI diffusion in a host country. De-legitimation of previous practices is necessary before the adoption of a new normality and the removal of path dependency (Oliver, 1992). The presence of MNEs is likely to support local de-institutionalisation by removing path dependency (Faulconbridge and Muzio, 2015).

MNEs can also influence the micro-foundations of institutional change by hiring local staff and imposing international business norms and values, which will influence the awareness of local labour (Kwok and Solomon, 2006). Thus, we propose the following hypothesis:

Hypothesis 2a. *The presence of foreign MNEs has a positive effect on CEI adoption in a domestic firm.*

The impact of foreign MNEs on CEI in domestic firms can vary with the type of CEI strategy in an MNE. There are two kinds of global strategy with which MNEs organise CEI across their subsidiary network: de-centralised (or local CEI strategy) and centralised (or global CEI strategy).

According to local CEI strategy, MNEs can distribute CEI activities locally in individual host countries. In the global context, institutional and geographic distance increases liabilities of foreignness and create barriers for MNEs in deploying technologies and managerial practices that have not been tested against local norms (Campbell *et al.*, 2012). Localised CEI allows MNEs to access local CEI resources to comply with local stakeholders' approbation criteria (Doz and Wilson, 2013).

In a global CEI strategy, an MNE's HQ is a storehouse of environmental technologies and practices. Using managerial capabilities to control intra-MNE flows of tangible and intangible assets, MNEs can centrally develop and transfer them across a network of foreign subsidiaries (Blomkvist *et al.*, 2010; Frost and Zhou, 2005; Pinkse *et al.*, 2010; Reger, 2004). A global strategy can ensure control and coordination across foreign subsidiaries and prevent negative legitimacy spillovers (Marano and Kostova, 2016).

We argue that MNEs' mimetic effects can vary, depending on whether they conduct CEI locally or globally. When their CEI is local, it is easier for domestic firms to obtain information about its tacit and complex processes. Localised implementation may entail

interaction between local and foreign firms, reducing the degree of causal ambiguity in the relationship between an MNE's social legitimacy and its corporate social strategy. Therefore, local CEI in foreign MNEs reduces imitation barriers.

On the other hand, a global CEI strategy introduces practices that the MNE can apply across subsidiaries. Such global practices are often developed by benchmarking the most stringent national environmental regulations, potentially over-achieving typical environmental responsibility targets in other countries (Marano and Kostova, 2016). Local application of global practices can make an MNE's CEI strategy more conspicuous and credible (Reed and Defillippi, 1990). Thus, under both types of CEI strategy the mimetic effects of foreign MNEs are positive.

Hypothesis 2b: *The presence of foreign MNEs using a global CEI strategy has a positive effect on CEI adoption in a domestic firm.*

Hypothesis 2c: *The presence of foreign MNEs using a local CEI strategy has a positive effect on CEI adoption in a domestic firm.*

Moderating effect of domestic institutions

Our preceding discussion highlights the direct coercive effects of domestic institutional pressures and mimetic effects from foreign MNEs. We now explore how domestic institutions strengthen mimetic effects from foreign MNEs.

Local imitators' proactive information-searching activities are conditional on motivation and incentives (Meyer and Sinani, 2009; Peng *et al.*, 2008). Under strong domestic institutional pressures, domestic firms are likely to develop strong awareness of and motivation for CEI. These firms are willing to consider a wide range of environmental issues in the environmental-strategy formulation process. In contrast, firms that operate under weak institutional pressures tend to focus on a narrow spectrum of environmental issues. With weak

awareness and motivation, firm strategies based on inter-firm mimetic mechanisms may have limited outcomes, perhaps due to internal bias filtering potentially relevant information (Monteiro *et al.*, 2008).

Second, mimetic effects from foreign MNEs are conditional on whether domestic firms have gained a threshold level of environmental capability to identify, integrate and exploit mimetic forces from foreign technological knowledge. Under strong domestic institutional pressures, a domestic firm may develop national environmental capabilities through compliance with national environmental regulations, conditions of government partnership programmes, or downstream customers where integration of environmental standards is obliged (Rugman and Verbeke, 1998). Leveraging pre-existing environmental capabilities, a domestic firm can more easily understand how foreign MNEs' practices relate to current issues in its domestic institutional field and can manage the process of transforming national environmental capabilities into international ones (Fligstein and McAdam, 2011). With weak domestic institutional pressures, however, domestic firms may find it difficult to determine the value of the mimetic process of benchmarking against foreign MNEs when their practices exceed national environmental standards.

Accordingly, we propose that mimetic pressures from foreign MNEs may influence local CEI if domestic firms face domestic institutional pressures.

Hypothesis 3a. *Stringency of environmental regulations* strengthens the positive mimetic effect of foreign MNEs on the CEI of domestic firms.

Hypothesis 3b. *Policy support from the government* strengthens the positive mimetic effect of foreign MNEs on the CEI of domestic firms.

Hypothesis 3c. *Transactional linkages with downstream customers* strengthens the positive mimetic effect of foreign MNEs on the CEI of domestic firms.

Data and methodology

Data

We selected South Korea as the empirical context. In recent years, the Korean government has been heightening the stringency of its environmental regulations, but domestic industries are at a relatively early stage in 'green consciousness', lagging behind developed countries such as the US and EU in terms of environmental-technology development (See Figure 2). In the early stages of institutional change, the adoption rate of a new practice can typically rise rapidly until it slows down as it reaches saturation (Guler *et al.*, 2002). This means South Korea is an ideal setting to observe how sensitively local firms respond to external stimuli such as inter-firm mimetic pressures from foreign MNEs.

Insert Figure 2 about here

We test the hypotheses using firm-level data from the 2010 Korean Innovation Survey (KIS), complemented with official statistics, including the annual Facility Investment Plan survey from the Korea Development Bank and economic statistics from Statistics Korea. The 2010 KIS was administered by the Science and Technology Policy Institute (STEPI) under the framework of the Oslo Manual Version 3 from the OECD from March to October 2010. The questionnaire sought quantitative and qualitative information concerning firms' innovation activities, including eco-innovation, in the period 2007-2009.

The survey used cluster sampling based on Statistics Korea's Census on Establishments. The questionnaire was sent by post and by visit if the respondent did not reply to the initial postal survey. The potential non-response bias was minimised by replacing non-responders with alternative cases from the initial sample. The number of cases collected was 3,925, a 51% response rate. The present study restricts analysis to a sub-sample of 1,967 firms who

identified themselves as domestic firms as opposed to subsidiaries of foreign MNEs, and indicated that they undertook general innovation activities by running either a permanent or temporary R&D team. These firms belong to 22 industries. Industry classification is based on two-digit Korean Standard Industrial Classification (SIC).

Dependent variable

The dependent variable is *CEI*, a binary indicator of whether CEI is adopted in a local firm or not. In KIS, questions ask if a respondent has conducted each of a range of CEI activities, viz. 1) increasing resource efficiency, 2) increasing energy efficiency, 3) reducing CO² emissions, 4) reducing hazardous waste, 5) reducing pollution, 6) recycling and the use of renewable energy, 7) developing energy-saving products, 8) developing counter-pollution products, and 9) developing recyclable products in the period 2007-2009. We assign 1 if the respondent has conducted any one of these, and otherwise 0.

Independent variables

The first key set of independent variables captures domestic institutional pressures. We employ three variables: *Regulation*, *Policy* and *Linkage*. *Regulation* measures stringency of environmental regulations based on the total spending on pollution-prevention equipment by the industry. It is normalised by total spending on all types of equipment. This proxy reflects the overall compliance activities made in response to existing environmental regulations within the industry. *Policy* is a dummy variable encoded 1 if the domestic firm has received any government policy support for innovation during the period 2007-2009. *Linkage* is measured by the share of downstream industrial customers in the total sales of a local firm.

The second key independent variable is *Foreign MNEs*. Lu (2002) and Delmas and Toffel (2008) measured a mimetic force based on the ratio of benchmarkable organisations in the industry. Following their definition, *Foreign MNEs* is measured by a proxy of the mimetic

effect that is based on the share of foreign-MNE subsidiaries in the total R&D expenditures in the industry. This measure captures the impact of the industry-level collective mimetic effect on individual local firms, not an individual foreign-MNE's direct impact on affiliated firms. A firm is classified as a foreign-MNE subsidiary if it answers 'yes' to the question as to whether it is an affiliate of a foreign MNE. We further differentiate *Foreign MNEs Global* and *Foreign MNEs Local*. *Foreign MNEs Global* is measured by the share of R&D expenditures of foreign MNE subsidiaries in an industry that does not conduct CEI locally and therefore uses the output of global CEI conducted at HQ or in other subsidiaries in the MNE. *Foreign MNEs Local* is measured as the share of R&D expenditures of foreign-MNE subsidiaries that conduct CEI locally. We determine a firm's local CEI strategy if a firm reported any type of local CEI to the survey.

Control variables

We control for factors other than the above that may influence a domestic firm's environmental innovation. *Size* is related to a firm's visibility to the public and responsiveness to environmental pressures (Darnall *et al.*, 2010). *Inter-firm cooperation* is a dummy variable capturing whether the firm has engaged in R&D cooperation with an industry partner. *Intra-firm cooperation* is also a dummy variable reflecting the firm's engagement in R&D cooperation with other affiliated firms within the same business group. *R&D Intensity* is entered to control for internal technological capabilities. *Competition*, measured as Herfindahl index in the industry, is a proxy for market structure.

Estimation strategy

Our dependent variable is binary. Thus, our main model is a logistic regression as follows:

$$\text{Prob}(CEI_{ij}=1|\mathbf{x}) = \beta_0 + \beta_1 \text{Foreign MNEs}_j + \sum \beta_k \text{Controls}_k + \varepsilon_{ij} \quad (1)$$

, where i stands for the i^{th} firm, and j represents the j^{th} industry based on industry classified at 2-digit industries, and k for k^{th} control variables. As several independent variables are measured at the industry level, we used cluster-robust standard errors. Four dummies of technology groups are entered, following the OECD definition of low, medium, medium-high, and high-tech industries.

Finally, we note a common method variance issue associated with using survey data. Common method variance can arise due to internal consistency of variables from the same source. Because our variables employ information from more than one data source, common method variance is unlikely to be a problem in this research (Chang *et al.*, 2010).

Empirical Results

The main dependent variable is whether a domestic firm has adopted CEI or not. The t-test result based on our data suggests rejection of the null hypothesis of no mean difference in CEI propensity between domestic firms and foreign MNEs. Domestic firms, on average, have a lower mean score for CEI than foreign-MNE subsidiaries. This is consistent with other findings that foreign firms are on average more environmentally-friendly than domestic firms (Golub *et al.*, 2011). Table I shows correlations and descriptive statistics of variables. The correlation coefficients are low, indicating multicollinearity is not a problem.

Insert Tables I and II about here

Table II shows the result of regression analyses. Model 1 is the baseline model including control variables. Model 2 tests the effect of domestic institutions, followed by Models 3 and 4, which examine the effect of foreign MNEs. In all models, *Size* and *Inter-firm* and *Intra-firm cooperation* are statistically significant and positive in Model 1. This means that CEI adoption in a domestic firm is affected by the firm’s internal resources and cooperation with

internal or external business partners. Current technological capability and market competition in the host country are not a significant driver of CEI adoption.

Effect of domestic institutions

H1 was that domestic institutional pressures positively affect CEI in a domestic firm. Model 2 reports a significant and positive effect from *Policy* ($b=0.420, p<0.01$) and *Linkage* ($b=0.204, p<0.10$). This result is consistent with existing studies (Delmas and Montiel, 2009; Nesta *et al.*, 2014). However, the coefficient of *Regulation* is not statistically significant ($b=4.892, p\geq 0.10$). This means that increased policy support and transactions with downstream customers increase the likelihood of CEI adoption in a domestic firm; however, the same does not happen when the firm faces more stringent environmental regulations. This result supports H1b and H1c, but cannot confirm H1a. This shows that depending on the type of domestic institutional pressure, a domestic firm can make different decisions and responses, either proactive or passive.

Effect of foreign MNEs

H2a proposed a positive mimetic effect of foreign MNEs on CEI adoption in a domestic firm. The coefficient of *Foreign MNEs* is positive and statistically significant in Model 3 ($b=5.530, p<0.01$). This indicates that the more foreign MNEs enter into a local industry, the more likely that domestic firms will adopt CEI. Our result supports H 2.

H2b and H2c predicted the positive effects of foreign MNEs under different CEI strategies applied. In Model 4, we divide the effect of foreign MNEs by type of CEI strategy, either local or global. Both coefficients of *Foreign MNEs Local* ($b=4.922, p<0.01$) and *Foreign MNEs Global* ($b=7.800, p<0.01$) are positive and statistically significant. Our results support both H2b and H2c. Furthermore, a t-test confirms that the coefficient for *Foreign MNEs Global* is greater than that of *Foreign MNEs Local*, and the difference is statistically significant. The

result shows that while all types of foreign MNEs have a positive effect on local CEI diffusion, the effect is greater if a foreign MNE uses global CEI strategy to transfer the outcome of its HQ's CEI to a subsidiary in the host country.

Moderating effect of domestic institutions

To test H3a, H3b and H3c – that domestic institutions moderate the mimetic effect of foreign MNEs – we enter three interaction terms between *Foreign MNEs* and each domestic institution variable, consecutively. The interaction term with *Regulation* is significant and positive in Model 5 ($b=199.3, p<0.05$). Thus, we adopt H3a. In the meantime, the coefficients for the interactions with *Policy* ($b=-1.667, p\geq 0.10$) and *Linkages* ($b=-.2483, p\geq 0.10$) are not significant in Models 6 and 7. Thus, H3b and H3c are not confirmed. The result shows that when a domestic firm faces more stringent environmental regulations, it can be more sensitive to the mimetic effect of foreign MNEs.

Discussion & conclusions

Discussion of findings

CEI is a proactive response that a firm adopts in pursuit of social acceptance by stakeholders who focus on environmental values. While past studies have overwhelmingly focused on coercive mechanisms, less attention has been given to non-coercive inter-firm mimetic mechanisms. As the role of the former has been overstated and mostly defined in single-country settings, the role of transnational agents in CEI diffusion has been overlooked. This paper has identified MNEs as a source of mimetic isomorphic mechanisms driving the diffusion of proactive responses such as CEI adoption. Foreign MNEs, either because of cumulative multinational experiences or anticipated liabilities of foreignness in host countries, engage in environmental practices and CEI to a greater degree than domestic firms.

Our first finding concerns the partial effect of coercive isomorphic mechanisms. Our result shows that firms react proactively to government policy support and inter-industry transactional linkages, but stringency in formal regulation does not generate the same proactiveness. This means that a firm may respond to command-and-control types of coercive pressures with a passive strategy, such as quick and easy external sourcing, e.g. licensing or purchasing (Sinclair, 1997). In contrast, market-based types of coercive pressure may spread CEI costs and uncertainty between firms, government and downstream customers; it may also facilitate domestic firms to seek ways to overcome inertia towards resource-intensive technologies, and to find effective solutions to environmental problems. These indicators imply that the coercive mechanism is multi-faceted and cannot fully explain why a firm adopts CEI as a proactive environmental strategy.

Our second finding is that foreign MNEs generate positive mimetic pressure for local CEI. MNEs conducting CEI strategy locally can transfer tacit knowledge about environmental strategies to local firms, while those conducting CEI strategy globally can demonstrate global standards of environmental technologies, conferring attention and credibility on such standards. Under domestic institutional pressures, both types of foreign-MNE strategies offer domestic firms benchmarks, though the greening effects of localised strategy exceed those of global strategy.

We also find a positive interaction effect between the mimetic effect of foreign MNEs and domestic institutional pressures within industries; domestic firms faced with more stringent environmental regulations are likely to be more responsive to foreign entry. The diffusion of CEI adoption in a national institutional field results from the joint effect of coercive and mimetic isomorphic mechanisms, and a transnational agent such as an MNE strengthens positive synergies between the two isomorphic drivers.

This study makes the following contributions. We confirm that the diffusion of CEI is driven by dual isomorphism. The dual-mechanism perspective offers a more comprehensive picture than a single-isomorphism perspective by explaining under what conditions a domestic firm may choose a proactive rather than passive strategy to adapt to growing pressure for more sustainable performance requirements. We have shown that neither coercive nor non-coercive inter-firm mimetic isomorphism can fully explain on their own a firm's proactive use of CEI, but that the decision is based on a combination of existing coercive institutional pressures and inter-firm mimetic mechanism.

Furthermore, we confirm the prevailing conviction that the effects of foreign MNEs on host countries can be extended to non-economic social development, such as sustainable development, in a host country (Tatoglu *et al.*, 2014). The concept of MNEs as boundary-spanners was initially developed to explain the role of MNEs in technological diffusion in cross-national technological fields; our study shows that it can be further extended into social and developmental agendas.

Finally, we suggest that national institutional fields are more open than previously assumed in the literature. Existing research highlighting coercive mechanisms has assumed national institutional changes to occur within a single, isolated national unit. The boundary-spanning MNEs that influence local diffusion of proactive environmental practices like CEI support sociological institutionalism's view that national institutional fields are increasingly open and that cross-border diffusion of practices occurs.

Managerial and practical relevance

This research generates managerial and practical implications. Firstly, our finding shows that a domestic firm can address institutional pressures when it can imitate foreign technology and managerial practices demonstrated by foreign MNEs. Firms from foreign sources can help

domestic firms to deal with the potential barriers of goal complexity and causal ambiguity in complying with collectively-proposed purposes such as environmental innovation.

Secondly, our findings suggest that an MNE can strengthen CEI to overcome liabilities of foreignness in the host country. Previous studies have suggested that MNEs may conduct CSR activities in a host country to demonstrate firms' social commitment and thereby overcome liabilities of foreignness and related business barriers (Campbell *et al.*, 2012). Our study has shown that an MNE's CEI activities in a host country can be visible and recognised as providing a role model for local industry, potentially enhancing the MNE's legitimacy.

Thirdly, we suggest incorporating into the host-country effect of FDI a broader scope of issues, both economic and social. This means that policy-makers in a host country can promote FDI in order to deliver green growth, while domestic firms need to further develop awareness, motivation, and capabilities to adopt green technology and management. Future FDI policy may seek strategic balance between different types of FDI, and, more importantly, align FDI policy with local informal and formal institutions to raise the awareness and motivation of domestic firms to participate in a green-growth agenda.

Limitations and future research

This research has a few data limitations. First, we used the R&D intensity of the MNE subsidiaries as the potential size of the mimetic effect of foreign MNEs. However, this may exaggerate the intensity of environmental performance outcomes, by overstating the merit of foreign MNEs as benchmarks. Future research might use a more accurate proxy, such as intensity of CEI expenditure or stock of environmental technologies in each foreign-MNE subsidiary. Furthermore, we used subjective response as an indicator of CEI adoption in a local firm. However, *ex ante* declaration of CEI adoption cannot be cross-tabulated with other indicators of *ex post* record confirmation of CEI adoption in a firm. Thus, we acknowledge that our finding is based on perceptions rather than fully objective information.

Finally, we note that our data, which was constructed after excluding responses from firms without innovation projects, can involve a selection bias. To address the data limitations, future research could base itself on survey data with more detailed profiles of firm-level environmental strategies.

Appendix A: Variable measurement and data sources

Variable	Measurement Description	Data Source
CEI	Count of eco-innovation in 9 areas, including 1) increasing resource efficiency, 2) increasing energy efficiency, 3) reducing CO ² emissions, 4) reducing hazardous waste, 5) reducing pollution, 6) recycling and use of renewable energy, 7) developing energy-saving products, 8) developing counter-pollution products, and 9) developing recyclable products	Korean Innovation Survey (KIS) 2010
Regulation	Total spending on pollution-prevention equipment by industry, normalized by total spending on all types of equipment in 2007 (ratio)	Korea Development Bank
Policy	Whether the firm has received any policy support for technological innovation in 2007-2009	KIS 2010
Linkage	Transaction values with industrial downstream customers in a firm's total sales	KIS 2010
Foreign MNEs	The share of R&D expenditures of foreign MNEs in an industry in 2007-2009	KIS 2010
Foreign MNEs Local	The industry share of R&D expenditures of foreign MNEs that have conducted CEI in South Korea in 2007-2009	KIS 2010
Foreign MNEs Global	The industry share of R&D expenditures of foreign MNEs that have not conducted CEI in South Korea but have conducted CEI globally in 2007-2009	KIS 2010
Size	Log (number of full-time staff)	KIS 2010
Inter-firm Cooperation	Whether a firm cooperated with any industry partner for innovation in 2007-2009	KIS 2010
Intra-firm Cooperation	Whether a firm cooperated with affiliates within the same business group for innovation in 2007-2009	KIS 2010
R&D Intensity	R&D expenditures divided by sales in 2007	KIS 2010
Competition	Industry's Herfindahl index	KIS 2010

Tables & figures

Figure 1.
The conceptual framework

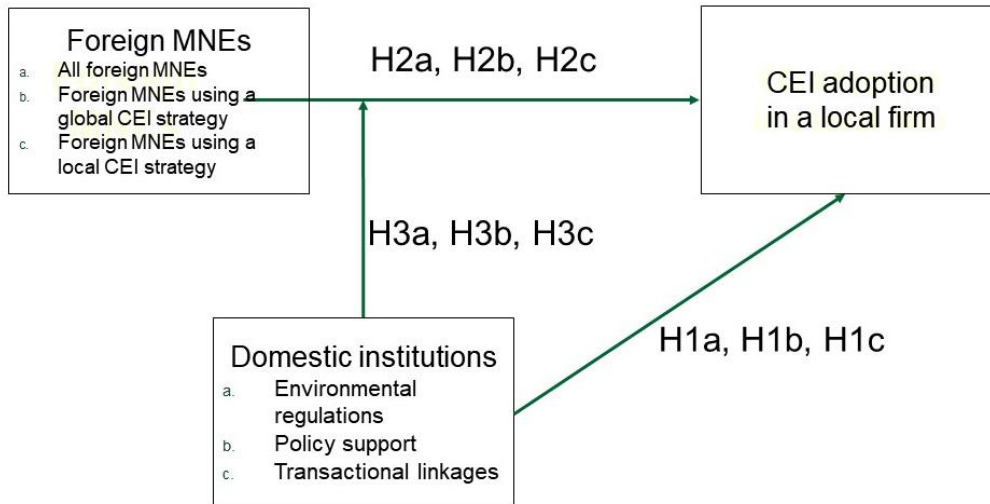
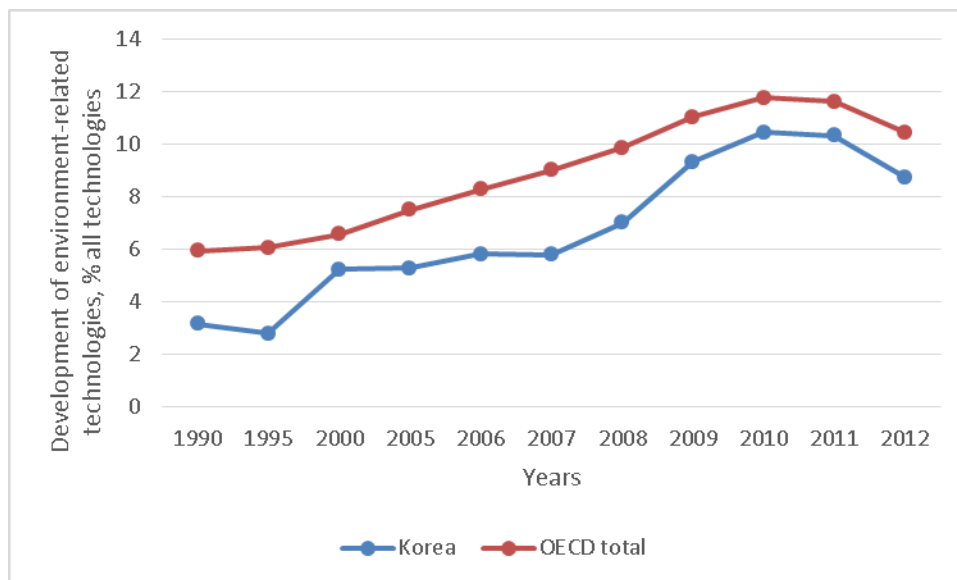


Figure 2.
Development of environmentally-related technologies as % of all technologies in South Korea and OECD



Source: <http://stats.oecd.org/>

Table I.
Correlations and descriptive statistics

	1	2	3	4	5	6	7	8	9	10	11	12
1 CEI	1.000											
2 Size	0.203***	1.000										
3 Competition	0.018	0.062***	1.000									
4 Inter-firm Cooperation	0.175***	0.138***	0.053**	1.000								
5 Intra-firm Cooperation	0.114***	0.269***	0.026	0.307***	1.000							
6 R&D Intensity	-0.028	-0.177***	0.058**	0.088***	-0.024	1.000						
7 Foreign MNEs	0.120***	0.035	0.160***	0.007	0.036	-0.071***	1.000					
8 Foreign MNEs _{Local}	0.080***	0.067***	0.207***	0.011	0.048**	-0.043*	0.738***	1.000				
9 Foreign MNEs _{Global}	0.080***	-0.030	-0.014	-0.003	-0.005	-0.052**	0.578***	-0.124***	1.000			
10 Regulation	0.034	0.033	0.035	-0.013	0.007	-0.086***	0.360***	0.388***	0.059***	1.000		
11 Linkage	0.068***	0.078***	-0.052**	0.029	0.059***	-0.048**	0.102***	0.072***	0.062***	-0.079***	1.000	
12 Policy	0.155***	0.184***	0.070***	0.222***	0.106***	0.134***	0.011	0.023	-0.011	-0.030	0.045**	1.000
Observations	1967	1967	1967	1967	1967	1967	1967	1967	1967	1967	1967	1967
Mean	0.563	4.373	0.353	0.229	0.032	0.074	0.076	0.047	0.029	0.012	0.354	0.567
Standard Deviation	0.496	1.382	0.264	0.420	0.176	0.128	0.064	0.052	0.043	0.014	0.443	0.496

Table II.
Empirical results

Dependent Variable = CEI	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Size	0.286*** (0.0405)	0.254*** (0.0438)	0.257*** (0.0431)	0.259*** (0.0418)	0.272*** (0.0421)	0.258*** (0.0433)	0.260*** (0.0435)
Inter-firm Cooperation	0.739*** (0.104)	0.659*** (0.0955)	0.685*** (0.0967)	0.687*** (0.0958)	0.685*** (0.0965)	0.685*** (0.0954)	0.684*** (0.0968)
Intra-firm Cooperation	0.610* (0.366)	0.574 (0.379)	0.522 (0.384)	0.534 (0.387)	0.523 (0.385)	0.518 (0.385)	0.530 (0.383)
R&D Intensity	0.0785 (0.667)	-0.113 (0.671)	-0.0620 (0.659)	-0.0783 (0.660)	-0.0711 (0.665)	-0.0726 (0.657)	-0.0575 (0.663)
Competition	0.0785 (0.291)	0.0179 (0.285)	-0.0738 (0.243)	-0.0302 (0.248)	-0.0283 (0.245)	-0.0757 (0.246)	-0.0633 (0.242)
H1a: Regulation		4.892 (6.080)	-7.033 (4.706)	-7.001 (4.918)	-26.35* (13.56)	-7.518 (4.765)	-6.962 (4.705)
H1b: Policy		0.420*** (0.0941)	0.420*** (0.0951)	0.420*** (0.0956)	0.420*** (0.0951)	0.546*** (0.152)	0.423*** (0.0945)
H1c: Linkage		0.204* (0.115)	0.170 (0.117)	0.180 (0.122)	0.170 (0.119)	0.173 (0.116)	0.368* (0.196)
H2a: Foreign MNEs			5.530*** (1.278)		2.186 (1.604)	6.546*** (1.170)	6.286*** (1.143)
H2b: Foreign MNEs _{Local}				4.922*** (1.385)			
H2c: Foreign MNEs _{Global}				7.800*** (2.178)			
H3a: Foreign MNEs x Regulation					199.3** (100.9)		
H3b: Foreign MNEs x Policy						-1.667 (1.910)	
H3c: Foreign MNEs x Linkage							-2.483 (2.103)

Technology group effect	Included	Included	Included	Included	Included	Included	Included
Constant	-1.249*** (0.196)	-1.407*** (0.206)	-1.353*** (0.204)	-1.357*** (0.205)	-1.267*** (0.227)	-1.413*** (0.216)	-1.421*** (0.213)
Observations	2,026	1,967	1,967	1,967	1,967	1,967	1,967
Wald Ch2	149.5	288.42	246.34	355.4	249.46	250.06	250.47
Prob > Chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo R2	0.0546	0.0614	0.0701	0.0714	0.0726	0.0706	0.0708

Note: Cluster-robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

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