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The Diffusion of Voluntary Environmental Programs: The Case of ISO 14001 in Korea, 1996–2011

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Abstract This paper examines the adoption of ISO 14001, which is known as the most famous voluntary environmental program. The data of this paper pertain to Korean [Throughout this paper, Korea refers to the Republic of Korea (South Korea)] firms in manufacturing industries from 1996 to 2011. Event-history modeling to examine firms' adoption of ISO 14001 finds that both resource-based factors and institutional factors have influenced the diffusion of ISO 14001 in Korea. By exploring time-related effects, I also find that while resource-based factors are important in the early periods of the diffusion, institutional factors become important in the later periods of the diffusion. This confirms the findings of previous studies that a firm's motivation to adopt organizational policies varies according to different diffusion periods. The paper concludes with a brief discussion of what this study tells us about the institutional context of ISO 14001 in Korea and Asia more broadly.

Keywords Resource-based view · Institutional theory · ISO 14001 · Korea

Introduction

Recently, a major change in environmental regulations has occurred in terms of governmental and private sector involvement (Bartley 2007; Moon and deLeon 2007). This change is the emergence of Voluntary Environmental Programs (VEPs). The well-known VEPs include ISO 14001, 33/50, Green Lights, Leadership in Energy and Environmental Design (LEED), and Energy Star Buildings (ESB). VEPs have been introduced as part of governments' environmental reform efforts to "promote innovation and flexibility, increase community participation and partnerships, improve compliance with environmental laws, and cut red tape and paper work" (Environmental Protection Agency 2014). Instead of improving environmental performance through explicit governmental controls and regulations, VEPs encourage firms to voluntarily set up their own environmental goals which go beyond legal compliance, and to achieve their objectives. The major assumption of VEPs is that stakeholders, who cannot otherwise directly observe participants' environmental performance, will nonetheless be encouraged to reward environmental action beyond legal compliance by awarding regulatory relief, higher market shares, consumer loyalty, goodwill, and higher product prices. VEPs are, therefore, designed to achieve both environmental and economic goals at the same time (Moon et al. 2013; Prakash and Potoski 2012).

Scholars claim that the rise in VEPs is associated with dramatic shifts in the regulatory processes. These are shifting from the traditional command and control strategies based on fixed standards enforced by the state toward social control strategies, such as market and social mechanisms, the provision of information, and even informal shaming processes (Bartley 2003; Delmas 2002). This new regulatory process is called self-regulation (Gunningham and Rees 1997). In recent decades, this transition from direct government control to self-regulation has been increasingly practiced and observed around the globe (Delmas and Montes-Sancho 2010; Prakash and Potoski 2013). The emergence of VEPs is a representative example

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of this transition toward the new regulatory process (Bartley 2007).

In order to understand the shifts in the regulatory processes, many researchers have begun to investigate why organizations adopt VEPs (King et al. 2005; Potoski and Prakash 2005a, b; Moon and deLeon 2007; Delmas and Montes-Sancho 2010; Christmann and Taylor 2001). However, VEPs are quite new, and our understanding of how they become diffused over time still is not adequate or clear. Most of the studies about VEPs have focused on the early adoption of the programs but have rarely taken a longer longitudinal approach covering at least a decade of data (Bansal and Hunter 2003; Delmas and Montes-Sancho 2010). Due to the limited availability of longitudinal data, scholars have had difficulty in fully understanding how VEPs diffuse over time. Specifically, the literature fails to address why some firms adopt VEPs earlier than others. Previous studies suggest that motives during the early periods of the diffusion processes can be different from those at later periods (Tolbert and Zucker 1983; Westphal et al. 1997; Moon 2008); therefore, it is important to examine the diffusion of VEPs using a longitudinal approach.

In addition, most previous studies of VEPs have focused on business organizations in the U.S. and Europe but have paid little attention to business organizations in Asian countries such as Korea, Japan, and China. Although the diffusion of ISO 14001 has been occurring very rapidly in Asia and this geographic region represents about 53 % of the total certification to ISO 14001 (International Organization for Standardization 2014), only a few studies investigate why organizations in these Asian countries have adopted ISO 14001 (Christmann and Taylor 2001; Welch et al. 2002; Nakamura et al. 2001).

To fill these gaps, this paper examines the diffusion of ISO 14001 across Korean manufacturing firms. ISO 14001 is one of the most popular VEPs. As of 2011, 291,926 facilities were certified to ISO 14001 across the world (International Organization for Standardization 2014). The number of facilities in Korea that have adopted ISO 14001 has been also rapidly increasing: from 309 in 1999, it went up to 11,124 in 2011. This paper addresses the following three research questions: (1) What are the factors that facilitate firms' adoption of ISO 14001?; (2) How do these factors differ in the early stage of diffusion as compared to the later stage?; and (3) What are the implications of the Korean case for understanding the institutional context of ISO 14001 in Asian countries?

To answer these questions, I apply Resource-Based View (hereafter RBV) and institutional theory to the analysis of the adoption of ISO 14001. Scholars have depended on these perspectives to understand the factors that promote the adoption of various VEPs (King et al. 2005; Moon and Bae 2011; Moon and DeLeon 2007; Delmas and Montes-Sancho 2010). An important line of research on VEPs finds that the adoption of VEPs is affected by the extent to which the programs generate positive and financial opportunities for a firm, and how institutional environments prompt firms to adopt these programs. These factors may be interrelated.

This paper contributes to the literature on VEPs in three ways. First, I use a longitudinal dataset, which allows me to compare the early stage of diffusion to the later stage of diffusion. The time period included in my analysis is from 1996 to 2011, which is the longest time period among studies on VEPs. Second, I enrich RBV and institutional theory by integrating two theoretical perspectives in a single framework; thus highlighting the fact that while strategic factors encourage the adoption of ISO 14001 in the early stage of diffusion, institutional factors play a major role at the later stage. Most other studies rely on either of the two theories to explain the diffusion of ISO 14001. In this paper, I integrate the two theories in a single framework. Third, this study adds to the literature on VEPs by examining the predictors of the adoption of ISO 14001 in an institutional context in an Asian country, and thereby extends Western-oriented findings of the diffusion of VEPs to Asian countries.

I begin with a review of the case of ISO 14001. Next, I develop and test hypotheses related to RBV and the institutional theory on the adoption of ISO 14001. Then, I discuss the impact of firms' strategic motivation and institutional contexts in Korea on their adoption of ISO 14001 and also the theoretical implications of the institutional context of ISO 14001 in Korea and Asia.

Background: ISO 14001

ISO 14001

ISO 14001 is one of the most broadly diffused and well-regarded VEPs. The International Organizations for Standardization (ISO) developed the ISO 14000 series of standards based on the need for improved environmental quality that was expressed at the United Nations Conference on Environmental and Development (UNCED) in Rio de Janeiro in 1992. The need for a new standard was also confirmed by the General Agreement on Tariffs and Trade (GATT) Uruguay Round Ministerial Decision on Trade and the Environment in 1994. In 1996, the ISO issued the first edition of the ISO 14000 series, a set of guidelines for developing and standardizing pro-environmental practices.

ISO 14001 dictates requirements for an organization's structures, responsibilities, practices, procedures, processes, and resources, with the goal being that responsible

environmental management is institutionalized within organizations. To be more specific, ISO 14001 requires each organization to undertake the following: develop environmental policies with a commitment to continuous improvement of environmental quality; identify all of its environmental aspects and then prioritize them based on the significance of their environmental impacts; establish environmental objectives and targets; develop work procedures to control environmental aspects; train employees on these procedures; demonstrate a commitment to comply with environmental laws and regulation; conduct self-assessment audits; and periodically review their management systems (Delmas 2002; Bansal and Hunter 2003; King et al. 2005).

ISO 14001 focuses on management processes rather than specific environmental outcomes. All of these processes aim to achieve continual improvement and mean that the VEP must be communicated to trained and empowered employees; a firm's procedures must also be documented in order to be certified and to maintain ISO 14001 certification. Although the rules of ISO 14001 are set up by ISO, the VEP program requires that each firm must pass an independent third-party audit. This step signals credibility.

Theory and Hypotheses

The Resource-Based View

RBV scholars argue that a firm's resources with distinctive attributes and capabilities would lead to its competitive advantage (Barney 1991; Wernerfelt 1984). The resources include tangible assets, such as its financial assets, physical plant and equipment, and raw materials, and also intangible assets, such as its reputation, culture, and intellectual property (Barney 1995). A competitive advantage occurs when an organization acquires or develops a combination of resources that enable it to outperform its competitors. There are two types of competitive advantage: differentiation and low cost (Porter and Van der Linde 1995).

RBV provides useful insights into how ISO 14001 can be a valuable resource that promotes firms' competitive advantages at two points (Hart 1995). First, ISO 14001 attracts the attention of environmentally conscious consumers, and thus help the firm build a green reputation. The "green market segment" in the world has been increasing, and a green reputation can generate positive market value by adding price premiums (Peattie 2001).[1] Second, the adoption of ISO 14001 contributes to developing a firm's operational efficiency. In other words, ISO 14001 enables firms to reduce operation and production costs through improving management processes (Arora and Cason 1996; Reinhardt 1998; Welch et al. 2002; Moon and deLeon 2007). The question remains, though, which firms are most likely to adopt ISO 14001 to achieve a green reputation and lower cost? I suggest below several hypotheses related to this question.

Chemical industries are usually regarded as "dirty." Firms in these industries are likely to be aware of VEPs and adopt the programs in an effort to clean up the industry's negative image (Bansal 2005; Bartley 2007; King and Lenox 2000). Liu and Anbumozhi (2009) find that firms that belong to chemical industry are more likely to disclose environmental information to protect their reputation than those in other industries. In addition, firms in the industry are likely to process considerable amounts of natural resources like oil and gas. Therefore, such firms are likely to adopt ISO 14001 to enhance their operational efficiency and achieve subsequent reductions in operation and production costs. Therefore, I hypothesize that

Hypothesis 1 A firm in a chemical industry is more likely to adopt ISO 14001.

Previous studies have found that firms depending on capital-intensive projects are likely to generate more pollution because they use a large portion of capital to buy expensive machines. Therefore, those firms are expected to process natural resources and to emit pollutants that have a significant impact on the local community (Moon and deLeon 2007; Hart 1995; Bansal 2005; Russo and Fouts 1997). Also, these studies show that operational costs of firms depending on capital-intensive projects are relatively high. Therefore, firms with a high level of capital investment intensity are likely to acquire a green reputation in order to attract the attention of environmentally conscious consumers, as well as to reduce operational cost. Moon and deLeon (2007) predict the positive association between capital investment intensity and the adoption of Green Light Program, using the large data of the U.S. firms. Accordingly, I suggest a following hypothesis:

Hypothesis 2 A firm with more capital investment intensity is more likely to adopt ISO 14001.

As indicated above, the adoption of ISO 14001 may not be an option for every firm. The cost of ISO 14001 is quite significant, and the investment in ISO 14001 might not have an immediate pay-off.[2] Only firms with enough slack resources are able to make an investment in adopting ISO 14001. Bansal (2005) shows organizational slack resources

[1] Visit the website (http://green.kocham.net) to access detail information about green markets in Korea.

[2] The fee for ISO 14001 certification ranges from $50,000 for small facilities to more than $200,000 for larger facilities.

are positively associated with corporate sustainable development. Therefore, I suggest a following hypothesis:

Hypothesis 3 A firm with superior financial performance is more likely to adopt ISO 14001.

Institutional Theory

The central argument of institutional theory is that organizations conform to social expectations about what good firms are supposed to do, such as complying with laws and regulations, following 'best practices' and 'modern' management advice, and adopting 'taken-for-granted' policies and practices. The result is a striking isomorphism of organizational structures (Meyer and Rowan 1977; Di Maggio and Powell 1983; Tolbert and Zucker 1983; Baek et al. 2012). Institutional scholars have theorized about institutional processes that give rise to organizational conformity to social legitimacy and expectations. In particular, Di Maggio and Powell (1983) identify three types of institutional pressures that lead organizations to structural homogeneity: coercive, normative, and mimetic pressures. Coercive pressures arise from both formal and informal rules and have force, sanction, persuasion, expedience, and invitation as their forms (Di Maggio and Powell 1983; Edelman 1990; Kelly 2003). Normative pressures primarily emerge from educational processes and professional networks (Di Maggio and Powell 1983). Universities and colleges train managers and staffs to follow socially legitimate values and norms. Professional networks such as professional associations and industry trade associations spread taken-for-granted values and norms to their member organizations, and this contributes to shaping organizational structures and behaviors (Greenwood et al. 2002). Mimetic pressures arise when organizational environments are poorly understood. To cope with environmental ambiguity, organizations are likely to imitate other successful organizations in their field (Galaskiewicz and Wasserman 1989; Di Maggio and Powell 1983). These three types of institutional pressures are ideally distinguishable, but they often cannot be readily discriminated from one another in empirical analyses.

Institutional theory is appropriate to understanding the diffusion of ISO 14001 for the following reasons: (1) various environmental issues have aroused public attention across the world (Frank et al. 2000) and also in Korea (Lee and Rhee 2005); (2) VEPs including ISO 14001 are becoming institutionalized through regulations and international agreement (Delmas and Montes-Sancho 2010); and (3) decision-makers are inclined to rely on their routines, societal values and expectations, and taken-for-granted assumption when they consider adopting new organizational practices (March and Simon 1958; Di Maggio and Powell 1983; Kelly 2003). The relevant institutional contexts in Korea and hypotheses are described below.

The Korean government established "The Promotion Act for Conversion to Environmental-Friendly Industry Structure (PACEFIS)" in 1995. This law was established in response to the following: UNCED in Rio de Janeiro in 1992 for improved environmental quality; GATT Uruguay Round Ministerial Decision on Trade and the Environment in 1994; the related launch of ISO 14001 by ISO (Park 2013). PACEFIS is the Korean law stipulating that public and private sectors are supposed to commit themselves to environmental issues and responsibilities, and act accordingly. Furthermore, this law encourages the Korean government to establish policies to promote the diffusion of VEPs in Korea[3] (15th article).

Governmental Incentives

In response to PACEFIS, the central and local governments in Korea offer various incentives for firms seeking VEPs. The governments in Korea have encouraged the adoption of VEPs including ISO 14001 through market-based incentives.[4] These incentives are categorized into two types: tax credits and subsidies. For tax credits, the central government in Korea provides 3–5 % tax credit for the certification fee for small–medium firms seeking ISO 14001. For subsidies, the local governments in Korea provide small–medium firms with a maximum of $7,000 as subsidies for the fee of ISO 14001 (Korea Accreditation Board 2014).[5]

Thus, the central and local governments in Korea concentrate their incentives on small–medium firms seeking VEPs. Small–medium firms are apt to be laggard in adopting new management policies because they are less likely to have sufficient resources (Kalleberg and Van Buren 1996). I, therefore, expect that as many small–medium firms are likely to adopt ISO 14001 as large-sized firms because the incentives help the small–medium firms to overcome their insufficient resources. These financial incentives do not directly require firms to adopt VEPs, but instead induce small–medium firms to have the programs. Accordingly, I suggest a following hypothesis:

[3] PACEFIS is a voluntary law, and it is not legally binding.

[4] The information about VEPs eligible for the governmental incentives is available at the web of Korea Accreditation Board (www.kab.or.kr).

[5] The amount of subsidies differs in administrative regions. "Gyeonggi-do" was the first local government which began to offer subsidies for small–medium firms seeking VEPs. This local ordinance has spread across Korean local governments since 2000. As of 2011, 11 out of 16 local governments provide subsidies with small–medium firms seeking management programs including ISO 14001.

Hypothesis 4 The variable indicating 'Small–Medium Firms' overrides the effect of firm size.

Vulnerability to Environmental Uncertainty

Along with the establishment of PACEFIS in 1995, public and industrial attention to environmental protection and VEPs has increased over time in Korea (Lee and Rhee 2005; Park 2013; Baek 2014). The legal changes explained above together with public and industrial attention to environmental protections and VEPs have created the normative expectation that firms should adopt VEPs, and this expectation constrains firms' behavior (Edelman 1990; Di Maggio and Powell 1983).

Previous studies suggest that newer firms are likely exposed to what has been called the "liability of newness" (Stinchcombe 1965; Haveman 1993). Such firms are much more vulnerable to environmental uncertainty than older firms because their service and products might not be socially recognized. To reduce this environmental uncertainty and obtain social recognition, the newer firms make a greater effort to comply with normative expectations. Delmas and Montiel (2009), using the U.S. automotive industry data, find that young automotive suppliers are more likely to adopt ISO 14001. Building on this idea, I expect that when a firm is newer, it is more likely to adopt ISO 14001 to conform to the normative expectation. Accordingly, I predict that

Hypothesis 5 A newer firm is more likely to adopt ISO 14001.

Financial Leverage

As VEPs have increasingly attracted public and industrial attention, investors' attention to the programs in Korea has also increased over time. Various investors such as banks and pension companies have begun to consider a firm's environmental performance and adopted VEPs to be a significant indicator when they evaluate the firm's financial management risk and even their performance in Korea (Oh et al. 2011). Therefore, firms that depend more on debt financing will be more likely to strive to improve their environmental performance and adopt VEPs. Liu and Anbumozhi (2009) find that a firm's financial leverage is positively associated with environmental information disclosure. Accordingly, I can suggest the following hypothesis:

Hypothesis 6 A firm with higher level of debt is more likely to adopt ISO 14001.

Global Institutional Pressures

In addition to changing the domestic institutional environment, institutional pressures can also originate from trade relations. VEPs including ISO 14001 are part of the international environmental discourse (Delmas and Montes-Sancho 2010), and I can surmise that Korean firms depending on foreign markets are more likely to have these 'internationally desirable' management practices. I expect that firms depending on foreign markets are likely to be influenced by international norms, and thus these firms are likely to adopt ISO 14001 in response to global institutional pressures. Christmann and Taylor (2001) find that firms with significant export volume are more likely to be influenced by international norms, and thus these organizations are more likely to have ISO 14001. Accordingly, I suggest the following hypothesis:

Hypothesis 7 A firm more dependent on foreign markets is more likely to adopt ISO 14001.

How Effects Differ Over Time

RBV and institutional theory both provide distinct insights into why firms adopt ISO 14001. The integration of these two theoretical logics in a single framework can further expand the understanding of a firm's adoption of ISO 14001. Previous studies about diffusion of other organizational policies and practices have offered a number of important insights into this issue. In particular, Tolbert and Zucker (1983) suggest that the motivation of adopters changes across diffusion periods. They found that later adopters are primarily interested in social legitimacy, while early adopters of management practices tend to seek technical gains from adoption.[6]

RBV scholars claim that valuable resources inside a firm can distinguish the firm from others and increase its efficiency and financial performance. This ultimately leads to a superior competitive advantage (Barney 1991). In this perspective, the adoption of ISO 14001 can be considered the imitable and non-substitutable resource that can obtain green reputation and increase operational efficiency. Therefore, I can suggest that the motivation of early adopters of ISO 14001 may be primarily explained by RBV. However, as ISO 14001 spreads across Korean manufacturing firms, it may lose its status as an imitable

[6] Some scholars criticize this two-stage institutionalization model because it conceptualizes institutional and technical forces as separate and distinct. They argue that technical considerations are also embedded in institutional forces. These scholars challenge this two-stage institutionalization model by assuming that institutional environments are fragmented and contested. In addition, the institutional environments are thought of as being influenced by multiple and competing logics. However, the history of Korean manufacturing industries is quite short, so that institutional environments are still immature. This condition coincides with Tolbert and Zucker's assumption of institutional environments (newly forming organizational fields). Therefore, my analysis follows the two-stage model.

and non-substitutable resource. Instead, ISO 14001 would come to be 'taken for granted,' and the adoption of ISO 14001 would be regarded as desirable and legitimate. Therefore, I can hypothesize the following:

Hypothesis 8 While the variables associated with RBV will be significant to explain the early periods of the diffusion process, the variables associated with institutional theory will be significant to explain the later periods of the diffusion process.

Data and method

Data

I have selected Korean manufacturing firms listed in the Korean stock market as of 2011 for my sample frame. My choice of manufacturing firms is related to the fact that as of 2009, 87.9 % of ISO 14001-certified firms fall into manufacturing industries.[7] Most financial and corporation-level data (e.g., the number of employees, the firm's net income and total assets, capital investment intensity, the size of exports) are only available for the listed firms. The number of firms included in this sample is 1168. The final analytical sample after deleting cases with at least one missing value from the independent variables was 982 firms with complete information.

Data are collected for the period ranging from 1996 to 2011. I use a database developed by the Korea Information Service Value (KISVALUE) to construct this sample and retrieve financial information and operating characteristics. KISVALUE is a business information service offered by the NICE credit rating agency in Korea, equivalent to Standard & Poor's or Moody's in the United States.

Dependent Variable

My dependent variable is whether a firm adopts ISO 14001 between 1996 and 2011. Given that my hypotheses are motivated by firm-level characteristics, my analyses are conducted at the firm level. While the certification to ISO 14001 occurs at the facility level, firms (headquarter offices) usually decide whether to pursue the ISO 14001 program. Once firms decide to adopt ISO 14001, they mandate or encourage their associated facilities to be certified to ISO 14001 (Darnall 2006; Delmas and Toffel 2008).

I operationalize a firm's adoption as the first year that one of the firm's associated facilities adopted the ISO 14001. A firm may have several facilities, and the facilities can be certified to ISO 14001 at different dates. The first decision to be certified to ISO14001 can reflect changes in firm-level strategies. Therefore, once a firm obtains the first certification, the second and the third certification can be obtained easily (Cañón-de-Francia and Garcés-Ayerbe 2009). The dependent variable is coded as 1 for the firm in the first year that one of its associated facilities adopted the ISO 14001. The year of the firm's first adoption of ISO 14001 is used to create the event marker that receives a value of zero for years that the organization is at risk of adoption and a value of 1 for the year of the adoption.

Data on firms' adoption of ISO 14001 are obtained primarily from the ISO 14001 certification data published by the Ministry of Knowledge and Economy in Korea, the only official government data source for ISO 14001. However, these data only cover certification information from 1996 to 2004. In order to obtain additional information on ISO 14001 certification from 2005 to 2011, I also use three additional credible sources: each firm's homepage, company profiles offered by 'Maeil Business News'[8] newspaper and KISVALUE, and an ISO certification database from the Korean Accreditation Board (KAB) website (www.kab.or.kr). Those databases supplement information about the first certification date for 2005 to 2011. Figure 1 displays the annual and cumulative number of ISO 14001 adoption in Korean manufacturing firms. 59 % of the firms in my sample adopted ISO 14001 by 2011.

Independent Variables

I create three measures to consider RBV: (1) chemical and petroleum industries; (2) capital investment intensity; and (3) financial performance (Darnall et al. 2008; King et al. 2005; Moon and DeLeon 2007). I use a firm's KSIC (Korea Standard Industry) code to determine if the firm belongs to the chemical and petroleum industry. Capital investment intensity is measured using the percentage of total assets to total sales of a firm (Bansal 2005). This indicates how much a firm has capital management capabilities. KISVALUE provides annual information on total assets and total sales. Financial performance is measured by return on assets (ROA), which is commonly used to measure a firm's financial performance. The information on ROA comes from KISVALUE.

I use four measures to assess institutional pressures toward the adoption of ISO 14001: (1) small–medium

[7] The most recent data about the distribution of ISO 14001-certified facilities across industries in Korea were available for 2009.

[8] This is one of most representative financial newspapers in Korea.

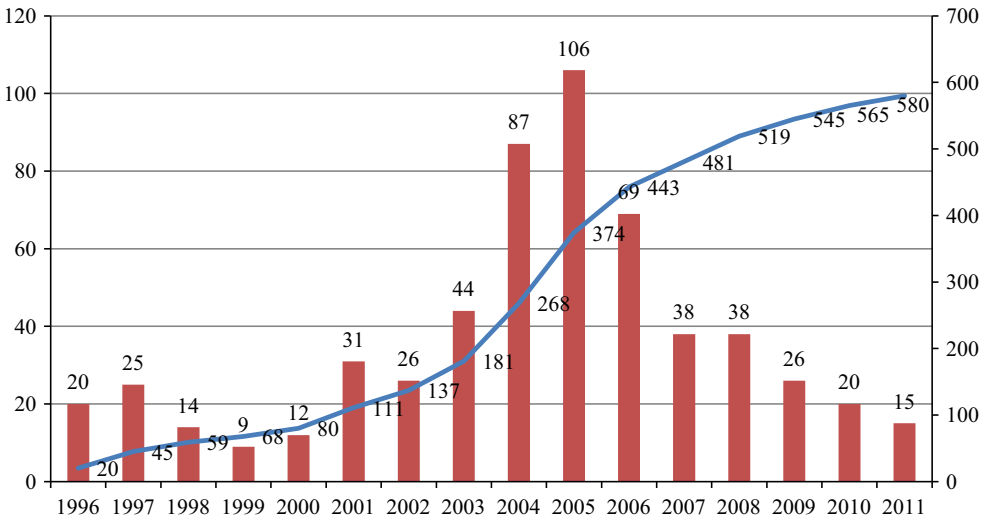

Fig. 1 The annual and cumulative numbers of ISO 14001 adoption in Korea

firms; (2) firm age; (3) financial leverage; and (4) the relative size of export volume. Small–medium firms are measured using whether a firm is covered by 'Small Medium Enterprises Basic Law.' The Korean government established 'Small Medium Enterprise Basic Law' in 1966 to facilitate the business of small–medium firms. In this law, the Korean government defines what small–medium firms are. Firms covered in this law could benefit from the Korean government through tax breaks and various incentives. KISVALUE provides information about whether a firm is covered by this law, and I can figure out whether a firm is 'legally' a small–medium firm. This variable is coded as 1 for small and medium firms, otherwise 0.[9] The age of the firm is measured by the number of years since the date of establishment of the firm. I employ a natural logarithm of this measure to accommodate right skewness. Financial leverage is measured using the percentage of total debt to total assets of a firm. This variable indicates how a firm depends on stakeholders such as banks and pension companies (Liu and Anbumozhi 2009). The relative size of export volume is measured using the percentage of annual export volume of firms to annual total sales of firms.[10] KISVALUE provides information about firms' establishment date, annual debt, and annual export volume. To ensure that causes precede the effects, all variables are lagged by one year (Box-Steffensmeier and Jones 2004).

Control Variables

I include two control variables to assess alternative explanations. First, I consider firm size to control for the size effect. Larger firms are more likely to be certified to ISO 14001 because they have more resources and bigger capacity (Kalleberg and Van Buren 1996; Baek et al. 2012; Bansal 2005). Firm size is usually measured using the total number of employees. KISVALUE provides information about the annual total number of employees of firms. I also employ a natural logarithm of this measure to accommodate right skewness.

Second, I consider the adoption of ISO 9001 to control for the effect of past experience with certifiable management standards. Many previous studies have shown that a firm's adoption of ISO 9001 predicts the adoption of ISO 14001 because they share a high level of commonalities (Delmas and Montes-Sancho 2010; Darnall 2006; King et al. 2005; Corbett and Kirsch 2001; Delmas and Montiel 2009; Moon and DeLeon 2007). A firm's adoption of ISO 9001 is measured in a similar way as my dependent variable. That is, this variable is measured by the first year that one of a firm's facilities adopted ISO 9001. Like my dependent variable, this variable is obtained from three different sources: (1) each firm's homepage; (2) company profiles offered by 'Maeil Business Newspaper' and KISVALUE, and (3) the ISO certification database from the Korean Accreditation Board (KAB) website (www.kab.or.kr). Table 1 displays the descriptive statistics of those independent and control variables. This is a description of

[9] This variable should be time varying covariate, but KISVALUE provides the most recently updated status of firms. That is, KISVALUE does not provide old information about whether a firm was a small and medium firm. However, according to government reports, only four firms were promoted from small and medium firms to large firms between 1996 and 2010. Therefore, I believe that firm status is not time varying, and I use the most updated status as a time-constant covariate.

[10] I impute the measure for the relative size of export volume based on a year. Through this imputation process, 1536 observations have increased. Before and after the imputation process, the significance of independent variables also does not change.

Table 1 Descriptive statistics, full sample (1996–2011)

Variable	Obs	Mean	SD	Min	Max
Resource-based view					
Chemical industry	9947	0.07	0.25	0.00	1.00
Capital intensity	9947	1.59	9.00	0.14	677.04
ROA	9947	0.03	0.16	−6.30	1.81
Institutional perspective					
Small–medium firms	9947	0.48	0.50	0.00	1.00
Firm age	9947	2.78	0.91	0.10	4.73
Financial leverage	9947	52.38	26.35	0.76	377.88
Export	9947	22.48	28.77	0.00	100.00
Control variables					
Firm size	9947	5.21	1.17	0.00	10.95
ISO 9001	9947	0.50	0.50	0.00	1.00

the means, standard deviations, and ranges for all years and all firms.

Analytical Strategy and Estimation

I model a firm's adoption of ISO 14001 using event-history methods. Event-history analysis produces strong evidence of how a range of independent variables affect the rate of certain events such as firms' adoption of ISO 14001. I employ an exponential model, assuming that changes in the hazard rate are contingent on changing covariates, rather than some inexorable trend during historical time (Frank et al. 2000). This statistical model is as follows:

$$h(t) = \exp\left(\beta_0 + \sum \beta_k X_{ki}\right)$$

where $h(t)$ represents the hazard rate of ISO 14001 adoption occurring in a given year i as a function of covariates X_k. My dataset includes 982 firms. This analysis relies on the 9947 at-risk firm-years with complete data for the variables of interest.

Analysis

I conduct three sets of statistical models. Each set of analyses includes two different statistical models. Two variables (small–medium firms and firm size) are expected to have a high level of correlation, and I plug each variable one at a time into a statistical model. The first set of analyses includes the entire period (1996–2011). The next set of analyses includes the take-off period from 1996 to 2003. The last set of analyses includes the later period from 2004 to 2011. According to the literature of diffusion study, I have chosen the cut-off year for the take-up phase versus the later phase of the diffusion of firm's adoption of ISO 14001. Many studies simply used mid-points of the observed period as a cut-off year to distinguish the early and later adopters (Westphal et al. 1997; Moon 2008). To conform to those studies, I also used the mid-point of observed period (2004) as a cut-off year. In addition, 2004 was the year ISO revised ISO 14001, and it was translated into Korean. This indicates that after 2004, ISO 14001 entered a mature phase of existence. Table 2 displays the results for these analyses.

Results

Table 2 presents the effects of independent variables on the adoption of ISO 14001. Model 1 and Model 2 present the entire period from 1996 to 2011. Model 3 and Model 4 present the period between 1996 and 2003, capturing early adopters of ISO 14001. Model 5 and Model 6 present the period from 2004 to 2011, capturing later adopters of ISO 14001. This analysis strongly suggests that Korean firms have adopted ISO 14001 to utilize as a competitive resource as well as to respond to institutional pressures. In addition, the results clearly show that firms' motivation to adopt ISO 14001 differs between the early and later periods of the diffusion process.

Hypothesis 1 states that firms in the chemical industry are more likely to adopt ISO 14001. The effect of the variable representing chemical industry is significant ($p < 0.001$) in the early periods (Model 3 and Model 4), and the effect disappears in the later periods of the diffusion process (Model 5 and Model 6). Hypothesis 2 predicts that firms with capital-intensive projects are likely to adopt ISO 14001. However, the variable indicating capital investment intensity is not significant in any period. Hypothesis 3 states firms with superior financial performance are likely to adopt ISO 14001. The results support this hypothesis with coefficients that are positive and significant ($p < 0.05$) but only in the early periods.

Hypothesis 4 states that small–medium firms are likely to adopt ISO 14001 as the same rate as larger firms, and the variable representing small–medium firms overrides the effect of firm size. In Table 2, the variable indicating small–medium firms is negative and strongly significant in Model 2, Model 4 and Model 6. These results show that small–medium firms are less likely to adopt ISO 14001 than larger firms, though the size of the coefficient is smaller for the later period (Model 6) than earlier (Model 4). This indicates that governmental incentives for small–medium firms may fail to override the effect of firm size on ISO 14001 adoption. This result, therefore, does not support Hypothesis 6. Furthermore, this result suggests that governmental incentives might not be effective to encourage small–medium firms to adopt ISO 14001. Hypothesis 5 predicts that newer firms are likely to adopt ISO 14001. The variable indicating firm age is negative

Table 2 Event-history analysis of adoption of ISO 14001 in Korean manufacturing firms

	1996–2011		1996–2003		2004–2011	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Resource-based view						
Chemical industry	0.294*	0.299*	0.763***	0.767***	−0.004	−0.005
	(0.146)	(0.146)	(0.205)	(0.203)	(0.216)	(0.216)
Capital investment intensity	0.001	0.001	−0.108	−0.105	0.010	0.009
	(0.004)	(0.004)	(0.119)	(0.111)	(0.007)	(0.007)
ROA	0.526	0.579	1.326*	1.255*	0.735	0.712
	(0.353)	(0.339)	(0.598)	(0.561)	(0.382)	(0.372)
Institutional theory						
Small–medium firms	–	−0.223*	–	−0.503**	–	−0.237*
		(0.087)		(0.171)		(0.103)
Firm age	−0.289***	−0.171***	−0.146	0.192	−0.392***	−0.357***
	(0.054)	(0.050)	(0.109)	(0.105)	(0.062)	(0.058)
Financial leverage	−0.003	−0.001	−0.003	0.001	0.006**	0.006**
	(0.002)	(0.002)	(0.004)	(0.003)	(0.002)	(0.002)
Export	0.007***	0.008***	0.002	0.006*	0.008***	0.009***
	(0.001)	(0.001)	(0.003)	(0.002)	(0.002)	(0.002)
Control variables						
Firm Size	0.236***	–	0.489***	–	0.142**	–
	(0.040)		(0.061)		(0.053)	
ISO 9001	1.185***	1.219***	1.125***	1.243***	0.837***	0.853***
	(0.102)	(0.102)	(0.173)	(0.170)	(0.127)	(0.127)
Constant	−4.150***	−3.278***	−6.324***	−4.727***	−3.168***	−2.451***
	(0.228)	(0.215)	(0.424)	(0.427)	(0.306)	(0.251)
Observations	9947	9947	5618	5618	4329	4329

Standard errors in parentheses

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

and significant ($p < 0.001$) only in the later periods. Hypothesis 6 states that firms with a higher level of debt are likely to adopt ISO 14001. The variable representing the debt financing is positive and significant ($p < 0.01$) only in the later periods. Hypothesis 7 predicts that firms more dependent on foreign markets are more likely to adopt ISO 14001. The variable indicating the relative size of export volume is positive and significant ($p < 0.001$) only in the later periods.

Hypothesis 8 suggests that a firm's motivation to adopt ISO 14001 differs in the diffusion periods. As predicted in Hypothesis 8, the RBV variables are only significant in explaining the firms' early adoption of ISO 14001, whereas variables in institutional theory are only significant to explain the firms' later adoption of ISO 14001. This suggests that firms' motives for the adoption of ISO 14001 change as the program becomes widely recognized. The results strongly support the prediction of Hypothesis 8.[11]

In terms of control variables, this study confirms that firm size and a firm's ISO 9001 adoption are positively associated with the adoption of ISO 14001. However, the effects of firm size and a firm's ISO 9001 adoption shrink over time. This indicates that firms adopted ISO 14001 regardless of the amount of their holding resources and

[11] I tried another cut-off year. Studies in the diffusion of management practices categorize corporate participants into various groups according to the timing of each firm's participation relative to the percentage of the total population that joined new programs (Rogers 2010). In particular, Rogers (2010) classifies the "early majority" as the first 50 percent of adopters. In my case, I use the 50-percent ISO 14001 adopter threshold to differentiate between early adopters and later ones. By 2008, 519 of 982 firms had adopted ISO 14001; those firms are classified as early adopters. On the other hand, 61 firms had adopted ISO 14001 between 2009 and 2011, and those firms are classified as later adopters. The analyses using alternative cut-off year also confirm that variables in RBV are significant to explain the adoption of ISO 14001 only in the early periods, as predicted Hypothesis 8. However, it does not capture the effect of institutional variables on the adoption of ISO 14001 in later periods well. These results might be affected by the fact that the later periods using alternative cut–off year do not include a sufficient number of events (i.e., ISO 14001 adoption) because it includes only three years of data.

their past experience of similar types of management programs.

Conclusion and Implication

These empirical results support various hypotheses from RBV and institutional theory. Firms adopt ISO 14001 as a competitive resource and in response to institutional pressures. In addition, the results show that the motivation to adopt ISO 14001 differs during the diffusion period. The motivation of early adopters of ISO 14001 is primarily explained by RBV, but the motivation of later adopters is explained by institutional theory. As more and more firms recognize and adopt ISO 14001, variables in institutional theory become increasingly important and the variables in RBV are of declining importance. This finding is consistent with previous studies that show that motivation to adopt organizational policies differs across diffusion periods (Tolbert and Zucker 1983; Westphal et al. 1997; Moon 2008; Delmas and Montes-Sancho 2010).

These findings also have three important implications for the institutional context in Korea and Asia more broadly. First, they imply that in contexts where the state has been traditionally strong but is moving toward being less controlling of regulatory policy, as in the case of Korea, its approach to environmental policy has been agenda-setting for the private sector. As noted above, the Korean government has initiated the discussion on VEPs through the legislation of PACEFIS in 1995. The law would rather create social expectation about environmental responsibilities and VEPs than mandate firms to be green. Furthermore, this legal change refocuses stakeholders' attention to environmental responsibilities and VEPs and shift firms' market strategies toward 'being green.' The Korean case exemplifies instance of strong states becoming less strong. It suggests that in such instances, the government, rather than mandating firms to be green by regulatory penalties, promotes corporate social responsibilities by making such responsibilities a market-place asset for the firm (Kang and Moon 2011; Kang 2010; Gond et al. 2011). In this sense, the government has changed the implicit rules of the game, which is something that contrasts to the approach of strong states to mandate by commands and controls.

Second, this study shows how ISO 14001 diffuses in an Asian context. As noted in previous studies (Lee and Rhee 2005; Christmann and Taylor 2001; Frank et al. 2007), societal demands for environmental sustainability and protection in Asian countries have rapidly intensified. Like Korea, many other Asian countries have actively promoted the growth of VEPs including ISO 14001 through government support programs (Delmas 2002; Organisation for Economic Co-Operation and Development 2014).[12] The countries such as China, Japan, and Thailand arguably have common structural characteristics. The Korean case, therefore, may be taken to be a hypothesis for the way of diffusion of ISO 14001 has occurred within the countries.

Third, my statistical results offer strong evidence that the institutional context in Korea has become favorable to the adoption of ISO 14001 over time. These findings suggest that firms may adopt ISO 14001 to simply conform to institutional pressures rather than to fulfill their needs in the later periods. Therefore, I expect that there might be some dissonance between ISO 14001 adoption and actual environmental outcomes in these periods (e.g., pollutant emissions and legal compliance with the Clean Air Act or other environmental laws). This study, therefore, calls for future research concerning the environmental outcomes such as pollutant emissions of ISO 14001-certified firms.

Finally, this work is limited in one primary respect. The results suggest that direct financial support by governments might not be effective to promote ISO 14001 adoption. Unlike Delmas' speculation (2002) that many Asian countries would lead in the rapid diffusion of ISO 14001 through financial incentives, the results fail to find the evidence that governmental incentives in Korea have successfully encouraged firms to adopt ISO 14001. However, I use a very rough indicator to measure the presence of governmental incentives in this paper. This study, therefore, also calls for further research to ascertain how organizations respond to financial incentives created by governments on the diffusion of VEPs using more refined measures.

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[12] Many Asian countries have supported the growth of ISO 14001 through government support programs. These countries include: Japan, China, Korea, Taiwan, Hong Kong, Thailand, Malaysia, Singapore, Indonesia, Vietnam, and Sri Lanka.

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