

**Title (Draft Paper)**

Policy Diffusion and the Fragmentation of Environmental Regulations in Asian Countries

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**Abstract**

To capture the global effect of policy diffusion, which occurs in some countries, but not others, the universe of diffusion situations needs to be addressed. This paper argues that regulatory diffusion to follower jurisdictions can be classified into three types: diffusion, non-diffusion, and partial diffusion. It examines why some environmental regulations diffused across several, but not all, Asian countries, resulting in the diffusion and non-diffusion of regulations. This paper also shows that even when countries adopt innovative regulations from other jurisdictions, original regulations are modified, and different provisions are adopted. Modified provisions create the partial diffusion of regulations. Diffusion, non-diffusion, and partial diffusion of environmental regulations are analyzed using case studies of three environmental issues: the regulation of toxic chemicals in products, hazardous waste management, and emissions trading schemes for greenhouse gas emissions. These are analyzed across 13 Asian countries. Using these case studies, this paper demonstrates that the three types of regulatory diffusion occur owing to differences in the causal factors underlying adoption among countries.

**Keywords:** diffusion, policy diffusion, fragmentation, environmental regulations, RoHS, REACH, hazardous waste management, emissions trading scheme (ETS)

## **I. Introduction**

Policy diffusion, the spread of innovative policies beyond jurisdictions, has been observed in multiple policy areas. One notable area is environmental policies (Busch, Jörgens, and Tews, 2003, 2005; Dolšak and Sampson, 2012; Daley and Garand, 2005). Busch, Jörgens, and Tews analyzed a wide range of environmental strategies, including national policy plans and strategies for sustainable development, eco-labels, energy/carbon taxes, and legal provisions on the free access to environmental information, to examine the process and determinants of policy diffusion (Tews, Busch, and Jörgens, 2003, 2005). Previous studies have examined the causes and consequences of policy diffusion, seeing policy diffusion as a supplement to global governance (Bush et al., 2016, p. 164).

Building on previous research, this paper shows a pattern of diffusion that includes diffusion, non-diffusion, and partial diffusion. Non-diffusion is defined as a situation in which a country has not adopted an established policy by a cut-off time. In addition, this paper defines partial diffusion as a situation in which regulations diffuse and are adopted with modifications in new jurisdictions. Partial diffusion has been addressed in a number of papers. For example, Busch and others described differences in administration and technology, as well as scope and ambition of adopted regulations among jurisdictions (Busch et al., 2005).

Examinations of the pattern of diffusion are needed to understand the consequences of diffusion for trade and environmental governance under globalization. With trade liberalization, goods move seamlessly across countries. Manufacturing companies choose the best location for operation and source components from multiple plants in different countries. Variation in policy requirements among countries due to partial diffusion may hamper trade as firms operating across countries may be required to meet the specifications of multiple countries.

How does extensive regulatory diffusion across countries affect firm behavior and decision-making? Companies may decide to locate in or trade with countries without regulations to reduce environmental management costs. A country without the capacity to adopt policies is at risk of becoming a pollution haven. At the same time, regional governance is fragmented and may create pollution havens.

With respect to empirical studies, one feature of this paper is that the cases cover the diffusion of environmental regulations and policies from developed countries to both developed and developing countries. The existing literature has examined various geographical issues related to policy diffusion. For example, Vogel examined diffusion from Germany to California, or the so-called California effect, which also applies to federal diffusion within the United States (Vogel, 1995, 1997a, 1997b), while Naiki examined diffusion from the EU to Japan (Naiki, 2010). Although issues in developing countries have been considered (Liu and Li 2016), most studies to date have focused on industrialized countries. To obtain a more comprehensive picture of policy diffusion in the management of various environmental problems, it is important to include analyses of developing countries.

Examinations of the linkages among developed and developing countries have been increasing in various fields of policy and regulation, including trade, finance, global supply chains, labor, environmental protection, and so on. As more developing countries introduce diffused policies, with different underlying causes or determinants from those of policies in developed countries, a lack of understanding of the situation in individual developing countries may lead to a misunderstanding of global governance on environmental issues.

In this paper, Asian countries, especially those developing ones have experienced rapid economic growth in recent decades, were chosen for case studies. These countries have often referred to foreign experiences and have adopted regulations related to environmental protection from developed countries. Thirteen countries with different income levels were examined, thus enabling us to perform comprehensive comparisons and to examine the dynamic causes and consequences of policy diffusion. Chemical substances, hazardous waste management, and emission trading schemes have been selected as issue areas to examine policy diffusion owing to their dynamic properties. With respect to emissions trading schemes, although adoption is limited to several jurisdictions, trading systems have been launched in major emitters, such as Japan, Korea, and China, in Asia.

## **II. Analytical Framework**

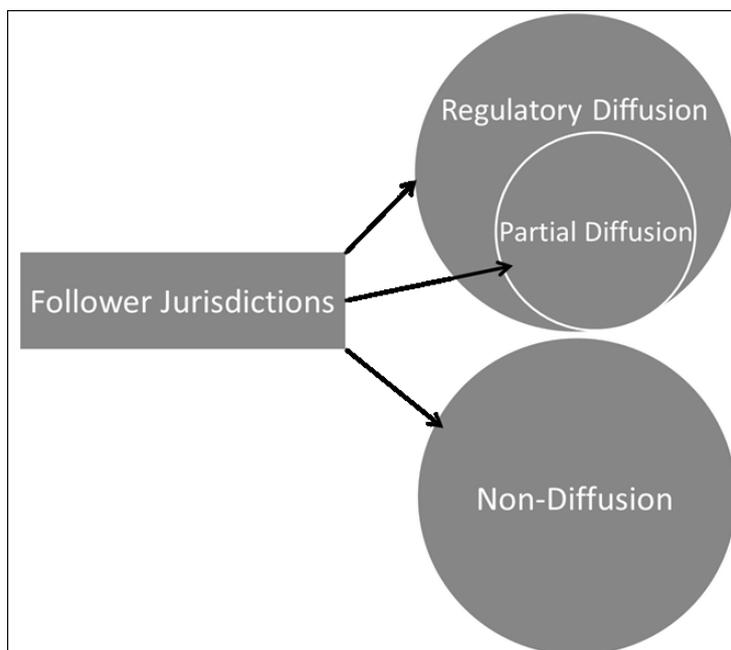
Diffusion occurs both horizontally, across nations or states, and vertically, from a national to subnational level (Daley and Galand, 2005; Tews et al., 2005). Studies of

policy diffusion have attempted to determine why and how regulations or policies diffuse (Simmons and Elkins, 2004; Shipan and Volden, 2008; Volden, 2008); however, little attention has been paid to the coexistence of diffusion and non-diffusion—why have some countries adopted certain regulations, while others have not (van der Heiden and Strebel, 2012)? Therefore, there is a mixture of countries demonstrating policy diffusion and non-diffusion (Uperlainen 2010). Although existing literature has identified this phenomenon, a systematic and comparative analysis including a considerable number of case studies is still lacking.

On the other hand, among countries that have adopted a pioneering regulation or newly innovated policy to attend environmental issues, some diffused regulations are modified from the original regulations, resulting in many variants. This creates heterogeneity among diffused policies and may negatively influence the order of global governance. Particularly, policy diffusion has become an important mechanism for the spread of innovative environmental policies in Asia, especially among developing countries. This paper presents case studies of policy diffusion, non-diffusion, and partial diffusion across jurisdictions in Asia.

As shown in Figure 1, this paper aims to provide an analytical framework for explaining both non-diffusion and partial diffusion of environmental regulations among countries. The mixed system of diffusion creates the fragmentation of governance and may hamper trade and environmental management. As illustrated in the Figure, follower jurisdictions choose to adopt regulations or not, which can be regarded as regulatory diffusion and non-diffusion. Within the diffusion of regulations, some jurisdictions adopt regulations that have been modified to suit their respective circumstances, and this scenario is regarded as partial diffusion in this analysis.

**Figure 1 Analytical Framework—Three Types of Regulatory Diffusion**



Source: authors.

This paper contributes to the literature by investigating two questions. The first question focuses on *policy diffusion vis à vis non-diffusion* and particularly the causes and determinants of the diffusion of environmental regulations to some jurisdictions but not others. What mechanisms cause diffusion in Asia? Do country income, openness to trade, industrial structure, characteristics of environmental issues, or other adoption by other countries affect policy diffusion?

The second question examines the causes and environmental and trade consequences of *partial policy diffusion*. Non-diffusion and diffusion along with variation in an original policy have important consequences for investment by firms and trade across borders with different regulatory stringencies under globalization. Is it possible that the rational behavior of firms has adverse effects in countries with loose or no regulations? Diffusion leads to greater policy convergence than non-diffusion, but partial diffusion may lead to policy fragmentation.

To address the above-mentioned questions, this paper examines three case studies of different issue areas in Asian countries, including toxic chemical materials in products, the management of hazardous waste, and CO<sub>2</sub> emissions trading schemes (ETSs), to

demonstrate a wide range of issues related to policy diffusion. For all the cases, diffusion is examined from large, influential countries, that is, those in the European Union and the United States.

Toxic chemical substances are regulated by the Restriction of Hazardous Substances Directive (RoHS) and the Regulation on Registration, Evaluation, Authorization and Restriction of Chemicals (REACH), both of which are EU directives. Diffusion of these regulations creates local variants in non-EU countries, but a worldwide agreement on how to introduce consistent regulations has not been reached.

Environmentally sound management of hazardous waste is promoted internationally under the Basel Convention, although the major concern of the convention is the transboundary movement of hazardous waste. The original management policies in most developing countries, including some Asian developing countries, such as South Korea, Singapore, Malaysia, and the Philippines, were formulated before the Basel Convention was entered into force. As a result, despite international norms, implementation differs from country to country. Partial diffusion of hazardous waste regulation is observed in Asian countries.

With respect to carbon emissions markets, ETSs were introduced only at the regional level because there was no pre-existing market. With the implementation of separate regional carbon markets, some have advocated for the establishment of linkages among existing schemes.

### ***Definitions and Mechanisms of Policy Diffusion***

Policy diffusion is considered an important approach to achieving governance on global issues, after “harmonization” through international negotiations and “imposition” through unilateralism (Jörgens, 2003). Policy diffusion, in contrast, generates solutions to domestic or even cross-border problems by decentralized imitation, persuasion, and learning, with minimal obligation (Jörgens, 2003, p. 4). Several definitions of policy diffusion have emerged from the study of cases in developed countries. Biedenkopf points out that policy diffusion is “the process through which policy originating in one jurisdiction affects policy in other jurisdictions, taking place in the absence of a negotiated agreement to transfer the respective policy between the jurisdictions” (Biedenkopf, 2012,

p. 106). This paper, the policy similarities as well as the causal relationships between the original and subsequent policies will be identified for each of the cases. Like Biedenkopf's work, it discusses the mode of regulation implementation, but expands the analysis to include reasons for the lack of implementation in certain jurisdictions.

The mechanism of policy diffusion is based on decentralized imitation, competition, persuasion, and learning, as can be observed in cases in the existing literature (Simmons and Elkins, 2004; Shipan and Volden, 2008; van der Heiden and Strebler, 2012; Volden, 2008). Other mechanisms have also been suggested that focus on the interdependence among countries (Obinger, Schmitt, and Starke, 2013; Simmons and Elkins, 2004). Policy adoption by a country alters the benefits of adoption by other countries.

Diffusion is considered as a cause of policy convergence; however, being a causal force of convergence does not necessarily mean being an effective mechanism of global governance" (Tews and Busch, 2001, p. 168; Busch and Jörgens, 2005). Many cases of international policy diffusion have been regarded positively as spread of innovative policy from one jurisdiction to others helps those that experience similar problems, especially in developing countries' context. However, despite the convergence of regulations in various countries in certain issue areas, fragmentation, rather than harmonization, can occur from the perspective of global governance. The analysis of policy diffusion vis à vis non-diffusion and partial diffusion needs to address the effects of policy diffusion on governance in host countries after regulations have been widely implemented. This paper also attempts to study these aspects of policy diffusion in the context of the aforementioned cases.

### **III. Empirical Analysis of Environmental Regulations in Three Cases**

Policy diffusion and the fragmentation of regulations in the following three issue areas are examined in the second part of this paper: chemical regulation, hazardous waste regulation, and greenhouse gas (GHG) ETSs. The cases are examined across 13 Asian countries. Table 1 shows that some countries choose to adopt regulations by learning from or imitating a pioneer country. Others, however, did not do so in specific issue areas. In particular, ASEAN countries, such as Cambodia, Lao PDR, and Myanmar, have not widely adopted some or all of these policies. Table 1 reveals that relative power of issues and that of countries in diffusion of these policies.

**Table 1 Policy Diffusion and Non-diffusion of Environmental Regulations in Thirteen Asian Countries**

Countries	Issue areas				Numbers of issues of diffusion
	Toxic Chemicals in Product		Hazardous Waste Management	Emission Trading System	
	RoHS	REACH			
<b>Japan</b>	Enacted (2006)	Not introduced	Enacted (1970)	Enacted (2002: Tokyo) 2011 (Saitama)	3
<b>South Korea</b>	Enacted (2007)	Enacted (2013)	Enacted (1986)	Enacted (2012)	4
<b>Singapore</b>	Enacted (2016)	Not introduced	Enacted (1988)	Not introduced	2
<b>Indonesia</b>	Not introduced	Not introduced	Enacted (1994)	Not introduced	1
<b>Thailand</b>	Enacted (2008)	Enacted (2015)	Enacted (1992)	Not introduced	3
<b>Vietnam</b>	Enacted (2011)	Not introduced	Enacted (1999)	Not introduced	2
<b>Malaysia</b>	Not introduced	Enacted (2009)	Enacted (1989)	Not introduced	2
<b>Myanmar</b>	Not introduced	Not introduced	Not introduced	Not introduced	0
<b>Cambodia</b>	Not introduced	Not introduced	Enacted (1999)	Not introduced	1
<b>Philippines</b>	Not introduced	Not introduced	Enacted (1990)	Not introduced	1
<b>Laos</b>	Not introduced	Not introduced	Enacted (2015)	Not introduced	1
<b>China</b>	Enacted (2006)	Enacted (2010)	Enacted (1995)	2013(7 pilots) Enacted (2017: National ETS)	4
<b>India</b>	Enacted (2011)	Under consideration	Enacted (1989)	Not introduced	2
<b>Numbers of countries of diffusion</b>	7	4	12	3	

Source: authors.

Note: The results are presented as of January 2017 and are subject to change due to future policy development.

Among the four regulations, hazardous waste management is the most diffused policy followed by RoHS, REACH, and emission trading systems. In terms of countries, China and South Korea adopted all, followed by Japan and Thailand where three of the regulations are adopted. However, most ASEAN countries adopted fewer regulations. The pattern shows that there are issues that tend to diffuse to other countries, and there are countries that tend to adopt other jurisdictions' policies.

Causal factors observed in the case studies are classified into the following three groups: (1) to avoid becoming a pollution haven, (2) to maintain access to an economically important market, and (3) to advance environmental protection by learning from other countries. Each country faces different economic, social, and political priorities; accordingly, these causes are a function of income levels, government capacity, industrial needs or firms' international competition, regional or international coordination, and needs to protect the environment.

In the following section, the causes and consequences of policy diffusion will be clarified through case studies, and the determinants of non-diffusion and partial diffusion will be examined in Asian countries.

## **1. Chemical Substances in Products (RoHS Directive and REACH Regulation)**

Product- or process-related environmental regulations have been introduced to protect human health and the environment by specifying product quality. Product regulation can affect the behavior of producers within and outside of regulated jurisdictions. The EU was a leader in the implementation of innovative chemical regulations in the 2000s. The most influential chemical regulations are the RoHS Directive and REACH Regulation of the EU. These regulations have had significant impacts on Asian companies as well as policies.

The EU RoHS was implemented in 2006 and restricts the use of hazardous substances, such as heavy metals and flame retardants, in electrical and electronic products<sup>1</sup>. The RoHS aims to manage products containing hazardous substances that can cause health problems or environmental degradation. The RoHS is aimed at producers both inside

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<sup>1</sup> RoHS Directive 2002/95/EC. It was revised by 2011/65/EU as RoHS 2.

and outside of the EU; all suppliers and assemblers involved in the manufacturing of final products for the EU market must take measures to satisfy the RoHS.

In the past decade, the EU RoHS has diffused to Asian countries, with modifications according to local conditions (Table 2). When public hearings on RoHS were conducted, some governments began to collect information in order to plan their approaches to deal with the EU regulations. Such planning enabled them to issue local versions of the RoHS subsequent to the introduction by the EU. Regulations were implemented in Japan in 2006, China in 2007, South Korea in 2008, and Thailand in 2009 (Michida, 2015; Ramungul et al., 2013). Most countries copied the threshold levels for restricted substances in their adapted regulations from those of the EU RoHS. However, the administrative and technical details vary among countries. Japan and Thailand created industrial standards, instead of regulating hazardous substances contained in products. While the EU regulated only final products, China regulated both final and intermediate goods. Countries such as Cambodia, Indonesia, Myanmar, Lao PDR, and the Philippines have not introduced RoHS-like regulations within their jurisdictions, and accordingly are considered non-diffusion cases.

On the other hand, the EU REACH is the European Regulation on Registration, Evaluation, Authorization and Restriction of Chemicals<sup>2</sup> and entered into force in 2007. REACH diffused to Asian countries, similar to the diffusion of the EU RoHS, but in a limited manner. A smaller number of countries have adopted REACH-like policies and the type of adoption was partial. In this paper, REACH-like policy refers to policies that require the notification and registration of chemicals depending on their type and weight after the EU REACH. REACH-like policy exhibits a pattern of partial diffusion. In general, chemical policy is much more complex than RoHS-type policy, which is applied to a specific product category without pre-existing policy in the same regulation. Introducing REACH-like policy is partially motivated by international agreements, such as Agenda 21 and SAICM (Strategic Approach to International Chemicals Management), to improve chemical management. REACH regulation prompted Asian countries to update their chemical regulations (Table 3). South Korea introduced a regulation that is similar to REACH, but countries like Japan and Malaysia only made incremental changes based on existing regulatory structures, although the modifications were affected by regulatory measures introduced in the EU REACH. Cambodia, Indonesia, Myanmar, Lao PDR, the Philippines, Singapore, and Vietnam have not adopted REACH and accordingly are

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<sup>2</sup> REACH Regulation European Parliament and Council Regulation No.1907/2006.

categorized as non-diffusion countries.

**Table 2 Diffusion of EU RoHS across Regions and to Asia**

<b>Year of Enactment</b>	<b>Country/Region</b>	<b>RoHs</b>
2006	EU	RoHS Directive
2006	Japan	JIS C0950 (J-Moss)
2006	China	Administrative Measure on the Control of Pollution Caused by Electronic Information Products
2007	South Korea	Act for Resource Recycling of Electrical and Electronic Equipment and Vehicles
2008	Thailand	TIS 2368-2551 (2008) (industrial standard)
2012	India	E-waste (Management and Handling) Rules, 2011
2011	Vietnam	Circular No. 30/2011/TT-BCT
2016	Singapore	Environmental Protection and Management Act, Amendment of the second schedule
	Cambodia	Not introduced
	Indonesia	Not introduced
	Malaysia	Not introduced
	Myanmar	Not introduced
	Laos	Not introduced
	Philippines	Not introduced

Source: J-NET21: Table created by the author using information obtained from various sources.

**Table 3 Diffusion of EU REACH across Regions and to Asia**

<b>Year of Enactment</b>	<b>Country/Region</b>	<b>Regulation/Measures</b>
2007	European Union	REACH Regulation
2009	Malaysia	Voluntary EHSNR (Notification and Registration of Chemicals) was introduced.
2010	China	Revisions on Measures for Environmental Administration of New Chemical Substances (Order 7)
2011	Japan	Revised Chemical Substance Control Law
2015	South Korea	Act on Registration and Evaluation of Chemicals
2015	Thailand	Hazardous Substances Notification B.E.2558
2012 (Drafting)	India	Drafting National Chemical Policy (Draft NCP-2012)

	Cambodia	Not introduced
	Indonesia	Not introduced
	Laos	Not introduced
	Myanmar	Not introduced
	Philippines	Not introduced
	Singapore	Not introduced
	Vietnam	Not introduced

Source: authors.

### **(1) Causes**

The major causal factor in the implementation of policies similar to the EU RoHS is a concern for a loss of access to the EU market. The EU has long been one of the most important export destinations for many Asian producers. Both governments and industries have been motivated to help local firms adopt the EU RoHS by issuing similar regulations in their own languages so that local exporting firms can remain competitive in the EU market. Countries such as China and South Korea aimed for a more complete adoption of the EU original policy with the intention to maintain market access to the EU.

The second cause is the concern that a country may become a pollution haven owing to a lack of counterpart regulations. Countries may have concerns that sub-standard products that cannot be exported to the EU may fill their domestic markets. As governments in some developing countries do not have the capacity to closely examine the appropriate regulatory scope and stringency appropriate for their own situation, it is safer to introduce the same regulation as that established in the EU.

The third cause is the need to harmonize standards within countries. Many intermediate producers began to receive various requests from customers related to the EU RoHS. However, some customers had their own interpretations or misunderstood RoHS requirements, leading to confusion among suppliers. Countries such as Thailand have therefore issued standards, rather than regulations, to harmonize RoHS requirements within the country (Ramungul et al., 2013). This motivation leads to partial diffusion, as some countries do not have an urgent need to facilitate regulatory compliance.

Finally, environmental concerns play a role in countries like Singapore and India. Singapore creates extensive landfills that are utilized for industrial purposes. Singapore fears that the land may be contaminated with hazardous substances, as ash from incinerators is used for landfills. India is also concerned about becoming a dumping

ground for substandard end-of-life products as the country has received a large amount of e-waste from many countries for recycling purposes. Countries with strong environmental concern, such as India and Singapore, adopt similar regulations, but tend to lag behind countries seeking to maintain market access with respect to the timing of the introduction of regulations.

There are non-diffusion countries for the EU RoHS. Cambodia, Indonesia, Lao PDR, and Myanmar have not adopted the RoHS regulation. Implementing chemical-related policy requires information on chemicals in both public and private sectors, but late-comer ASEAN countries are primarily importers and users, rather than producers, of chemicals, and hence do not possess extensive information on the chemicals that they use. Additionally, laboratories that perform testing on hazardous materials and chemicals are needed for implementation. The countries lacking such infrastructure exhibit delayed adoption of product regulation, such as the EU RoHS. Moreover, Cambodia, Lao PDR, and Myanmar do not have strong manufacturing industries, particularly electric and electronics industries that require compliance to maintain EU market access. For larger companies whose headquarters are located in developed countries, regulatory compliance can be achieved with assistance from headquarters. In addition, governments may lack the capacity to implement regulations, hampering the introduction of RoHS-like regulation.

The EU RoHS is a new set of policies that corresponds to a previous regulation, and full adoption is relatively easy for follower countries. In contrast, the adoption of REACH, an overall chemical regulation, is incremental, as countries have existing, complex chemical policies. Full adoption of REACH is usually not feasible. Still, some modifications have been made in various countries, such as additional chemical registration requirements.

Korea and China have introduced chemical regulations that are strongly influenced by the EU REACH, but Japan adopted only a small part of the REACH regulation. The partial adoption of a REACH-type regulation by Japan is explained, in part, by the incompatibility with existing legal policies and social structure (Naiki 2010). However, Japan has adopted a REACH-like policy that requires notification and registration for all chemicals, including chemicals that were not included under previous policies. Malaysia has introduced a voluntary chemical registration system motivated by REACH and risk assessment will be performed by the government to develop regulatory measures for

selected chemicals. Thailand also started to require the notification and registration of listed chemicals for production as well as importation beginning in 2015. These measures were partly adopted from REACH and were inserted in existing policy, leading to partial diffusion.

## **(2) Consequences**

As Asian countries have adapted the EU RoHS and modified it to fit their individual circumstances, there are now diverse versions of similar regulations or standards. Although the kinds and thresholds of hazardous substances are copied from the EU, differences in regulations and standards are observed with respect to targeted products as well as testing and labeling requirements. Electronic and electric products manufacturers that produce and market globally are now faced with multiple requirements in the global market. Some countries that aim to maintain EU market access create contradictory and complicated regional regulatory situations outside of the EU. This is harmful, especially to small and medium enterprises that export to multiple markets or produce parts for final products for export, as they may lack the capacity to collect information on global regulatory developments.

For chemical regulations, fragmentation occurs as a result of the *ad hoc* development of national regulatory measures in response to the EU RoHS and REACH. Follower countries introduce policies that are similar to, but different from, the EU regulations. Overall policy diffusion of the EU RoHS created a race-to-the-top, but from a trade perspective, leading to fragmentation.

Countries without regulation run the risk of becoming pollution havens. Firms that have not adopted regulations of the EU and other following countries are likely to send products to countries lacking the regulations. Pollution havens may occur in terms of production as well as waste. The current situation in which product regulations diffuse without a hierarchical structure is expected to continue. International coordination and the development of a consistent policy can benefit firms and help lower trade barriers.

## **2. Hazardous Waste Management**

Hazardous waste that is handled improperly affects ecosystems and human health more severely than other types of waste. In the 1970s, developed countries began to

enact legislation to manage hazardous waste, after facing various pollution problems in the 1960s. Various regulations were introduced to control air and water pollution. Several types of legislation are observed. Some countries, such as the United States, focus only on industrial hazardous waste. Others, such as Japan, Germany, and South Korea, focus on industrial waste, which includes industrial hazardous waste.

In recent years, household hazardous waste has received increasing attention. Some countries, however, struggle to integrate household hazardous waste into existing hazardous waste regulations and/or municipal solid waste regulation. Because the starting point for hazardous waste regulation is industrial waste, this paper focuses on the diffusion of industrial hazardous waste regulations. As a case study, hazardous waste legislation in several Asian countries will be examined owing to the variation in stages of economic development. Among thirteen Asian countries, eight have introduced hazardous waste regulation: Japan, South Korea, China, India, Singapore, Malaysia, the Philippines, Thailand, Indonesia, Vietnam, Cambodia, and Lao PDR (Table 4). Myanmar has not yet introduced hazardous waste regulation.

**Table 4 Diffusion of Hazardous Waste Regulation**

<b>Year</b>	<b>Country</b>	<b>Law or Regulation</b>	<b>Per Capita GDP (constant 2005 US\$)</b>	<b>Manufacturing Sector Share in GDP (%)</b>
1970	Japan	Waste Management and Public Cleansing Act	15,161	35.9%
1972	Germany	Waste Disposal Act	17,473	36.0%
1976	USA	Resource Conservation and Recovery Act	23,944	24.2%
1986	South Korea	Solid Waste Management Act (industrial waste)	6,279	26.7%
1988	Singapore	Environmental Public Health (Toxic Industrial Waste) Regulations	14,616	27.3%
1989	Malaysia	Environmental Quality (Scheduled Wastes) Regulations	2,969	23.8%
1989	India	Hazardous Waste (Management and Handling Rules)	389	16.4%
1990	Philippines	Toxic Substances and Hazardous and Nuclear	1,002	24.8%

		Wastes Control Act of 1990		
1992	Thailand	Factory Act Hazardous Substance Act	1,919	27.5%
1994	Indonesia	Government Regulation on Hazardous Waste Management	1,036	23.3%
1995	China	Law of the People's Republic of China on Prevention and Control of Environmental Pollution by Solid Waste	782	40.7%
1999	Vietnam	Decision No. 155, 1999.	504	17.6%
1999	Cambodia	Sub-Decree on Solid Waste Management	310	14.0%
2015	Laos	Ministerial Instruction on Hazardous Waste Management	818 (2014)	8.9% (2014)
	Myanmar	Under consideration		

Source: Compiled by authors. The data on GDP per capita and share of manufacturing sector in GDP after the 1980s were extracted from the World Development Indicator. Shares of manufacturing section in GDP in the 1970s were extracted from OECD (1984)

### (1) Causes

The major reason for the diffusion of hazardous waste regulation in Asian countries is environmental protection. Countries that achieved industrialization and the enforcement of water and air pollution controls relatively early have introduced industrial hazardous waste regulation. Singapore was one of the Four Asian Dragons that achieved rapid economic development in the 1970s and 1980s. The per capita income of Singapore reached more than 14,600 USD (PPP constant price of 2005) in 1988, when it introduced hazardous waste regulation. The share of GDP of manufacturing sectors reached 27.3% at that time. By 1995, Malaysia, the Philippines, Thailand, and Indonesia all introduced regulations to control industrial hazardous waste. In these countries, the share of the total GDP of the manufacturing sector ranged from 23% to 28%. These countries all introduced air and water pollution controls prior to the introduction of industrial hazardous waste regulation.

In Indonesia, industries with pollution control requested a disposal site for hazardous waste around 1980 (Hilman, 2002). The improper management of hazardous waste had already been reported in these countries, even before the hazardous waste regulation was enacted. For example, in the 1980s in Malaysia, radioactive waste from a factory

processing rare earth was disposed of improperly, harming the lives of local people.

Industrialization in Asian countries has been stimulated by foreign direct investment from developed countries. In addition to high labor costs in developed countries and the development of infrastructure in Asia, meeting the requirements of pollution control and hazardous waste regulations in developed countries may be too costly for manufacturers, eventually causing them to transfer to Asian countries and continue to produce industrial waste. For instance, the improper dumping of radioactive waste in Malaysia in the early 1980s was caused by a Japanese company. This case helped to elevate awareness of the necessity of hazardous waste regulation (Nakamura, 1993). India introduced hazardous waste regulation in 1989, when it enacted chemical regulation. Hazardous substances and waste received attention in India as a result of toxic gas leakage from a factory in Bhopal in 1984. The leak killed more than 15,000 citizens in Bhopal. The factory was based on foreign direct investment from the United States.

Another factor promoting diffusion is the desire to avoid becoming a pollution haven due to the transboundary movement of hazardous waste. Developing Asian countries introduced hazardous waste regulation to prevent the improper management of hazardous waste generated by industry or imported from other countries.

In the 1980s, owing to an increase in the cost of treatment and disposal, hazardous waste was shipped from developed countries to developing countries. Various incidents occurred; for example, a 1988 fire at a storage site that kept unclaimed hazardous waste in a Bangkok port affected the health of local residents. The incident was one of the catalysts for the introduction of hazardous substance and industrial waste regulations related to the transboundary movement, treatment, and disposal of hazardous waste. Before the introduction of hazardous waste regulation, Indonesia, the Philippines, and Cambodia all faced problems with imported hazardous waste from developed countries.

However, the major obstacle to the introduction of hazardous waste regulation in developing countries was a lack of capacity. Governmental officials did not have the capacity to manage hazardous waste. Academics, consultants, and laboratories able to identify hazardous characteristics were limited. Available recycling technology caused air and water pollution. Moreover, hazardous waste disposal and treatment facilities did not exist. For instance, in Myanmar, a lack of other related regulation involving industrial wastewater and air pollution control may reduce the urgency of hazardous waste control.

Foreign direct investment from developed countries increased until 2012. After the political system changed, donors supported the establishment of a legal framework on environmental issues.

Although hazardous waste is generally defined in the Basel Convention, parties are permitted to develop their own definitions. Therefore, individual countries have leeway in formulating definitions. The resulting differences can be regarded as partial diffusion and are caused by differences in the volume of specific waste generated and in differences in the capacity to evaluate hazard levels.

## **(2) Consequences**

As mentioned above, the Basel Convention lists hazardous characteristics, waste streams, and types of hazardous waste. However, the convention neither specifies the minimum concentration of hazardous substances in the material nor defines a method for testing. Fundamentally, hazardousness can be defined based on various aspects, such as toxicity, infectiousness, flammability, and other properties, as well as by various criteria within these categories. Testing method also varies. In addition, end-of-waste criteria, which distinguish between waste and recycled products, are not clearly defined in an international framework.

As a result, conflicts have been observed. For example, “compost” exported from Singapore to Indonesia in July 2004 was regarded as hazardous waste by the Indonesian government owing to the high concentration of metals in the material. After several discussions, Singapore agreed to take back the materials, although they did not admit responsibility, since they had insufficient information about the Indonesian regulations. In another example, a Japanese company exported secondhand automobile parts to Africa. While en route to Africa, the French government classified the parts as hazardous waste and stopped the container in transit because it was not properly packed (Kojima et al., 2013).

Hazardous waste regulation alone is not sufficient to implement environmentally sound management. The enforcement of regulations and investment in treatment and disposal facilities with environmentally sound technologies are needed. Laboratories to identify hazardous materials should be established. The capacity for the enforcement of regulations should be developed. In summary, it certainly takes time to achieve

environmentally sound management of hazardous waste.

### 3. Emission Trading Schemes

The third case is the introduction of a market-based approach to the reduction of GHG emissions, the so-called ETS, which has been firstly implemented as a region-wide system in the EU, then in the North America, New Zealand, and Asian countries, including China. Since the 1990s, ETSs have been viewed in the context of the Kyoto Protocol as a flexible, economic, and effective tool for reducing GHGs. However, there is no international agreement for the introduction of a global ETS or carbon market, despite efforts by the EU since the establishment of its own ETS. Although the post-Kyoto framework agreed upon in Paris in December 2015 does not have a clause for emissions trading, independently developed trade schemes within states or across borders are welcomed. (Article 6, the *Paris Agreement*).

Currently, ETSs are established and operating in ten countries, including developed and developing countries. Some of these are seeking (or have established) mutual linkages. Many other major GHG emitters, such as Canada, Mexico, Brazil, and Russia, are considering introducing their own schemes (Table 5)<sup>3</sup>. ETS is considered a case of policy diffusion, although the schemes have been adjusted or modified to adopt to the circumstances of individual areas (Paterson, 2014; Betsill and Hoffmann, 2011). Particularly, since 2013, China introduced seven experimental pilot programs that have different rules and targets according to regional circumstances across the country to determine the most suitable system. President Xi Jing-ping of China, now the largest GHG emitter in the world, declared reduction targets and a plan to introduce a national ETS in 2017, which will probably become one of the largest markets in the coming years.

**Table 5 Overlook of Current ETS, including those that are “Scheduled” and “Under Consideration”**

Status	Country, region, or sub-region	Term
Operating	EU-ETS	2005~2020
	New Zealand	2008~2020
	RGGI (US)	2009~2018
	Tokyo (Japan)	2010~2019

<sup>3</sup> The Ministry of Environment and Natural Resources (SEMARNAT), the Mexican Stock Exchange and MEXICO2 signed an agreement to develop an Emissions Trading Scheme (ETS) pilot on Monday 15<sup>th</sup>, 2016.

	Saitama (Japan)	2011~2019
	Switzerland	2013~2020
	Kazakhstan	2013~2020
	California (US)	2013~2020
	Quebec (Canada)	2013~2020
	Seven Chinese ETS pilot programs	2013~2017
	Korea	2015~2026
<b>Implementation scheduled</b>	National Chinese ETS	2017~
	Canada	2018~2022
	Ontario (Canada)	2017~2020
	Manitoba (Canada)	--
	Ukraine	--
<b>Under consideration</b>	Brazil	--
	Chile	--
	Mexico	--
	Russia	--
	Taiwan	--
	Thailand	--
	Turkey	--
	Vietnam	--
	National Japanese ETS	--
	Rio de Janeiro (Brazil)	--
	Sao Paolo (Brazil)	--
	Washington (US)	--

Source: IEA, *Energy, Climate Change and Environment 2014 Insight: Executive Summary*, 2014; International Carbon Action Partnership (ICAP), *Emissions Trading Worldwide: Status Report 2016*, made on January 23, 2017.

## (1) Causes

The reasons for the establishment of ETSs in regions and countries can be viewed from two perspectives: policy and economic factors.

From a policy-oriented perspective, the expansion of domestic GHG ETSs can be attributed to the mitigation of GHG emissions. ETS serves as a more flexible and effective mechanism for restricting GHG emissions as compared to exogenous compulsory regulations on emitters, such as energy and power producers (Meckling, 2011a, 2011b). Therefore, for those regions, countries, or sub-nation states with emissions reduction targets, ETS is a policy tool that can help to efficiently achieve these reduction goals (Meckling and Jenner, 2016). For example, under an ETS, trading gives emitters incentives to reduce emissions below the cap and sell the allowances for profit. The system also discourages polluters from increasing emissions, since they must purchase credits if their emissions exceed the allowances. This explains why large emitters, such as the EU and China, would like to introduce their ETSs to lower

abatement costs in reducing GHG emissions.

From an economic perspective, countries are motivated to acquire market access by the acceptance of ETS as a domestic measure for reducing emissions. Once the trading scheme becomes stable and market grows, it can be argued that a country would like to pursue market power to influence the price and maximize its profit, instead of simply being a price-taker. Moreover, investors are encouraged to finance new emission reduction projects. For the reasons stated above, it is supposed that countries or sub-national municipalities introduce ETS because they would like to introduce environmental protection measures, while securing market access by constructing the carbon market. Various factors may explain the decision not to introduce an ETS, including the existence of other policies (e.g., a carbon tax), less necessity (e.g., a low emissions level), or a lack of reduction targets.

As shown in Table 5, many jurisdictions are currently operating, scheduling, or considering the introduction of ETSs via rules such as targeted emitters (industry), the criterion of cap allocation, and penalties, and these are not necessarily consistent among jurisdictions. The reasons for modifying the ETS can include factors related to localization, such as differences in development levels and industrial structure. The ETSs are designed and introduced to accommodate local circumstances, resulting in the situation of partial diffusion.

## **(2) Consequences**

In the absence of an international ETS, some relatively mature and stable carbon markets, such as those of California and Quebec, have established mutual linkages. The linkage between the EU-ETS and other national or regional ETSs, particularly the Chinese ETS, has been discussed over the last several years. Nevertheless, problems and concerns have been documented, such as cheating, heterogeneity among provinces, and a lack of legal rules, indicating the unpredictability of the Chinese national ETS (Xiong and Qi, 2015; Lo, 2016). These concerns may cause difficulties in the establishment of linkages between the ETS of China and other regions.

Considering the relationship between the forthcoming Chinese national ETS to be established in 2017 and the existing EU-ETS, an economic analysis indicated that such linkage does not necessarily guarantee efficient reductions in China owing to mutually

limited access to allowances and the Chinese intensity emission reduction target (Arimura, 2015). Additional time, experience, and modifications are required to achieve a status similar to the division of labor among various national and sub-national ETSs.

#### IV. Conclusion

In this paper, three case studies of different issue areas, namely, chemical materials in products, hazardous waste management, and ETS as responses to climate change, were explored to analyze the causes and consequences of the diffusion of regulations vis-à-vis non-diffusion and partial diffusion. The three types of diffusion were observed in these issue areas.

Three main causes of regulatory diffusion were analyzed across cases: avoiding becoming a pollution haven, obtaining access to markets, and protecting the environment. Arguments related to pollution havens explain the policy diffusion of chemical and hazardous waste regulations, while market access explains chemical regulation diffusion and the wide introduction of ETS. Non-diffusion is also observed in some certain countries. A lack of incentives or a lack of capacity to implement new regulations likely explains why policy diffusion does not occur in particular countries (Table 6).

**Table 6 Causes of Policy Diffusion, Non-Diffusion, and Partial Diffusion**

Case Mechanism Cause	Toxic Chemicals in Products		Hazardous Waste Management	Emissions Trading Scheme
	Chemical Regulation RoHs	Chemical Regulation REACH		
<b>Policy diffusion and non-diffusion</b>				
Causes of Policy diffusion	<ul style="list-style-type: none"> <li>•Market access</li> <li>•Avoidance of pollution haven</li> <li>•Harmonization of domestic standards</li> <li>•Environmental protection</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental protection</li> <li>•Achieve internationally agreed upon target</li> </ul>	<ul style="list-style-type: none"> <li>•Avoidance of pollution haven</li> <li>• Environmental protection</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental protection</li> <li>•Market access</li> <li>•Reduced abatement cost</li> </ul>

Causes of non-diffusion	<ul style="list-style-type: none"> <li>•Lack of capacity</li> <li>•Less necessity</li> </ul>	•Lack of capacity	<ul style="list-style-type: none"> <li>•Lack of capacity</li> <li>•Less necessity</li> </ul>	<ul style="list-style-type: none"> <li>•Other policy tools</li> <li>•Less necessity (low emissions)</li> </ul>
<b>Partial diffusion</b>				
Causes of partial diffusion	Localization (domestic industry)	Localization	<ul style="list-style-type: none"> <li>•Lack of capacity (industry)</li> <li>•Lack of a unified definition</li> </ul>	Localization (local development, industrial structure)

Source: authors.

With respect to hazardous substances contained in products, countries have adopted regulations to secure market access to the EU, the pioneer region of the regulation. Countries that have not adopted the regulation lack information as well as the political capacity necessary to implement the regulation. Developing countries tend to copy policies to prevent environmental pollution due to a lack of data or scientific examination. However, government capacity for implementation and economic or social situation tends to be different from the originating country, modification is needed.

Regarding hazardous waste management, countries have adopted, to protect the environment, especially in the context of pollution haven. In fact, some countries such as Malaysia were suffered from improper dumping of hazardous waste from factories invested by foreign countries. Some countries such as Thailand, Indonesia and Cambodia experienced improper import of hazardous waste from other countries. One of the obstacle for Asian developing countries to adopt hazardous waste regulation was lack of capacity on hazardous waste management.

For emissions trading, countries and regions have established schemes to achieve economic efficiency with respect to emissions reduction. As for developing country such as China, to secure market access by taking the initiative and learning the experience to stabilize the carbon market in constructing trading schemes is regarded distinctive.

By exploring the consequences of partial diffusion through case studies, jurisdictions take actions independently by learning, modifying, and implementing the regulations

pioneered by other jurisdictions, which may bring about convergence. However, policy diffusion may also cause fragmentation of regulations among jurisdictions, which is referred to as partial diffusion in this paper, resulting in different levels of impact. Some of the impacts can be simply ignored or dealt with by modifying regulations, but others may create barriers. The causes of partial diffusion, depending on the case, include localization, a lack of capacity, and a lack of unified definitions.

The regulations related to chemical substances in products in Asia, although policies and regulations derived from the EU directive have been copied in other jurisdictions, similar regulations in host countries are actually in conflict with each other. Negative effects, such as trade barriers, have resulted, affecting both manufacturing and the supply chain.

In the case of hazardous waste management, increases in hazardous waste generation and the import of hazardous waste in Asian developing countries were major drivers of the enactment of hazardous waste regulation. Although the Basel Convention exists, the regulations introduced in member states have slight differences, such as differences in definitions and measurement approaches. These have caused inconveniences in the global management of hazardous waste, where discrepancies in interpretation and operational problems are observed. Thus, partial diffusion is also observed in hazardous waste regulation in Asia, especially among developing countries.

Based on an analysis of ETS introduction, current efforts to reduce GHG emissions are based on voluntary actions by countries. It would be more efficient if all countries work together to reduce worldwide GHG emissions, such like the institutional linkages among ETSs or carbon markets with that of China have been promoted by many policy makers. However, the stabilization of forthcoming national schemes in China, that is, to temperately maintain the current fragmented system, tends to be prioritized in the process of market construction.

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