

Engaging Economic Development Agencies in Environmental Protection:
The Case for Embedded Autonomy

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ABSTRACT

In this paper, we examine the role of economic development agencies in strengthening the environmental performance of industry within rapidly industrializing East Asian economies. Three case study examples are considered, namely, the role of the Industrial Development Board in reducing industrial pollution in Taiwan, China, pollution control in the palm oil industry in Malaysia, and the role of the Economic Development Board in influencing environmental performance of industry in Singapore. Conceptually, we build upon the concept of embedded autonomy to consider the ways in which agencies of economic development can work with firms and industries while simultaneously remaining autonomous from these firms with respect to setting and enforcing performance standards. The three cases suggest that a form of policy integration that more directly integrates economic and environmental goals within agencies of economic development may be feasible, but only where there exists a strong autonomous government bureaucracy and where there is strong societal commitment to improving the environmental performance of industry.

Introduction

Over the past decade many policy analysts have called for reform in the ways in which governments pursue improvements in the environmental performance of industry (Davies and Mazurek 1998; Enterprise for the Environment 1998; NAPA 1997). Traditional command-and-control regulatory approaches, it is suggested, fail to capitalize fully on the innovative capabilities of firms and industries and as a result generate costs of abatement that are unnecessarily high (Hausker 1999). Reformers call for greater flexibility and innovation in how environmental goals are met (Chertow and Esty 1997; Gunningham and Grabowsky 1998). Various alternatives are discussed, including greater use of information-based policy tools, devolution of policy implementation to regions and localities, and increased cooperation between government and industry in seeking cost-effective solutions to environmental concerns. Critics of these proposed reforms suggest that ceding discretionary decision making authority to firms and industries amounts to a weakening of regulatory enforcement that will undermine future gains in environmental performance (Steinzor 1996). But are there approaches to environmental protection that can take greater advantage of the innovative capabilities of firms without sacrificing the ability of regulators to hold these firms to tough performance standards? Most recent work addressing this question has focused on reforms within environmental protection agencies, such as analysis of the Project XL initiative of the US Environmental Protection Agency (Blackmann et al 2001). In this paper, we examine the potential contribution of a broader array of government institutions in such reform initiatives. In particular, we consider the role of agencies of economic development in fostering improvements in the environmental performance of industry.

Underlying the current dispute over policy approach is a fundamental dilemma in the environmental regulation of industry. Within an environmental regulatory system, it is typically

firms themselves that are the primary locus of information, ideas and capabilities needed to improve environmental performance, including information about the costs and benefits of changes in products and production processes, about the opportunities and constraints (financial, technological, organizational) present within an industry, and about the situation of particular firms. Accessing this information, and mobilizing fully the capabilities of firms, typically requires effective cooperation between firms and regulators. But cooperative relations are both difficult to sustain and are open to processes of co-optation in which private interests supersede public goals. In an effort to minimize the threat of regulatory capture, regulatory systems tend over time to become more bureaucratic, legalistic and rule-based (Stigler 1971; Laffont and Tirole 1991). This in turn tends to restrict information flow and limits the range of options available to mobilize the innovative capabilities of firms. Absent such information, governments are constrained in their ability to design and implement policies that yield cost-effective improvements in environmental performance. Critics of the environmental protection system as it has evolved in the United States and elsewhere suggest that it is precisely this dilemma over how government can work with firms, without losing autonomy from firms, that needs to be resolved if further major improvements in the environmental performance of industry are to be achieved.

Within the United States, environmental regulatory reform initiatives are focused primarily upon the environmental regulatory agency, the EPA. Various European countries have explored different approaches to environmental protection, such as the creation of 'environmental covenants' between government and industry in the Netherlands (Wallace 1995). In newly industrializing economies, where environmental protection agencies are often weak and under-resourced, policy makers are re-considering the potential contribution to environmental improvement of a wider array of government institutions, including agencies of economic

development at the national, regional and local level. Initial assessment would suggest that the problem of maintaining autonomy from firms, while simultaneously mobilizing firm-based capabilities for improving environmental performance, is likely to be even greater among such agencies of economic development, as compared to freestanding environmental agencies possessing a single mandate for environmental protection. In many rapidly industrializing countries, particularly in East Asia, it is these same economic development agencies that have been at the forefront of ‘grow now, clean up later’ development strategies (Bello and Rosenfeld, 1992; O’Connor 1994; Chan, 1993). On the other hand, these agencies of economic development often have close working relations with firms, and a tradition of working collaboratively to improve economic and technological capabilities of firms—including improvements that often carry significant environmental benefit (Amsden, 1989; Haggard, 1990; Wade, 1990; Huff, 1994; and Rock, 2001). To the extent that such relations can be mobilized toward improving environmental performance, the outlines of an alternative policy approach are visible. Any such policy initiative will likely be supplemental to, not a substitute for, environmental regulation pursued from within a freestanding environmental agency.

In the current paper, we examine the duality of cooperation and autonomy through an analysis of the role of economic development agencies in strengthening the environmental performance of industry within rapidly industrializing East Asian economies. Three instances of engagement are examined, namely, the role of the Industrial Development Board in reducing industrial pollution in Taiwan, China, pollution control in the palm oil industry in Malaysia, and the role of the Economic Development Board in influencing environmental performance of industry in Singapore. Conceptually, we build upon Peter Evans’s (1995) concept of ‘embedded autonomy’ to consider the ways in which agencies of economic development can work with firms and industries while simultaneously remaining autonomous from these firms with respect to

setting and enforcing performance standards. The three cases suggest that a form of ‘policy integration’ that more directly integrates economic and environmental goals within agencies of economic development may be feasible, but only where there exists a strong autonomous government bureaucracy and where there is strong societal commitment to improving the environmental performance of industry.

Industry-Government Relations in Environmental Protection

In a review of the effectiveness of the environmental protection system in the United States, US EPA official Dan Fiorino (2000, p 544) concluded:

“The old model of centralized regulation has accomplished most of what it can. Although we still need a regulatory system to establish standards of behavior and discourage cheating, we need to fundamentally redesign it. Environmental policy in the future will depend more on local and regional initiative, standards of performance rather than process, and societal capacity for learning more than for issuing and seeking conformance with legal commands.”

While strong performance goals are required, greater flexibility and innovation in the ways in which these goals are met is warranted.

Fiorino’s diagnosis is shared by a number of other policy analysts. For example, Ayres and Braithwaite (1992) suggest the need for ‘responsive regulation’. Rather than a unified rules-based approach, centered on deterrence initiatives, these authors argue for a pyramid of approaches tailored to specific contexts and to the history of behavior of the firms involved. For firms with a history of malfeasance, a poor compliance record, and significant environmental risk, strict command and control oriented regulatory approaches may be most appropriate. For firms with a record of good-faith efforts to improve environmental performance, the pyramid of approaches also includes flexible strategies that involve close cooperation between firms and regulators. The benefit of cooperative approaches, it is suggested, is that they allow the harnessing of the innovative capabilities of firms, they reduce the cost of achieving

environmental improvement, and they allow scarce enforcement resources to be targeted at non-compliant firms. Supporters of such cooperative approaches remain committed to tough environmental standards, and to a performance-based system of environmental management (Hausker 1999). But they seek greater flexibility in how environmental standards are met.

As Scholtz (1993) has noted, the major problem with cooperative approaches is one of control. "To prevent regulatory agencies from being unduly influenced by firms in the ongoing negotiations over acceptable standards of compliance, regulatory advocates attempt to restrict the flexibility of regulatory agencies." Research into the economics of regulatory capture suggests that traditional rule-based systems of regulation exist in part to reduce the threat of cooption by firms and other interest groups (Martimort 1999). By allowing firms flexibility in how environmental goals are to be met, regulatory reform creates additional opportunities for cooption of regulatory authorities, and more generally for delay and avoidance in achieving environmental goals. Similar concerns have been raised regarding the effectiveness of voluntary environmental initiatives in improving the environmental performance of firms (King and Lenox, 2000 and Howard, Nash, and Erhenfeld, 2000). Some suggest that voluntary and cooperative approaches are helpful in securing environmental improvement for firms only to the extent that such improvements also yield economic benefit (such as improvements in energy efficiency). Where environmental goals are at odds with the economic interests of firms, cooperative approaches breakdown. The initial empirical evidence on the effectiveness of cooperative approaches has been quite mixed (Wallace, 1994 and Blackman, et al, 2001). But this may have more to do with the lack of experience of regulators in pursuing such approaches, and the tendency to partial implementation within complicated regulatory systems in which firms are regulated separately for different pollutants.

How then to maintain the autonomy of the regulatory process while simultaneously realizing the benefits of cooperation? In addressing this question, we make use of the concept of embedded autonomy. Evans (1995) introduced this concept as a way of describing the relation of government agencies to industry in the so-called developmental states of East Asia. During the 1970s and beyond, several East Asian newly industrializing economies achieved very rapid rates of economic growth and poverty reduction. Following a pathway of export-led industrialization, GDP in these countries over the period 1965-1995 grew at an average annual rate of 5.5%, or more than double the rate of the OECD economies (World Bank 1998). To varying degrees, economic management in each of these countries was marked by a strong interventionist state that used such strategies as targeting particular sectors, subsidizing investments in R&D, controlling entry to industries, and protecting nascent industries (Amsden, 1989; Wade, 1990; Haggard, 1990; Huff, 1994; and Rock 1999 and 2000). State economic development agencies worked closely with firms and industry associations.

Much of the mainstream literature on economic development is critical of state intervention in economic processes, suggesting that it opens the way for corruption and mismanagement (World Bank, 1993). Evans (1995) argues that the developmental states of East Asia were able to avoid the worst of such problems, striking a balance between engagement with firms and independence from these firms. At the same time, state policy benefited from close relations with firms (for example, by allowing government agencies to keep abreast of the current technological and financial capabilities of firms). How was this balance between engagement and autonomy achieved? Evans (1995, p 12) suggests the following:

“Highly selective meritocratic recruitment and long-term career rewards create commitment and a sense of corporate coherence. Corporate coherence gives these apparatuses a certain kind of “autonomy”. They are not, however, insulated from societies as Weber suggested they should be. To the contrary, they are embedded in a concrete set of social ties that binds the state to society and provides institutionalized channels for the continual negotiation and

re-negotiation of goals and policies. Either side of the combination by itself would not work. A state that was only autonomous would lack both sources of intelligence and the ability to rely on decentralized private implementation. Dense connecting networks without a robust internal structure would leave the state incapable of resolving “collective action” problems, of transcending the individual interests of its private counterparts. Only when embeddedness and autonomy are joined together can a state be called developmental.”

Evans (1995, p 41) goes on to note:

“We are, after all, talking about capitalist societies in which neither investments nor production can be implemented without the cooperation of private actors. The idea that states operate most effectively when their connections to society are minimized is no more plausible than the idea that markets operate in isolation from other social ties. Just as in reality markets work only if they are “embedded” in other forms of social relations, it seems likely that states must be “embedded” in order to be effective.”

Our interest here is in embedded autonomy as analytical entry point for studying government-industry relations in the environmental regulation of industry. In a review of the literature on regulation within the OECD economies, we were able to identify only one study that used this concept in an analysis of environmental protection. In a case study of the California logging industry, Davidson (2001) examines the implementation of the US Endangered Species Act and the degree to which regulators were able to maintain autonomy from logging interests while simultaneously working with the logging companies. To the extent that strategies can be found to maintain autonomy, Davidson (2001, p 240) concludes that “the potential benefits are numerous, including an increased capacity for monitoring, access to local knowledge, the ability to balance social interests to limit capture, and a broadening of environmental constituency support beyond national environmental interests, which do not always coincide with local political and ecological contexts.” The utility of the concept of embedded autonomy likely depends on the ways in which the goals of environmental protection are defined. When viewed as an issue of compliance with a given standard, the value of embedded autonomy is likely to be modest. When environmental protection is viewed in dynamic fashion, as a process of continuous improvement

in environmental performance, then harnessing the innovative capabilities of firms and industries becomes a critical priority and the concept of embedded autonomy becomes of greatest relevance.

Our research focuses on the role of agencies of economic development in promoting environmental improvement in East Asia. Given past failures of environmental policy in Asia (ADB 1997; UNEP 1999; UNESCAP 2000), there is a growing interest among policy makers within the region in broadening the range of institutions involved in promoting improvements in environmental performance to include core agencies of economic development (Asian Development Bank 2001). There are several reasons for such interest. First, agencies of economic development in many cases work closely with firms and industries in efforts to improve technological and managerial capability. Research suggests that strategies that improve the overall economic efficiency of firms, such as upgrading managerial and technological capability and providing enhanced access to capital and to leading-edge technology, also yield important environmental benefit (Rock, 2001). Second, economic development agencies have access to a wider range of resources and policy tools that can be brought to bear on improving economic and environmental performance, including policies related to investment approval, market access, facility licensing, land-use planning, and the like. Third, in contrast to the relatively weak position of many freestanding environmental regulatory agencies, economic development agencies typically are well resourced and have important positions of influence with respect to industrial and development planning within industrializing economies. Stated another way, economic development agencies are embedded in the economic process – in the fundamentals of investment, technology development and trade – in ways that nascent environmental agencies typically are not. As the concept of embedded autonomy suggests, however, engagement with private firms needs to be balanced with autonomy from those firms.

In what follows, we examine three cases in which agencies of economic development have become involved in promoting environmental improvement. The case studies show that relations among different government agencies, between agencies of economic development and agencies of environmental regulation, are a critical part of the approach taken to improving environmental performance. Engagement with economic development agencies created the conditions under which environmental regulatory agencies could succeed in setting and pursuing environmental performance goals, a process that we have labeled policy integration (Angel and Rock 2001).

Embedded autonomy in East Asia.

Over the past three decades, the first-tier East Asian newly industrializing economies (NIEs), as well as selected second tier East Asian NIEs, successfully strengthened their environmental regulatory systems, implementing tough environmental performance standards and investing in a strong centralized system of regulatory enforcement (Rock, 2001). Traditional command and control regulation has progressively been supplemented by a variety of second and third generation policy tools, such as pollution charges and other market-based instruments. The result of these efforts was a substantial reduction in pollution and improvements in ambient air and water quality. Significant improvements in air and water quality were achieved in Singapore (Rock, 2001) Taiwan, China (Rock, 1996) and Malaysia (Rock, 2001). Even China has been able to improve air quality in its largest cities (Wang and Lui, 1998, p. 381). In addition, Malaysia was able to almost totally de-link pollution from production of its palm oil mills without undermining its pre-eminent position in the world palm oil market (Vincent *et al.* 2000).

Table 1 details improvements in air quality for three of the East Asian NICs, namely, Singapore, Malaysia and Taiwan, China. The three countries report different measures of air

pollution over the period 1975-99 (and in the case of Singapore the main summary measure of air ambient quality switches from Total Suspended Particulates (TSP) to concentrations of small particulate matter (PM10)). While there are annual variations in ambient air quality, the overall trend is toward significant improvement. In the case of Taiwan, China, for example, the mean annual concentration of small particulate matter is reduced by approximately one-third over the period 1984-1999. And this improvement occurs against the backdrop of very rapid industry-led economic growth. As indicated in Table 1, there remain significant differences among the three countries in ambient air quality (the particulate level in Singapore in 1999 was approximately half that in Taiwan, China).

Our analysis of the implementation of strengthened systems of environmental protection in East Asia suggests that the creation of a powerful national environmental agency equipped with appropriate policy tools was a necessary but not sufficient condition of success. In Singapore, Malaysia, and Taiwan, China governments recognized that environmental success depended on linking new environmental agencies with decision-makers in more powerful economic development and industrial promotion agencies. Close relations with those agencies proved critical to gaining support for environmental improvement in government and business and in identifying cost effective abatement options as well as opportunities for lowering the energy, water and material intensities of production. Without these relationships, it is not clear that the environmental agencies would have succeeded in implementing effective systems of environmental regulation. How this has been done varies quite significantly from economy to economy.

Singapore gave its environmental agency an important 'seat' at the industrial policy table by linking the promotional decisions of its investment promotion agency and the infrastructure decisions of its premier infrastructure agency to a requirement that firms receiving support meet the

environmental requirements of its environmental agency (Rock, 2001). The Economic Development Board (EDB) offered promotional privileges—typically tax holidays, accelerated depreciation allowances and access to space in one of the country’s premier industrial estates administered by the Jurong Town Corporation (JTC)—to get firms in particular industries to locate in Singapore. But before promotional privileges were granted by the EDB and space allocated by the JTC, the Ministry of the Environment (ENV) had to approve each firm’s production process and its plan to abate pollution to meet the country’s tough emissions standards. Occasionally the ENV rejected a particular industry as too polluting, more frequently it worked closely with these firms to identify cost effective treatment technologies. The ENV also worked with the JTC to locate the most polluting industries farthest from residential and commercial populations. The ENV helped the JTC to shrink the geographic distribution of hazardous activities and to co-locate similar activities with similar waste streams in the same locations. This facilitated several common solutions to pollution problems.

Malaysia’s weaker environmental agency relied on close relations with firms in the Crude Palm Oil (CPO) industry, a powerful industry association, and a prominent oil palm research institute to clean up CPO wastewater emissions. The decision to link the environmental agency, the Department of the Environment, with CPO mills, a CPO industry association, and an oil palm research institute, PORIM—the Palm Oil Research Institute of Malaysia—reflected a political reality that CPO mills could not be shutdown without undermining the government’s most successful rural anti-poverty program (Rock, 2001). This program managed by FELDA, the Federal Land Development Authority, developed new small-farmer palm oil farms complete with infrastructure clustered around larger palm oil estates and CPO mills. Following race riots in 1969 and subsequent announcement of Malaysia’s New Economic Policy, which was designed to reduce poverty among rural ethnic Malays, both private financed and FELDA financed oil palm

production schemes and CPO production grew exponentially as Malaysia captured a large share of the world CPO market. But this came at substantial environmental cost as CPO wastes soon clogged a large number of the country's major rivers. Trapped between the economic success of its small-farmer oil palm schemes and growing complaints about CPO wastes from rural ethnic Malays, the government set about on a pragmatic search for cost effective treatment technologies. Once these technologies were identified by PORIM and evidence accumulated that CPO mills were adopting these treatment technologies without undermining profitability or exports in the industry, the Department of the Environment (DOE) imposed emissions standards and ratcheted them up over time as more cost effective treatment technologies emerged. The result was an effective delinking of pollution from the scale of palm oil production and export.

The government in Taiwan, China (Rock, 2001 and 1996) followed a third pathway to industrial environmental improvement by linking its environmental regulatory agency to its powerful industrial policy agency. Because its premier industrial policy agency, the Industrial Development Bureau (IDB) in the Ministry of Economic Affairs opposed environmental clean up, fearing it would undermine the profitability of industry at a time industry was being 'hollowed out' by rising wage rates and an appreciating currency, the government's environmental program initially bypassed the IDB. Once the environmental agency began imposing sanctions on polluters, the IDB realized that it needed to develop its own environmental strategy. This led it to develop a joint pollution prevention waste minimization program with the Taiwan Environmental Protection Agency. It led the IDB to offer promotional privileges to firms for the purchase of pollution control equipment. The IDB also used its promotional privileges to foster development of an indigenous environmental goods and services industry that it expected to become export-oriented. In fact, as has been typical of the IDB's export promotion programs, it set quantitative export targets for this industry and appears to have conditioned access to

promotional privileges to the meeting of those targets. And most intriguingly, the IDB invested in creation of a state of the art research program on the energy, water, materials and pollution intensities of Taiwanese industries in the Industrial Technology Research Institute (ITRI), the premier science and technology institute in Taiwan.

Linking new environmental agencies with more powerful economic development and industrial policy agencies in East Asia helped gain critical support for environmental improvement within government and from business. It fostered trust and confidence between environmental agencies, economic development and industrial policy agencies and the business community over a shared need to clean up the environment without imposing costs on firms that endangered their profitability, growth, and export potential. The involvement of economic development agencies was a powerful sign to the business community as to the seriousness of the government's commitment to the goal of environmental improvement, as well as to the commitment to finding solutions that did not impose unreasonable costs on firms and industries. Experience with particular policy tools, such as progressively phasing in stricter emissions requirements based on advances in best available technologies that do not involve excessive costs, built confidence that environmental improvement and strengthened economic performance were goals that could be jointly pursued.

Another key benefit obtained by linking environmental protection agencies and development agencies relates to lowering abatement costs. Inter-agency cooperation facilitated access to important information about the costs of abatement and the impact of those costs on profitability and the ability of regulated firms to export. Most importantly, it facilitated joint searches for cost effective abatement technologies and for ways to reduce pollution intensities and intensities of use of energy, water, and materials. Reducing abatement costs and energy, material, water and pollution intensities were and are particularly important to firms and

governments in East Asia. This is because both were convinced that environmental improvement could not come at the expense of poverty reduction, increasing incomes, diversifying economies, expanding export bases and upgrading the technical capabilities of indigenous firms in these economies

Governments in the first tier East Asian economies, most particularly Singapore, Malaysia, and Taiwan, China found various ways to reduce the costs of abatement. In the early days, Singapore's Ministry of the Environment (ENV) invested heavily in a worldwide search for the most cost-effective abatement technologies (Rock, 2001). This empowered the ENV by making it acutely aware of best available treatment technologies not entailing excessive costs (BATEEC). Because many of the promoted firms in Singapore had little experience with pollution control, the ENV used this information to develop lists of reputable environmental goods and services providers that it shared with promoted firms. This reduced information barriers for those firms and eased their transition to less polluting technologies. Over time, the ENV got tougher by asking firms seeking promotional privileges if they planned to use cleaner technologies, whether they were willing to substitute materials use to reduce the toxic intensity of production, and how they planned to reduce water use in the face of Singapore's freshwater scarcity. Because the ENV was knowledgeable about international best practices and had intimate relations with promoted firms, it was able to help the firms lower abatement costs and lower energy, water, materials and pollution intensities.

The government in Taiwan, China (Rock, 2001 and 1996) vested authority for identifying cost minimizing treatment technologies, for lowering the costs of abatement, and for reducing the energy, water, materials and pollution intensities of production to the IDB. As in Singapore and Malaysia, the IDB invested in information gathering about the costs of alternative treatment technologies for the firms and industries it promoted. The IDB also subsidized the purchase of

pollution control equipment by offering tax reductions and accelerated depreciation allowances and access to subsidized for purchase of pollution control equipment. Because the IDB ultimately came to see development of an indigenous environmental goods and services industry as one of the next steps in its promotional strategy, it subsidized the creation of an indigenous environmental goods and services industry that it expected to become export oriented. And it engaged in state of the art research on the energy, water, materials, and pollution intensities of Taiwan's industries that included benchmarking performance against international best practices.

Our analysis suggests several reasons why intensified engagement among industry, agencies of economic development and agencies of environmental regulation was successful in the three case study countries. First each of the programs had the commitment and support of key decision-makers. In Malaysia, for example, growing protests over CPO pollution from rural Malays, a vital political constituency for the ruling Malay party, meant that neither the government, nor the private sector, nor the environmental agency could ignore the environmental costs of CPO production (Rock, 2001). This forced the environmental agency, the CPO industry, and a palm oil research institute to build relationships with each other and engage in a joint search for a least cost solution to pollution. Admittedly, the palm oil example is something of a special case in that government action was driven by the dependence of the ruling Malay party on its rural political base (where the palm oil mills are located). But the data in Table 1 show that urban air quality improved as well suggesting that environmental improvement in Malaysia has not been limited to reducing CPO emissions. Second, commitment of key policy-makers was undergirded by merit based and goal driven bureaucracies, negotiated consensus building decision-making processes, and an ability to integrate environmental considerations into the unique decision-making structures and institutions used to guide economic and industrial growth in each of these economies. Bureaucrats in city governments, environmental, economic development, and industrial policy agencies were first and foremost highly

trained goal oriented pragmatic problem solvers. They possessed substantial independence from organized interests in civil society, including business interests. This autonomy made it possible for those in government to devise and implement trial and error step-by-step environmental programs and policies to solve real practical pollution problems.

Except for Singapore, those in regulatory and other government agencies committed to environmental improvement also took advantage of growing public criticism of 'grow first clean up later' environmental strategies. But how they did so varied. Some times, as in Malaysia, regulatory agencies cracked down on polluters following highly publicized pollution incidents that strengthened their hand at the expense of firms and economic agencies who wanted a more go slow approach to environmental improvement (Rock, 2001). Sometimes, as in Taiwan, China regulatory agencies engaged the public in ambient and environmental standard setting and in environmental impact assessments for large projects (Rock, 2001 and 1996). And sometimes, as in the PRC and Taiwan, China regulatory agencies channeled public complaints through citizen 'hotlines' to strengthen their hands against those proposing a more go slow approach to environmental cleanup and to demonstrate to others (mayors and other government officials) that they were responding to citizen complaints (Rock, 1996 and 2001).

Conclusion

In seeking additional ways to improve the environmental performance of industry, policy analysts have turned their attention to institutions that traditionally have not played a large role in environmental protection, including agencies of economic development. Economic development agencies are in many cases well 'embedded' in economies in the sense that they typically are heavily involved in developing firm-based capacities for innovation and improvement. In this paper, we have described three cases from East Asia in which these relationships with firms and industries

have been mobilized as a way of pushing forward the environmental performance of industry. Freestanding agencies of environmental regulation have worked with economic development agencies and with industry to build support for environmental improvement and to identify cost-effective ways to reduce industrial pollution. Reductions in industrial pollution within the three case study countries suggest that this strategy of involving economic development agencies in environmental protection was quite successful (see Table 1).

Success derived in part from the embedded autonomy of the economic development agencies, goal driven bureaucracies, opportunistic behavior on the part of regulators, and from mounting public pressure for environmental improvement. Unfortunately, many of these elements appear to be lacking in many other industrializing Asian economies. There is little evidence that top leaders in most of the rest of Asia are committed to environmental improvement. Public sector bureaucracies in much of the rest of Asia tend not to be as merit-based, pragmatic or goal driven as they are in the first tier East Asian NIEs. To make matters worse, those bureaucracies have substantially less technical capacity and less embedded autonomy, particularly from business, and they are fraught with more or less patron-client ties that reinforce rent-seeking rather than development oriented behaviors (Khan and Jomo, 2000). This is particularly true of industrial policy agencies such as ministries of industry, boards of investment, and public sector science and technology institutes. Because of this, reformers in government, with support from the World Bank and the International Monetary Fund, are hard at work dismantling the traditional selective instruments and institutions of industrial policy in these economies. Trade regimes are being liberalized, subsidized directed credit programs are or have been largely dismantled, lists of promoted industries are being whittled down, and promotional privileges are being discarded in favor of simple market-driven outcomes.

This might lead some to conclude that there few opportunities for achieving environmental

improvement through the forms of policy integration described in this paper. We believe this conclusion is unwarranted. Even when national level considerations look unfavorable there may be real opportunities to engage in local environmental improvement. In Indonesia, for example, where a progressive mayor in a relatively large and rich coastal city took advantage of a highly publicized pollution incident to implement a city level monitoring and inspections program of major industrial facilities within the city (Aden and Rock, 1999). This occurred against the backdrop of a weak national environmental agency that has had relatively little success in improving ambient environmental quality. But even this weak national agency was able to garner enough high level political support, including from the president, to design and implement a unique public disclosure program that monitored and disclosed, through a simple color coding system, the environmental performance of major industrial water polluters (Afsah and Vincent, 2000). In China, urban mayors have played a key role in implementing a city-level environmental performance rating and public disclosure program. Research suggests this environmental monitoring program allows local level environmental protection bureaus to engage with more powerful economic development agencies in ways that are impacting urban air pollution (Rock, 2001 and Rock, Yu and Zhang, 1999). The next frontier of environmental policy reform may well lie in mobilizing embedded autonomy at the local scale.

We conclude with a final comment. The concept and practice of embedded autonomy speaks to the ways in which the capabilities of economic development agencies can be harnessed to the task of upgrading the technological and managerial capabilities of firms and industries with resultant improvements in economic and environmental performance. Embedded autonomy does not imply any change in the development agenda of an industrial economy, or in the structural relationship between very rapid urban-industrial growth and the environment. If the development mandate is one of growth without regard for the environment, then embedded autonomy will be of little relevance.

But if, as is increasingly the case in many industrializing economies, there is growing public pressure for and government commitment to environmental improvement, then embedded autonomy speaks to one of the ways in which governments can go beyond traditional environmental regulatory approaches and harness more fully the innovative capabilities of firms and industries to reduce the costs of pollution abatement. The role of economic development agencies in this regard will likely be supplemental to, not a substitute for, an effective agency of environmental protection, backed by clear and consistently enforced environmental performance goals.

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Table 1
Ambient Air Quality Data: Selected Years

Year	Singapore		Malaysia	Taiwan	
	TSP	PM10	TSP	PM10	PSI
1975	39				
1976	42				
1977	30				
1978	35				
1979	36		157		
1980	47		181		
1981	39		159		
1982	44		119		
1983	42		104		
1984	31		188	90	
1985	32		139	90	
1986			162	96	
1987			138	89	
1988			136	88	14.92
1989			120	95	16.18
1990			105	96	16.33
1991		42	104	97	16.25
1992		40	100	90	11.32
1993		39	87	78	8.18
1994		48	90	70	6.83
1995		32	85	67	5.73
1996		33		64	6.12
1997		50		63	5.23
1998		35		58	4.61
1999		30		59	4.69

Notes: 1. Singapore data on Total Suspended Particulates (TSP) are in μm^3 and are from Annual Report 1985, Ministry of the Environment, Singapore, p. 12. Singapore data from 1991-94 are PM10 concentrations in air in μm^3 and are from Annual Report, 1994, Ministry of the Environment, Singapore, p. 20. Data for PM10 for 1995-2000 are from Annual Report, 2000, Ministry of the Environment, Singapore, p. 22.

2. Data for TSP for Malaysia for 1989-94 are for Kuala Lumpur and are from Environmental Quality Report, 1994. Malaysia: Department of the Environment, p. 12. Data for 1995 are from World Bank, World Development Indicators, 2000. Washington, D.C.: World Bank, p. 163. Data from 1979-1988 are from AIR Executive an electronic database maintained by the USEPA.. This database can be downloaded at www.epa.gov/airs/aewin.

3. Taiwan data on PM10 concentrations in air are measured in μm^3 . Taiwan data on PSI relies on the U.S. EPA's Pollution Standards Index (PSI) and measures the percent of days in a year when air quality is poor (PSI>100). Data for years prior to 1992 on both indicators are from Office of the Science and Technology Advisor, TEPA, 1995. "A Cleaner Home and a Better Image Abroad: Taiwan's Environmental Efforts". Taipei, Republic of China: Environmental Protection Administration, pp. 15-15 except PM10. Data for 1992 onwards are from the Taiwan APEC –Virtual Center "Indicators of Environmental Protection" www.apec-vc.org.tw.

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