

Toward Clean Shared Growth in Asia

Dr. David P. Angel
Associate Provost and Laskoff Professor
Clark University, Worcester, MA

Dr. Tubagus Feridhanusetyawan
Economist
Center for Strategic and International Studies,
Jakarta, Indonesia

Dr. Michael Rock
Senior Economist
Winrock International
Washington DC, USA

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By *Dr. David P. Angel*, Associate Provost and Laskoff Professor, Clark University, Worcester, MA, dangel@clarku.edu; *Dr. Tubagus Feridhanusetyawan*, Economist, Center for Strategic and International Studies, Jakarta, Indonesia, tubagusfds@hotmail.com; *Dr. Michael Rock*, Senior Economist, Winrock International, Washington DC, USA, mtr@winrock.org.

SUMMARY

We outline a policy approach to promoting clean, shared growth among the newly industrializing economies of Asia. By clean, shared growth, we mean a process of sustainable economic development that yields both improvements in environmental quality (locally and globally) and continued enhancement of socio-economic welfare. The critical challenge is that of reducing the energy, materials, pollution and waste intensity of urban-industrial activity. The critical opportunity lies in influencing the technology choices and management of new urban and industrial investment. To meet this challenge, public policy must go beyond controlling pollution to the adoption of policies that drive down the energy, materials, pollution and waste intensity of urban-industrial activity in a dynamic of continuous improvement and superior performance. For this to succeed, the policy response must go beyond environmental regulation to encompass a coordinated array of interventions in industrial, technology, trade and urban policy, and promote pro-environmental forces emerging in civil society, the private sector, and global governance. Public policy must promote performance measurement as a basis for harnessing market forces, community engagement, and private ordering to the goal of clean shared growth in Asia. Once identified, measured and tracked as an issue of economic performance, then the environmental intensity of economic activity becomes more susceptible to the force of the market and of society at large, whether this be through consumer demand, community pressure, or supply chain management. The openness of East Asian economies to trade, investment and technology, combined with growing public concern with the environment, and the increasing globalization of markets and information flows, suggest that these latter forces can be powerful drivers of improved environmental performance. Public policy has a key role to play in bringing these drivers to bear on the investment and technology decisions of private industry, and in fostering a clear performance orientation among firms.

THE CHALLENGE OF CLEAN SHARED GROWTH IN ASIA

The environmental problems of developing Asia are now well documented. The combination of rapid urban-industrial growth and de facto 'grow now and clean up later' environmental strategies have resulted in low energy efficiency within industry, natural resource depletion, materials-intensive production, polluted rivers and ground-water supplies, and unhealthy air in many Asian cities. According to the Asian Development Bank (Lohani 1998), average levels of air particulates in Asia over the period 1991-95 were approximately five-fold higher than in OECD countries and twice the world average (see Table 1). Measures of water pollution,

such as BOD levels and levels of suspended solids, were also substantially above world averages. Prior to the current crisis, energy demand in Asia was doubling every 12 years and demand for electricity was growing two to three times faster than GDP, resulting in major increases in greenhouse gas emissions.

Important efforts to address many of these environmental problems are currently underway within the region. Over the past ten years, greater resources have been committed to pollution control and to the remediation of existing pollution. Investments have also been made in urban infrastructure, particularly in water supply and sanitation systems, and to a lesser extent, in mass transit systems. In addition, environmental regulatory systems are being strengthened in a majority of countries within the region. There is also lively debate within Asia about the relative importance of command-and-control policies, market-based regulatory instruments, information disclosure, pollution prevention, clean production, and other aspects of environmental regulatory practice. Although actual results vary widely from country to country, evidence suggests that enhancements in regulatory activity are yielding important incremental improvements in the environmental performance of industrial firms within the region (Aden & Rock 1999; Aden et al. 1999; O'Connor, 1996; Rock 1996b; USAEP 1997; Vincent, 1997).

Table 1: Environmental Conditions in Asia, Average 1991-95

	Asia	Africa	Latin A.	OECD	World
Air Pollution					
Particulates (mg/m ³)	248	29	40	49	126
SO ₂ (mg/m ³)	.023	.015	.014	.068	.059
Water Pollution					
Suspended solids (Mg/L)	638	224	97	20	151
BOD levels (Mg/L)	4.8	4.3	1.6	3.2	3.5

Source: Lohani (1998)

What these regulatory initiatives have not done is change the basic structural relationship between urban-industrial growth and the environment, and the attendant trajectory of increased energy and materials use, pollution and resource depletion. Indeed, environmental policy as we know it today - in Asia and in the rest of the world - is not directed towards such a transformative goal. Born of the concerns and expectations of OECD economies in the 1960s and 1970s (such as improving local and national environmental quality, minimizing health and safety risks, and reducing pollution from a mature urban-industrial capital stock), environmental policy is only beginning to come to terms with the global sustainability challenge. To be sure, there have been a multitude of important innovations in environmental regulatory approaches and policy instruments, as well as increased efforts to tailor regulatory approaches to local economic, social and political conditions. But the core focus of environmental policy for industry continues to be that of reducing negative environmental 'outputs' (such as pollution and waste) and on improving local environmental 'outcomes' (such as air and water quality). What the growing body of scientific evidence on deforestation, climate

change and resource depletion has taught us, however, is that the sustainability challenge goes beyond pollution and declining local environmental quality, to human-induced degradation of the biosphere. While current environmental policy yields incremental improvements in energy and materials efficiency (as a means of reducing pollution and improving local environmental quality), these plant-level improvements are typically over-ridden by the scale effects of energy- and materials-intensive economic development.

Nowhere in the world is the challenge of 'changing course' - of shifting to patterns of economic development that are less energy, materials, pollution and waste intensive - more urgent than in the rapidly industrializing economies of Asia. Most of Asia is in the midst, not at the end, of an urban-industrial led development transition unparalleled in its scale and intensity. GNP per capita in East Asia has grown at an average annual rate of 5.5% over the past thirty years, or more than twice the rate of the OECD economies (World Bank 1998b). This has in many ways been a development triumph, reducing poverty and improving life expectancy within the region. But the average GNP per capita of Indonesia, Malaysia, the Philippines and Thailand (the so-called second tier NICs) in 1996 was still a modest \$2,392, or approximately one-tenth of that in the high income OECD economies. Roughly half of the work force on average in these four countries in 1990 was still employed in agriculture. Six out of ten people live outside of urban areas.

Future increases in per capita income within the region will almost certainly entail continuing massive shifts in economic structure, from agriculture into industry, and from rural areas into cities. What this likely means is the largest increase in urban population in human history. By one estimate, the urban population in the East Asian NICs, including China, will increase from about 550 million in 1995 to almost 1.2 billion in 2025 (World Resources Institute, 1997: 151). Asia's share of global output which was roughly 10% in 1950 and 30% in 1995 is expected to reach 55% to 60% by 2025 (Radelet and Sachs, 1997: 46). The rate of growth may be in doubt; the direction of change is not.

Absent new policy interventions, the likely impacts of such large scale industrial and urban growth in Asia over the next thirty years are also reasonably predictable. Even with substantial improvements in environmental regulation and a significant shift towards cleaner technology within the region, the Asian Development Bank (1997) predicts declining environmental quality under a 'business as usual' scenario in the lower income countries of South-East Asia, such as Indonesia and the Philippines, and South Asia. This conclusion is also shared by projections for air quality from the World Bank (1997). Recent work suggests a similar finding for energy consumption. For example, Carmichael and Rowland (1998) project that current pollution prevention programs, if widely implemented in Asia, have the potential to yield a 30 percent improvement in energy efficiency of economic activity by the year 2020. But even if such efficiency improvements are achieved, energy usage and attendant greenhouse gas emissions will still double over this time period (Carmichael and Rowland 1998). Asia will overtake the OECD economies as the largest source of greenhouse gas emissions worldwide sometime between 2015 and 2020.

It is this shadow of the future - the large scale increase in urban and industrial activity in Asia forecast for the next three decades - that demands a new policy response. Given the very likely continuing major shift from agriculture to industry, and from rural areas into cities, the critical challenge in Asia is to reduce substantially the energy, materials, pollution and waste intensity of urban-industrial activity in ways that support continued improvement in socio-economic welfare. This is the challenge of clean shared growth in Asia. Our goal in this paper is to lay out a policy framework to address this challenge i.e. to turn the trajectory of future urban and industrial activity in Asia towards patterns of development that are less energy, materials, pollution and waste intensive in a dynamic of continuous improvement and superior performance. This paper addresses the broad architecture of the policy approach only. Detailed discussion of particular areas is provided in an accompanying set of six thematic papers (on information as a policy tool, on technology and investment policy, on trade and economic policy, on environmental policy, on governance and civil society, and on urban policy).

Three Core Themes

The policy framework we propose draws on three core themes. First, that the sustainability challenge facing rapidly industrializing Asia today is qualitatively different from the environmental concerns that underlay the emergence of mature environmental regulatory systems within OECD economies during the 1960s and 1970s. The context within which regulatory systems must operate diverges in important ways even among Asian economies. Accordingly, policy development must begin by identifying the economic, political and social conditions in Asia and the world that constitute the structure of the sustainability challenge, and the attendant opportunities for change. Foremost among these conditions is the anticipated future expansion in urban and industrial activity, and the need to shape this trajectory of future economic development. In addition, the policy response must reflect the profoundly globalized character of many economic and social processes in Asia today, from investment and trade, to sources of information and technology, and locations of end-user markets.

Second, given that future increases in per capita income in much of Asia will almost certainly entail major shifts from agriculture into industry, and from rural areas into cities, the key policy focus must be on substantially reducing the energy, materials, pollution and waste intensity of urban-industrial activity. Reductions in energy, materials, pollution and waste intensity must continuously offset ongoing expansion in urban and industrial activity. This likely requires improvements that go well beyond what is required to meet baseline local environmental and health needs, and beyond the improvements achieved through existing environmental regulatory approaches. And because the sustainability challenge in Asia includes such global concerns as greenhouse gas emissions and resource depletion, it is imperative that the policy approach address the actual use of energy and materials (i.e. intensity-of-use), and not just ameliorate the pollution and waste bi-products of urban-industrial activity. Framed in these terms, the policy focus necessarily moves beyond controlling pollution to influencing basic processes of investment, technology

change and market development, or what we call the 'denominator' of economic activity.

Third, we argue that the focus on intensity, and on the urban-industrial process itself, expands the range of drivers and points of entry that can be harnessed to the goal of improved environmental performance. The array of possible drivers of improved environmental performance is wide, from community pressure to market demand, supplier relations, international agreements, and environmental regulation. Effective environmental regulation will be crucial to success. But within the policy domain, shaping the energy material, pollution and waste intensity of urban-industrial activity is as much an issue of technology, trade, urban, and industrial policy, as it is of environmental policy per se. The openness of East Asian economies to trade, investment and technology, and the increasing globalization of markets and information flows, suggest that these economic processes are potentially powerful drivers of improved environmental performance. Public policy has a key role to play in bringing these drivers to bear on the investment and technology decisions of private industry, in fostering a clear economic and environmental performance orientation among firms that promotes a dynamic of continuous improvement, and by fostering systems of civic ordering (e.g. public-private partnerships) and private ordering (e.g. management cultures) that support these goals.

THE CHALLENGE OF CLEAN, SHARED GROWTH IN ASIA

How can public policy best address the challenge of clean shared growth in developing Asia today? The most common response to this question has been to look to the environmental regulatory systems of the United States and other OECD economies as potential models for policy intervention. There is certainly much to be gained from the OECD experience, as evidenced by the progress made over the past three decades in reducing industrial pollution and improving environmental quality within these economies. But there are at least two reasons to suppose that a broader frame of reference will be valuable. First, regulatory approaches within the OECD are themselves undergoing a process of re-assessment and change (OECD 1997). This re-evaluation is linked to a growing interest in the role that civil society, information, the corporate sector, technology innovation, and markets can play as drivers of improved environmental performance (see, for example, Davies and Mazurek (1996, 1998); Heaton 1997). Second, the environmental problems and concerns, and the economic, social and political context within which environmental policy was developed, within the OECD economies in the 1960s and 1970s are very different from those of developing Asia today (a partial list of these differences would include levels of foreign direct investment, external trade, scale of urban areas, rate of industrial growth, effectiveness of legal systems, and so on). To take but one example, whereas the OECD economies had a relatively mature urban-industrial capital-stock and infrastructure, developing Asia is in the midst of rapid urban-industrial growth. Economic and political context have profound implications for the policy response.

Our analysis begins with the character of the development process in East Asia today, and the global economic, political and technological context within which that

development is taking place. Our comments are necessarily broad, for in some instances there is as much variation within the developing economies of East Asia, as there is between East Asia and the OECD. Our key focus is upon the developing economies of South-East Asia. But as we show below, the challenge and the opportunity of clean shared growth in Asia entails a set of structural characteristics that have broad significance within the region.

Industrial-led development: firstly, industrialization and technology catch-up are central elements of the development model that brought rapid shared growth to the economies of East Asia¹. Typically development involved a shift from agriculture into labor-intensive and resource-intensive industries, in the first instance, and then into more knowledge and technology-intensive industries, such as electronics, as well as producer services. Two consequences follow for our analysis. First, because much of Asia seeks to emulate the model of development pursued by the first-tier Asian NICs, rapid industrialization will undoubtedly remain at the core of the sustainability challenge within the region. Second, because the development model pursued by the Asian NICs depends on technology catch-up and the cultivation of local innovation capability, influencing the pattern of technology investment and change is a key opportunity for policy intervention.

Future growth: most low income countries in Asia, including the second tier East Asian NICs (Indonesia, Malaysia, Philippines, and Thailand), are still in the early stages of a profound urban-industrial development transition. Most of the industrial stock that will be in place twenty-five years from now is not on the ground today². What this means in practice is that the next three decades will likely witness the most prodigious expansion of urban-industrial activity in Asia in the history of the world. This is both a threat to sustainability and an opportunity to shape, at an early stage, the energy, materials, pollution and waste intensity of new urban-industrial investment. If actions are taken now, there is a once in a country's lifetime opportunity to achieve a more sustainable growth trajectory. This opportunity is significantly different from that faced by the OECD countries when they launched their environmental programs in the 1970s. Then the problem was not how to make the new urban-industrial capital stock cleaner but rather how to retrofit a large existing capital stock with end of pipe controls to reduce emissions after they were produced.

Private industry: the development process in Asia today is driven overwhelmingly by private capital. As of the mid-1990s, public investment (largely development assistance) constituted only 10% of new capital flows in east Asia. Of the dominant private investment, approximately 50% was foreign direct investment by international business. The implication is clear. Achieving clean shared growth depends on greening the new investment and technology choices of private business. Public policy must focus on promoting conditions under which such greening will take place. The prospects for such policy intervention may never have been better. Many leading companies are undergoing an unprecedented re-assessment of their own role in a sustainability transition (Fischer and Schot 1993; Roome 1998; Socolow et al. 1996, Graedel and Allenby 1995). Sometimes this takes the form of the greening of supply chains and the identification of win-win opportunities in

economic and environmental policies, including those affecting technological change and openness to the world economy (Wheeler and Martin, 1992 and Heaton, 1997). Sometimes it takes the form of new international voluntary environmental management standards and private law model of environmental regulation, such as ISO 14000, or of industry codes of conduct (as in the chemical industry's Responsible Care Program) (Roht-Arriaza, 1995). And sometimes it takes the form of corporate disclosure and accountability (as in the rapid growth of corporate environmental reporting and green accounting) (Ditz and Ranganathan, 1997 and UNEP, 1997).

Late-comer: as O'Connor (1994) has noted, the late-comer status of Asian NICs within the global economy is an important context for policy response. This is particularly the case with respect to technology, where Asian NICs have access to an array of environmentally advanced technologies developed within OECD economies. There is now considerable evidence that newer plant and equipment developed mostly within the OECD economies tends to be or can be made cleaner than existing plant and equipment (Wheeler and Martin, 1992; Christensen et al., 1995; Nelson 1994; Arora and Cason, 1995). This means that it is now or soon will be technically and economically possible for manufacturers in the NICs to import, adopt, adapt, modify, and innovate on an industrial capital stock that will tend to be cleaner simply because it is newer³. The policy challenge is to promote the selection and use of such clean technology in new urban and industrial investment. Since the majority of technology design and development remains centered with OECD economies, technology policy in the OECD will be crucial to clean shared growth in Asia, and indeed around the world. To repeat, the critical technology is not that of end-of-pipe pollution control, but new and improved product and process technologies that are designed to achieve higher efficiencies in energy and materials use.

Urban-based: industrialization in East Asia has been closely allied with highly concentrated urban growth. The Bangkok region, for example, accounts for almost one-half of Thailand's GDP and a little more than 75% of manufacturing value added (World Bank 1994a: 8). Four cities on Java (Jakarta, Surabaya, Bandung and Semarang) account for 36% of Java's and 27% of Indonesia's industrial output (World Bank 1994a: 75). As a consequence, much of East Asia's industrial pollution is concentrated in urban areas. This means that efforts to address industrial pollution need to be framed in the context of addressing allied urban environmental problems. It also means that urban governance, land use control and urban infrastructure investments are likely to be important elements of the policy response.

Globalization: the shared growth miracles of Asia occurred in tandem with rising openness to trade and investment within the world economy. Because of this, the Asian NICs are more integrated into the global economy than their counterparts elsewhere. In fact, they are at the leading edge of globalization. In broad terms, open-economies increase the interdependence of Asia and the global economy at large, whether this be in terms of market demand, investment and technology supply, or the global impacts of economic change (such as climate change). Open economies are already exposing manufacturers in the NICs to an increasingly wide range of pro-

environmental market pressures. Because the shared growth miracles in East Asia are predicated on the export of manufactures to countries in the OECD, these external market pressures will only increase over time. In our view, successful developing country exporters of manufactures will learn and are learning to meet environmental market requirements the same way they learned to meet developed country buyers' on-time delivery, quality, and packaging requirements (Keesing, 1988). At the same time, the importance of international investment, and of multinational national corporations, to the development process in Asia today creates an additional point of entry for addressing environmental performance. There is growing evidence that both local and international financial institutions operating in developing countries and capital (stock) markets in developing countries operate in ways that either reward or punish firms for their environmental behaviors. Environmental due diligence in lending is an increasingly common practice in Asia.

Governance and Civil Society: despite strong pressures to global convergence, there remain substantial differences between SE Asian societies and countries like the United States in many dimensions of governance and civil society, ranging from the strength of legal systems, to traditions of strong public policy planning (as in the industrial and technological planning pursued by the first tier NICs), to the role of regional governance systems (such as ASEAN and APEC), to the presence of NGOs, and transparency in financial transactions. It is also within these areas of governance structure that there is the greatest variation among countries within South-East Asia. Public policy must recognize and respond to these differences and to the specific social and political context of individual countries.

Having said this, there are several general trends that are likely to be of importance for policy intervention. As in other parts of the world, the growing availability of information and the growth of non-governmental organizations is creating a new force within governance structures of Asia. To varying degrees in each of the NICs, citizens, communities, and organized groups in civil society are placing increased pressure on governments and private sectors to improve environmental quality. In some places, such as Indonesia, public sector environmental agencies are taking advantage of public and community pressure to devise low cost enforcement strategies that take advantage of the concern of firms for their (environmental) reputations (Afsah and Vincent, 1997). In our assessment, achieving clean shared growth will depend in part on the ability of Asian countries to harness these processes of private and civic ordering.

Economic Crisis: jointly, the above seven elements (industrial-led development, future growth, private capital, later-comer advantages, concentrated urbanization, globalization and governance) define the critical context within which a policy response must be developed to meet the challenge of clean shared growth in Asia. But no analysis of context would be complete without reference to the economic and fiscal crisis that has dominated the region over the past two years and more.

To begin with, it is important to note that the effects of the crisis and the prospects for a return to past patterns of rapid growth vary widely within the region. Thailand, Indonesia and South Korea were hardest hit and experienced a substantial real

contraction in output. Per capita income in Indonesia, for example, fell from approximately US \$1,100 per capita in 1996 to US \$460 per capita in 1998. Malaysia and the Philippines were also hard hit. The economies of Singapore, Taiwan and China have not experienced the free fall in output visible elsewhere (World Bank 1998b).

The immediate environmental effects of the economic crisis included cutbacks in regulatory activity, delayed investments in new technology, and reductions in overall levels of economic activity and attendant pollution (Afsah (1998), World Bank (1998b)). The crisis will likely also effect the sectoral composition of economies, especially in the lower income countries of South East Asia. Most manufacturing industries with a high import content have suffered from deteriorating exchange rates and a slow down in export opportunities. Industries with high local content, such as natural resource based industries, will likely increase in importance in the short term.

It is also possible that the economic crisis will trigger more broadly ranging changes in policy practices and patterns of development. Attention has focused in this regard upon two particular themes, namely, disclosure/transparency and commitments to an open economy. In the aftermath of the crisis, many observers voiced support for a partial retreat from the growing openness of trade and investment within the region (Lim 1998). Certainly, the volatility of capital flows, especially debt flows, in East Asia intensified the crisis. The World Bank (1998b: 10) reports that in the space of one year net capital flows reversed by more than US \$100 billion. But as yet there has been little evidence of a broad withdrawal from open economies. Indeed, for most Asian NICs, export growth remains a key strategy for recovery from the crisis, albeit dependent upon economic recovery in Japan and continued economic growth in North America and Europe. In addition, foreign direct investment exhibits less short term volatility than others forms of private capital investment.

We conclude that despite the profound and traumatic effects of the crisis, the economic and political context for policy response outlined above remains valid⁴. While the timing and pace of future economic growth is uncertain, the key opportunity remains that of influencing the energy, materials, pollution and waste intensity of new urban-industrial investment. Reductions in intensity will continue to depend upon both environmental regulation, and increasingly upon a performance-based dynamic of continuous improvement within firms. What is perhaps of greatest uncertainty, is the strength and balance of different drivers of environmental performance, such as market demand, community pressure, and supply-chain management, within East Asia.

THE ISSUE OF INTENSITY

Having established the context for policy response, we now examine in more detail the nature of the environmental challenge facing East Asia in coming decades. Environmental problems within the region are in part the result of the sheer pace of growth of the past twenty-five years. But these problems also reflect an initial emphasis in many Asian economies on pollution-intensive and energy-intensive

manufacturing and resource processing industries, and the limited attention paid to pollution control and pollution abatement. One consequence of this has been a high energy intensity of GDP⁵. In high growth Asia, every kilogram of oil equivalent of energy consumed produces only \$1.40 of output. This is 40% of the energy efficiency of the U.S. and 15% of Japan's energy efficiency. There is also evidence that certain types of pollution have been growing even faster than output. To take but one example, the toxic intensity of GDP increased 5.4 times in Indonesia between 1976 and 1984. Comparable figures for Malaysia (3.05 times), Thailand (2.48 times) and Korea (2.5 times) are equally worrying (Brandon and Ramankutty, 1993: 74). Emissions of organic water pollutants increased rapidly in conjunction with rapid urban-industrial growth.

Reducing pollution from industry and improving local air and water quality have been important environmental regulatory priorities within the region, especially over the past decade. There are now a wide variety of efforts underway to strengthen environmental regulatory systems, promote pollution prevention and clean production (for a recent review see USAEP 1996). Given these ongoing activities, two critical questions need to be answered. The first is whether current regulations approaches, if widely adopted and enforced, are sufficient to reduce industrial pollution and improve local environmental quality within developing Asia. The second is whether a policy approach focusing on regulation of industrial pollution and improving local environmental quality will simultaneously resolve broader environmental concerns, such as resource depletion, escalating fossil fuel consumption, and climate change. Our main conclusion with respect to the first question is that projected outcomes depend critically on the energy, materials, pollution and waste intensity of new investment in East Asia (about which there is a paucity of good data). And in regards to the second question, we conclude that current policy approaches - focused as they are on controlling pollution - are insufficient to the challenge. Hence our call for a new policy approach to build upon and complement existing activity.

Future levels of industrial pollution and environmental quality within east Asian economies are sensitive to two critical modeling assumptions, namely, the rate of growth of industrial output, and most especially the energy, materials, pollution and waste intensity of industrial activity. Prior to the current crisis, most researchers predicted continued rapid growth in industrial output, and a reduction in some measures of pollution intensity of industrial activity within the first and second-tier Asian NICs. Actual levels of pollution and environmental quality depend upon the relative strength of these two often countervailing trends within individual countries. The analysis is complicated in that growth and pollution intensity are likely to be interdependent variables.

By way of illustration, one influential World Bank (1994b) study of Indonesia projected disastrous increases in pollution in that country by the year 2020, amounting to a ten-fold increase in water pollutants, a fifteen-fold increase in emissions of suspended particulates into the air, and a nineteen-fold increase in emissions of bioaccumulative metals, such as mercury and lead. The pollution intensity of industrial activity with respect to particulates, BOD and toxics (but not

bioaccumulative metals) was predicted to decline modestly in Indonesia over this twenty-five year period as a result of shifts into industrial sectors that were less polluting. But these declines were overwhelmed by a predicted thirteen-fold increase in industrial output by 2020.

A second World Bank study, again conducted prior to the crisis, demonstrates how changes in the assumptions made concerning pollution intensity result in quite different outcomes (World Bank 1997). The 'business as usual' scenario in this second study predicted a more rapid decline in pollution intensity within industrial sectors, based upon the assumption that all new capital investment would have emissions that were 25-50% lower than existing capital stock. Pollution intensity would fall as new, cleaner technology increased as a share of total capital stock. Under this more favorable scenario, particulate levels (a measure of air quality) in Jakarta were predicted to increase approximately 60% over the period 1995-2020. This represents an improved outcome over that projected in the 1994 World Bank study, though still a marked decline in air quality. The real costs of air pollution in Jakarta were expected to more than double over this period. Similar projections of declining air quality were made for Bangkok, Manila, and other South-East Asian cities⁶. It is only under scenarios that assume much more rapid declines in pollution intensity that urban air quality is projected to improve in lower income East Asian NICs⁷.

What is the basis for possible reductions in the pollution intensity of industrial output? Generally, three broad processes are involved. First, sectoral shifts in the composition of industrial activity away from resource-processing into assembly and technology-intensive industries typically reduces the overall pollution intensity of industrial output (though not of toxics and bioaccumulative metals). Second, if new capital investment is cleaner than existing capital stock, then the process of new investment and growth reduces the average pollution intensity of industrial output. Third, strengthened regulatory requirements and enforcement, public pressure, market demand and other drivers of improved environmental performance support more effective pollution control of existing industrial activity (e.g. retrofitting improved end-of-pipe control equipment), and more importantly, support investment in best-available-technologies that meet world class environmental standards, as well as more general pollution prevention activities, such as encouraging recycling and reuse, and planning decisions that minimize energy and materials demand⁸.

If the experience of the OECD and first-tier East Asian NICs is a guide, then we should expect that with rising incomes in East Asia all three of these processes will contribute to reducing the pollution intensity of industrial activity, offsetting the effects of increased industrial output. A recent study by Hettige et al. (1997) models these effects for water pollution, using data on emissions from a set of developed and newly industrializing countries for the period 1977-89. This study finds that pollution intensity of industrial activity falls sharply with income up to income levels of US \$6,000 per capita, and is stable thereafter. These types of findings, along with growing evidence that East Asian NICs are moving to strengthen environmental

regulation systems, lead some observers to conclude that the region is on the road to reduced industrial pollution and improved environmental quality.

Three points of caution need to be voiced in this regard. First, the anticipated improvement in environmental quality is largely a feature of the first tier NICs and the medium-income economies of SE Asia. Thus even with reductions in the pollution intensity of industrial output, air and water quality are expected to continue to decline in lower income economies, such as Indonesia, as growth in industrial output exceeds the rate of improvement in pollution intensity. It is important to recall in this regard that all the second tier NICs had per capita incomes in 1996 of less than US \$4,000, and per capita incomes in China and much of South Asia were less than US \$1,000 per capita. In much of Asia environmental conditions will get worse before they get better (Lohani 1998). Second, as we have seen the projections by the World Bank and others of lower net industrial pollution in certain East Asian NICs depend critically on assumptions that new capital investment will be 25-50% cleaner than existing capital stock. In our assessment, this assumption requires careful empirical evaluation (for example, by documenting the extent to which firms investing in Asia today are choosing, maintaining, and extending cleaner technologies).

Third, our core concern is with the environmental challenges of rapid urban-industrial growth that are not fully addressed through controlling industrial pollution at the plant-level. The most visible of such challenges are the ever-expanding use of energy and materials, resource depletion, and global climate change. In the area of energy, for example, even with a projected 30 percent improvement in energy efficiency, energy usage is expected to double by the year 2020. It is on this basis that we propose a policy approach that focuses directly upon the energy, materials, pollution, and waste intensity of urban-industrial activity, as opposed to addressing these issues indirectly and partially through pollution control.

THE DRIVERS OF CHANGE

The focus on intensity necessarily brings us to the industrial process itself, to shaping the basic processes of investment, technology change and market development within the industrial economy. What determines these investment, technology and market decisions as they relate to environmental performance? The traditional answer to this question is environmental regulatory policy. But environmental regulatory policy is only one means of shaping investment and technology decisions; and it has been most successful in bring firms and industries into compliance with particular performance standards through end-of-pipe pollution control. Environmental regulatory policy has been less successful in moving firms beyond compliance and engendering a self-sustaining dynamic of continuous improvement. By moving beyond pollution control to the industrial process itself, we are able to call on a range of additional policy drivers, from industrial and urban policy to various forms of private and public governance.

Accordingly, the policy framework we propose supports multiple-strategies focusing on a variety of performance drivers. In developing this framework, we recall the key

elements of the development context laid out earlier in the paper, including the key challenge of driving down the energy, materials, pollution and waste intensity of future urban-industrial activity. We begin with the role that environmental policy, including environmental regulation, might play in meeting this challenge.

Environmental Policy⁹:

Our analysis suggests that environmental regulatory systems in Asia will be called upon to support three types of goals. First, regulatory systems have a responsibility to protect public health. Most likely this will be achieved through the establishment of clear and consistent ambient environmental standards that are in turn linked to discharge limits for individual facilities. Once ambient and discharge standards are set, regulators must ensure compliance. Some countries, particularly in the first tier NICs have gone a long way towards doing just this. In others there remains a need to strengthen the legal authority and the institutional and technical capability of regulatory agencies. It is unlikely to be the case that Asian economies will adopt fully the kinds of traditional command and control regulatory approaches put in place in many OECD economies during the 1970s and 1980s. These approaches are now widely seen as being too costly and too difficult to implement (Russell, 1990). At the same time, the opportunity exists to learn from the experiences within the OECD and take advantage of many emerging regulatory opportunities, including: (1) a multi-media approach to environmental management and control; (2) greater public disclosure of environmental performance; (3) firm and plant level flexibility in how performance goals are met; (4) increased use of market based instruments, such as pollution taxes and tradable permits.

Second, environmental regulatory agencies will be asked to reduce industrial pollution through pollution prevention and clean production (as opposed to pollution control). Crucially this involves correcting market, policy and coordination failures which discourage firms from searching for and adopting production practices that lower energy, materials, pollution and waste intensity. Partly this involves correcting the bias of much regulatory policy to pollution control solutions. But it also involves harnessing market processes to the goal of clean production. Unlike pollution control, which is almost always derivative of regulatory policy, pollution prevention and clean production are responsive both to regulatory policy and other competitive pressures in the market place, such as materials costs and opportunities for 'win-win' economic savings. Here the key advance will be in reducing the often high transactions costs and learning costs associated with clean production alternatives.

Clearly initiatives pursued under the first two goals described above (protecting public health and supporting clean production) will contribute towards the goal of clean shared growth. However, resultant improvements in energy and materials efficiency, in particular, are unlikely to be sufficient to the scale of improvement that is required to offset continued urban-industrial growth. Accordingly, we anticipate that the challenge of clean shared growth will place new demands on environmental regulatory systems. It is to this third set of expectations, linked to substantial improvements in energy, materials, pollution and waste intensity, that we now turn.

Extending environmental policy:

In the context of clean shared growth in developing Asia, environmental policy must make three critical contributions. Firstly, it must articulate clear environmental and developmental goals. One result of the regulatory re-invention process within OECD economies has been recognition of the importance of clear and consistent goals that communicate priorities and directions to all segments of society, and set benchmarks for measuring progress (cf. National Academy of Public Administration 1995; Steinzor 1998). Such a goal and outcome driven policy framework fits well with approaches taken to past development successes - in agriculture, primary education, export-led industrialization and others - by East Asian NICs. But it must also reflect emerging claims for greater public participation and transparency in the policy making process.

Second, environmental regulation - and regulators - must support the integration of policy making and policy implementation across multiple organizational domains, from industry to trade and technology, from public policy to corporate management, from local environmental quality to global and regional environmental concerns, and from national policy to regional and international regulation. Traditional environmental policy has been pursued largely as an issue of environmental regulation and largely within environmental ministries or departments. The need now is to introduce environmental goals into line ministries, and then to integrate environmental regulatory policy with industry, trade and technology policy. Such integration must also coordinate policy making at multiple geographical scales, from the local to the national, regional (e.g. ASEAN), and international (e.g. WTO).

Third, environmental policy must support a performance-orientation on the part of firms and industries. Crucial to this will be improvements in the quality and quantity of information available on the environmental performance of firms¹⁰. It should by now be clear that information is a powerful policy tool. Information will increasingly become a driver of change both for firms, for whom it is the foundation of performance based management, and for government and society at large. Fortunately, there is substantial evidence that information development and disclosure are promoting improved environmental performance of industrial firms in East Asia. Indonesia has a color-coded environmental rating and disclosure program for major water polluters that has improved environmental performance (Afsah and Vincent 1997). China's sustainable cities index program, which annually rates, ranks and publicly reports on the environmental performance of its major cities, appears to be influencing the location of industrial activity, the rate of growth of urban infrastructure, and plant level investments in pollution control.

To date, information on environmental performance has largely been used as a tool of environmental regulation i.e. to assess whether firms are meeting externally imposed regulatory standards. Increasingly this information will be used in at least four other ways. First, as a tool of strategic management by firms that are seeking to optimize their own environmental performance, whether it be with respect to energy efficiency, or life-cycle impacts of products. Second as an element of financial and

risk management by banks, investors, insurance companies and the financial community at large, in the same way that standardized accounting information is currently used. Third, as part of a marketing and corporate management strategy. Increasingly, purchasing decisions inside and outside of the firm will be linked to information on environmental performance, whether this be through market regulations, ISO 14000, green labeling, or supply chain management. Finally, as a tool by which communities, citizens, and organized groups in civil society hold governments (there own as well as others), as well as the private sector accountable for performance. Public policy must foster and harness these trends toward performance-based management in the public and private sectors.

Industrial and Technology policy: one of the conclusions of our analysis is that meeting the challenge of clean shared growth is as much an issue of industrial and technology policy as it is of environmental policy per se¹¹. This is because successful efforts to reduce the energy, materials, and pollution intensities of industrial production will depend critically on the development and deployment of new technologies, and on the capability of firms to use existing plant and equipment efficiently, to know how to improve on it and innovate with it, and how to manage efficiently the process of technical change and technology acquisition. Unless firms can do these things and do them well, there may be significant limits to their ability to ratchet up into skills intensive industrial growth (as Korea and Taiwan have done in different ways (Kim, 1997 and Wade, 1990)) and to respond to pressures from regulatory agencies, communities, and markets that would push them in a direction that lowers energy, material, pollution and waste intensities.

If we are right, three important implications follow. First, policies that promote firm level technical learning and capabilities acquisition that are necessary for the second tier NICs to recover from the current economic crisis and gain competitiveness in skills intensive manufactures are likely to be equally good for energy, material, pollution and waste intensity reduction. They should make it easier for firms to engage in better housekeeping practices and minor process innovations that prevent pollution. They should make it possible for firms to "stretch" existing plant and equipment by substantially modifying it to reduce energy and materials use. They should also make it easier for firms to evaluate imported plant, equipment, and technology. Second, because intensity reduction is or will be a relatively new activity for industrial firms in the NICs and Asia more generally, industrial firms in the NICs and in Asia more generally are likely to need industry and technology specific information (and specialized technical training) on how to do this. This is the just the kind of information and specialized training that institu8 Tc 0.047are part of the national technology infrastructure (such as industrial technology institu8es or standards agencies) are good at providing. They should be encouraged to provide such information and training to overcome information failures and the high transac8 Tc costs associated with reducing energy, materials, pollution and waste intensities. This is most likely to be true for small and medium enterprises (SMEs) and governments in the NICs would be advised to consider expanding existing MNC/SME linkage programs designed to do this to include environmental considerations (Battat, Frank, and Shen, 1996). It may also make sense to consider developing such programs for large domestic firms and their suppliers.

Not surprisingly, doing all of this and doing it well also requires governments to invest in national technical capability building by supporting education, particularly in engineering (and environmental engineering) and by investing in institutions that test materials, inspect and certify quality standards (including environmental quality standards such as ISO 14000), calibrate measuring instruments, and provide difficult to obtain information (including in the area of clean technologies). As the experiences of Korea and Taiwan demonstrate, large investments in literacy, in education and in engineering training make it easier for firms to acquire technical capabilities (Tan and Batra 1995).

For the short and medium term, most technology and capital equipment will continue to be sourced from OECD economies. Accordingly the kinds of investment and technology transfer, adoption and use policies described here have to extend across international boundaries, and from OECD economies to developing Asia. Within this international domain, trade and investment policy emerges as an additional crucial policy lever for shaping technology choices, and more generally shaping the environmental policy of industry.

Trade and Investment policy: as discussed earlier in this paper, one of the defining contexts for clean shared growth in Asia is the degree to which development has occurred in parallel with increasing economic integration on a global scale, and especially in terms of levels of international trade and investment, as well as the prominent role of MNCs in the development process. This suggests that international multilateral regulation of investments and market processes, as well as private-law models of international business regulation (such as ISO 14000) can be used as policy tools to promote reductions in energy, materials, pollution and waste intensity of new industrial investment in developing Asia¹².

To date, there has been only mixed success in building in environmental concerns into multilateral agreements. Policy initiatives toward harmonization of environmental standards within multilateral trade agreements and introduction of environment riders within the multi-lateral agreement on investment have achieved only modest gains, partly because of concerns on the part of developing countries that environmental standards will be a form of indirect protectionism (see, for example, Esty 1997). More progress has been made with explicit international environmental agreements, such as the Montreal Protocol and the Framework Convention on Climate Change. Despite the limited achievements to date, multilateral agreements remain an important domain for policy intervention.

The recent explosion in private capital flows-- both direct foreign investment by multinational corporations and of portfolio flows-- means that states can no longer flout what Matthews (1997: 57) calls the de facto rules being set by markets. This can be seen most clearly in Asia's current financial crisis. With respect to the environment, we are witnessing the rapid emergence of what Roht-Arriaza (1995: 486-499) refers to as a global private law model of environmental regulation. This private law model relies, at least in part, on private, producer-based systems of international environmental standards. Sometimes this takes the form of

multinational corporations imposing their home country practices on their subsidiaries located elsewhere (Brown, Himmelberger, and White, 1993) or on their suppliers. Sometimes this takes the form of private business organizations, such as the Business Council for Sustainable Development (BCSD), the Coalition for Environmentally Responsible Economies (CERES), the Global Environmental Management Initiative (GEMI), the International Chamber of Commerce¹³, or the Chemical Manufacturers¹⁴, creating their own standards for measuring and comparing the environmental impacts of their activities (Roht-Arriaza, 1995: 497-499). And sometimes, as with ISO 14000, it takes the form of development of a wide ranging set of private law international environmental standards governing everything from the development of acceptable private sector environmental management systems, to environmental auditing, product life cycle analysis, and environmental labeling (Roht-Arriaza, 1995).

These global links are of especial importance to the externally oriented export economies of East Asia. To date, most attention has focused on developing a regulatory structure to match the global economy, whether through WTO, GATT, APEC or other international and regional organizations. It is possible that these emerging international regulatory bodies will be important drivers of improved environmental performance. But it is more likely that the market processes of globalization described above will be of importance. Having said that, it is far from clear that private-law regulation will develop as a powerful driver of superior environmental performance in Asia. Our recommendation in this regard is for the urgent development of effective systems of performance measurement. A good place to begin is with the development of a standardized, low cost, scaleable approach to measuring the energy, materials, pollution and waste intensity of production, and of technology choices. The measurement systems should include information on greenhouse gas emissions. We must then investigate how such information can be used most effectively by firms, consumers, suppliers, municipalities and the like. As with price and quality, the ability to measure environmental performance is crucial to harnessing market processes and private management systems to the goal of clean shared growth.

Urban policy: currently in developing Asia rapid industrialization and rapid urbanization are tightly intertwined. The majority of industrial activity occurs within urban areas and the environmental impacts of industrial activity are amplified by concentrated urban form. Precisely because cities are the locus for so much of the industrial transformation underway in developing Asia today, they are also the focal point for civic engagement with the development process. Such civic engagement at the urban scale will likely be critical to achieving clean shared growth, and urban policy can make an important contribution by enhancing governance capabilities within cities, by promoting effective models of public-private partnership, and by enhancing the quality and quantity of information available on the environmental performance of industry within cities¹⁵.

Why is enhanced urban governance and civic engagement likely to be of importance to clean shared growth? First, there is some evidence to suggest that successful policy development and implementation benefits from the opportunity to take account of

place-specific conditions accorded by devolution of decision making to the local-level (John 1994). This is especially the case where policy decisions require difficult trade-offs among multiple potentially competing priorities, such as improving environmental conditions, reducing unemployment and improving economic welfare. Second, collaborative governance and civic engagement promote broad 'ownership' of the regulatory and policy initiative. Such broad ownership occurs when all participants (community groups, business, government, unions, and others) have a stake in the success of a policy approach, and recognize that systemic failure is a worse option than seeking compromise and common ground. Such ownership is likely to be of particular importance as developing Asia continues to undergo wrenching changes not just in economic structure, but in social and political organization as well.

Beyond this critical issue of promoting enhanced governance-capability at the urban scale, urban policy can support clean shared growth by enhancing urban management, most especially in the areas of location and land-use planning, and in the provision of urban infrastructure. In much of developing Asia, urbanization is taking the form of massive mega cities with population concentrations of upward of ten million people. Such urban concentration increases the stress on dissipative systems within the natural environment, and creates extreme localized environmental problems (such as water supply, and waste disposal). Location and land-use policy has a major role to play by structuring where industries locate and how people move from home to work.

Cities also have to do a better job at managing urban infrastructure. Available evidence suggest that infrastructure expansion is not keeping up with rapid population and economic growth. This is partly due to the fact that city governments often lack the capacity to tax the new income created within cities as a means of financing infrastructure investments. But in some countries it is also due to lack of competition among public service providers, lack of managerial autonomy and outcome accountability, and poor relations between service providers and end-users (World Bank 1994a).

Governance and Civil Society: while cities will be the locus for civic engagement and greater public pressure on governments and the policy process, this urban scale activity will be but one part of the continuing development of civil society in Asia in coming decades. Indeed, one of the great unknowns of the development transformation that will unfold in Asia over the next thirty years is the way in which civil society will develop, and the attendant forms of governance that will emerge. This dimension of the development context also will likely show a high degree of variation among Asian societies.

Most analysis of civil society focus on the growth of NGOs and the role that information access now plays in supporting increasingly powerful international networks of NGOs. Rapid reductions in the costs of communicating information, over fax machines, telephones, and the internet now mean that NGOs in one country can and are easily reached by NGOs in any country. The impact of this on private and public policy making within countries and between countries has been

amply demonstrated by Matthews (1997). As she sees it, NGOs now deliver more development assistance than the entire UN system (excluding the World Bank and the IMF (Matthews, 1997:53), and they are increasingly successful in pushing even the largest and strongest governments around. Thus when the U.S. and Mexico attempted to hammer out a trade agreement behind closed doors, NGOs in both countries forced both governments to negotiate more openly and to pay greater heed to health and safety, pollution, consumer protection, and labor practices than either had intended (Matthews, 1997: 54).

What the future holds in this regard is far from clear. Under these conditions of uncertainty, our recommendation is for a pro-active process of participatory engagement with community groups, NGOs and others. In short, engagement carries a higher probability of benefit, and lower risk, than exclusion. While we cannot as yet systematically demonstrate that civic engagement will succeed as a driver of clean shared growth, we do know that exclusion from the policy process undermines effectiveness and legitimacy of outcome (DeWitt 1994). As with the case of private business, the bedrock of such civic engagement is information. Here we cite again the success of the PROPER environmental rating and disclosure program in Indonesia to secure improvements in environmental performance.

SUMMARY AND CONCLUSION

There is no roadmap to cleaner shared growth in developing Asia. But we can already recognize (1) the scale of the challenge, (2) the important points of strategic entry, and (3) the likely driving forces of change. We submit that the critical opportunity lies in reducing the energy, materials, pollution and waste intensity of new urban and industrial investment. Success in this endeavor requires harnessing "new" drivers of environmental performance. This would entail:

- Acceptance of clean shared growth as a strategic goal, focusing on the development of clean technologies, industries, and urban infrastructure as both sources of economic advantage and of environmental improvement.
- This commitment must be communicated as a clear 'market signal' through which to influence the future technology and investment decisions of private firms, capital markets, urban municipalities, and consumers.
- Leveraging private industry and capital as the principal agents for developing clean products and production processes

This can only be achieved by strengthening the internal and external drivers of technology and investment decisions. Partly this will involve the establishment and enforcement of environmental standards. The new policy opportunity involves promoting the use of information, performance measurement, market pressure, and supplier linkages as drivers of superior performance. Globalization substantially enhances the likely effects of such public and market drivers. But there is also a large role for public policy. It must focus on (1) environmental regulation, (2) fostering information and market pressures, and (3) the use of economic and technology

policy, land use control, licensing and other instruments to promote clean investment and technology decisions directly.

Given this, what would a clean shared growth policy agenda look like? The policy matrix would begin with a portfolio of environmental regulatory institutions, policy instruments and capacities for implementation and enforcement. Effective environmental regulatory systems are the bedrock of clean shared growth. Such regulatory systems begin with clear performance expectations for firms and industries; these performance expectations must be consistently enforced and backed by appropriate responses to non-compliance, ranging from penalties to technical assistance. The regulatory expectations must in turn be supported by effective policy instruments, and here healthy debate continues around the appropriate mix of command-and-control, market based instruments, and information-based policies, such as performance disclosure. These policy instruments must be tailored to the range of firms and industries present within an economy, including small and medium sized enterprises, and foster innovation in new policy approaches, such as sector and place-based environmental management. The environmental regulatory system must progressively be built around concepts of pollution prevention and clean production, going beyond end-of-pipe pollution control. It must also address issues of resource pricing and infrastructure financing and development. And the environmental regulatory system must encourage a wide portfolio of private initiatives, ranging from ISO 14000 and supply chain management, to environmental due diligence in investment.

To varying degrees, the developing economies of South East Asia have begun to put in place the elements of such an environmental regulatory system. The first tier NICs, (Hong Kong, Singapore, South Korea, and Taiwan), have the core elements of a command-and-control environmental regulatory system in place. Here the important priority is to move beyond end-of-pipe pollution control toward the use of market based instruments, pollution prevention, and clean production, and to strengthen non-regulatory drivers that support the achievement by firms of superior performance that goes beyond compliance with base-line environmental standards. These developing regulatory systems must increasingly search for more efficient ways to yield continuous improvement in environmental performance, especially among small and medium-sized enterprises. Among the second tier NICs (Indonesia, Malaysia, Philippines, and Thailand), and China, there is an urgent need as a next step to strengthen the basic institutions of environmental regulation and to ensure the development of effective capacities for implementation and enforcement. In some economies (Thailand and the Philippines), environmental agencies operate without landmark environmental legislation that empowers them to set ambient and emissions standards, monitor performance, and enforce compliance (see Rock et al. 1999). In others (Indonesia and Thailand), regulatory agencies have no authority to monitor, inspect, or enforce facility-specific emissions standards. In virtually all of these economies, regulatory agencies lack both sufficient technical capacity and sufficient resources to effectively manage national environmental protection programs. Even as these basic capacities of environmental regulation are being strengthened, the second tier Asian NICs must draw upon the experience of industrial economies around the world and move aggressively toward the adoption

of market-based instruments, pollution prevention, clean production and superior environmental performance.

If environmental regulation is the bedrock of clean shared growth, much of the new policy opportunity - and the urgent policy imperative - involves going beyond compliance in a dynamic of continuous improvement leading to superior environmental performance. It is only with such superior performance that the scale effects of rapid urban-industrial growth will be offset by parallel reductions in the energy, materials, pollution and waste intensity of economic activity. Here, as a first step towards such a transformative development dynamic, we highlight four broad policy initiatives. In various forms, these initiatives are appropriate to all of the Asian NICs and are supplemental to environmental regulatory policy per se.

The first initiative involves strengthening non-regulatory drivers of environmental performance. The range of potential non-regulatory drivers is broad, including market demand, community pressure and cost reduction. The key to harnessing these drivers, we argue, is the development and disclosure of transparent, low cost, scaleable and standardized information on the environmental performance of production lines, enterprises, firms, industrial sectors, urban areas, and national economies. Various experiments with such performance metrics are underway in Asia, such as the PROPER program in Indonesia (Afsah and Vincent 1997), and China's urban environmental indicators program (Rock, Fei and Zhang 1999). An important policy priority is the development and widespread adoption of effective systems of environmental performance measurement and disclosure.

The second initiative involves the identification and implementation of development goals for clean shared growth. Here we would highlight four dimensions of the goal setting process: it must be directed to the next twenty years of development transformation in the region (2020); it must be framed in terms of energy, materials, pollution and waste intensity of urban-economic activity, and in terms of basic economic processes of investment and technology change; it must be forged in partnership with business and the public; and it must facilitate the identification and coordination of environmental performance goals across a range of relevant policy domains, from industry to technology and trade.

The third initiative focuses specifically on enhancing the capability of firms and industries in Asia to develop, use, adapt, adopt and improve upon product and process technologies and associated manufacturing practices in a dynamic of continuous improvement. Absent such in situ industrial and technological capabilities, it will be extremely difficult for Asian economies to achieve the kind of economic transformation needed to improve substantially both environmental performance and socio-economic welfare. There is no one model for how such technological and managerial capacity building might be achieved. Success in South Korea was heavily dependent on large firms (Kim 1997); in Taiwan it involved close collaboration between industry and government-sponsored R&D centers (Rock 1996b).

The fourth priority initiative is that of enhancing institutional capabilities for clean shared growth at both the local and the national scale, and in terms of Asia's participation in regional and international environmental agreements. Increasingly many policy decisions about clean shared growth are being devolved down to local communities and urban areas; it is important that the devolution of responsibility also be accompanied by the development of institutional capability and resources for policy implementation. At the same time, considerable attention needs to be given to the interplay among different levels of governance, from the local to the national to the international, and to the horizontal interplay among different policy domains.

We conclude with one final comment. It is important to recognize how little we know about many specific aspects of clean, shared growth. For example, we lack systematic data on the characteristics of current industrial investment and technology flows in Asia. How clean, or dirty, is current investment? How effective are current policy initiatives, such as information clearing houses and clean production roundtables? To what extent do current production technologies present 'win-win' opportunities in Asia, yielding both economic and environmental benefit? There is an urgent need for systematic research and evaluation to parallel the kinds of policy innovation outlined in this paper.

ENDNOTES

1. This is not to denigrate the importance of intensification of agriculture, or of massive investments in basic education, health care, infrastructure, and family planning to the success of the East Asian shared growth model.
2. In a pre-crisis study of Indonesia, the World Bank (1994b) projected that 85% of capital stock that would be in place by 2020 is not in place today. Even with the current recession and then slower and delayed growth, the significance of new investment remains. At an annual growth rate of manufacturing output of 7.25% (just half the growth rate maintained during the 1990s prior to the crisis), manufacturing output doubles every ten years.
3. We do not, however, have good data on the extent to which manufacturers are availing themselves of cleaner technology within SE Asia. Because most existing policy presumes a 20-30% improvement in energy and materials efficiency simply through the use of newer, cleaner technology, this becomes a critical policy issue.
4. Among East Asian economies, Indonesia remains most vulnerable to long term economic and political dislocation.
5. While the ratio of commercial energy use to GDP is high relative to OECD standards, commercial energy use per capita is low and expected to rise very rapidly over coming decades. For the four second tier NICs (Indonesia, Malaysia, Philippines, Thailand), commercial energy use per capita measured in kilogram oil equivalents was 820 kilograms in 1996, as compared to 5123 kilograms in the higher income OECD economies (World Bank 1998a).

6. Note that under these more optimistic business-as-usual assumptions urban air quality improves in China's largest cities, but falls dramatically in other cities in China.
7. In this 1997 World Bank study, the business as usual scenario in pollution intensity of BOD emissions from large industrial sources, resulting in substantially reduced levels of BOD in water in Indonesia over the period 1995-2020.
8. Such policies go beyond the firm per se, as for example, in urban planning activities that minimize transportation flows associated with industry.
9. For detailed discussion, see the accompanying framing paper "Public policies to promote a clean shared industrial growth in East Asia" (Rock, Ooi Ling, and Kimm 1999)
10. For a detailed discussion of information and information disclosure as a policy tool see the accompanying framing paper "Industrial environmental performance measurement: information for a clean revolution in SE Asia" by Deborah Savage and Mingsarn Koasa-ard (1999).
11. See the accompanying framing paper "Technology and environmental performance leveraging growth and sustainability" by George Heaton and Budy Resosudarmo (1999).
12. See the accompanying framing paper "Globalization and the environment in Asia: linkages, impacts and policy implications" by Daniel Esty and Mari Pangestu (1999).
13. In 1991, the ICC created the Business Charter for Sustainable Development in response to recommendations in the 1987 Bruntland Commission report on the environment (Roht-Arriaza, 1995: 498).
14. In North America, CMA developed its own Responsible Care Program in 1991. The program binds CMA members to a set of principles regarding safe chemical development, use and transfer, as well as to a code of management practices (Roht-Azziaza, 1995: 498)
15. See the accompanying framing paper "Industrialization cities and the environment in Pacific Asia: toward a policy framework and agenda for action" by Michael Douglass and Ooi Giok Ling (1999).

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