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Best Practice on Environmental Policy in Asia and the Pacific: Chapter 5

Policies for Material and Energy Efficiency Gains in Small and Medium Enterprises

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Resource efficiency and recycling and strategies for sustainable production and consumption need to be further developed throughout Asia. To improve resource efficiency the small and medium enterprises (SMEs) that occupy a majority of industrial sectors and contribute a large proportion of Asian gross domestic product must become central actors. This research reviews the role of SMEs in Asia in connection with resource efficiency improvement, and provides insights into why governments need to work with the private sector and local communities to make further advances in resource efficiency. A pattern-matching analysis of 43 examples of good practice from 11 countries reveals a range of factors that are common to success. These include: good supply-chain linkages; industry clusters; producer associations; voluntary agreements through public-private partnerships; good technical support; and the underlying threat of increased regulation if voluntary approaches fail. This paper is part of the series of eight linked papers presented in this special issue of the *International Review for Environmental Strategies* (*IRES*).

Keywords: environmental policy, small and medium enterprises, SMEs, resource efficiency, energy efficiency

1. Introduction

Asian economic growth, building on rapid industrialization, has increased the region's economic output by four times in the past 20 years. Land, water, energy, and other resources have been exploited at an unprecedented pace. Despite such growth, the region still contains the majority of the world's poor, and economic growth and resource utilization remain unavoidable priorities, especially in developing countries. How can the region sustain its fast-growing economy while minimizing the pressure on remaining natural resources (WorldWatch Institute 2006)?

Production and consumption patterns in Asia are undeniably unsustainable (Asian Development Bank 2005). Export-oriented production with low resource efficiency coupled with mass domestic consumption accelerates the linear throughput of resources rather than closing production and consumption loops, and generates massive amounts of waste. Improvement of resource efficiency is a vital strategy in correcting this unsustainable pattern. Resource efficiency (also called eco-efficiency) is a management strategy based on input/ output measures, that seeks to maximize resource productivity in

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order to reduce pollution or waste per unit of output, and to generate cost savings and competitive advantages (Organization for Economic Co-operation and Development 1997). Resource efficiency can be achieved through means such as material substitution and sourcing, design for the environment, cleaner technologies, process waste minimization and recycling, and reduced packaging and transport (ACTETSME 2003).

Small and medium enterprises (SMEs) play a key role in Asia's socio-economy, accounting for more than 90 percent of manufacturing industry (ACTETSME 2003), with a 60–70 percent share of domestic production (Asian Institute of Technology 2002). The contribution of SMEs to Asia's gross domestic product is somewhere between 30 and 60 percent (Hall 1995). In Indonesia, 99.9 percent of all registered companies are categorized as SMEs, employing more than 80 percent of the workforce (Guerin 2002). Hence resource efficiency in the region cannot be achieved without a major contribution by SMEs.

2. Literature review

2.1. Resource efficiency concepts

a. Industrial ecology

The concept of industrial ecology grew out of the idea of "industrial metabolism"—the flow of materials through the industrial system and into the environment—mimicking ecological processes in nature. By analogy with natural ecosystems, industry can be viewed as a collection of industrial organisms organized into a network through which energy and (used and reused) materials flow, and from which come products and services (Bringezu 2003). Minimizing physical exchanges with the environment and establishing "internal material loops" (the re-using of materials within the factory) that are driven by renewable energy flows are essential to a sustainable industrial metabolism (Allenby and Richards 1994). Recycling of materials; "cascaded use" (the extraction of more value out of the same material as it cascades through the production process); and increased energy efficiency are major components of a sustainable industrial metabolism (Graedel and Allenby 1995).

b. Cleaner production

In the 1990s, cleaner production was promoted by various United Nations and other organizations. The basic proposition was that better and cleaner production processes would not only save resources and reduce waste, but would also be more profitable—a win-win solution. Thus, cleaner production means reducing environmental impacts from processes, products and services by using better management strategies, methods and tools (Angel and Rock 2000). Related terms include *green business*, *sustainable business*, *eco-efficiency*, and *waste minimization*.

c. Factor X

Factor X is an efficiency concept that has been applied to reduction in resource use, where X refers to a value ranging between 4 and 50 (Hofftren 2001). Lower values of X relate to short-term environmental improvement. Thus, a factor X of four, advocated by von Weizsacker, Lovins, and Lovins (1997) targets doubling wealth while halving resource consumption resulting in a fourfold

increase in resource efficiency over the next 20–30 years. The factor 10 concept (Schmidt-Bleek 1993) argues that even a tenfold increase of resource efficiency is technically feasible over the next 30–50 years (Bleischwitz and Hennicke 2004; Hofftren 2001). Others have argued that for the developing world to enjoy a standard of living similar to that of the US and Europe, efficiency improvements by a factor of 50 will be needed (Welford 2005).

d. Other concepts

Other concepts used in connection with resource efficiency include: *dematerialization* (using less physical resources and embedded energy per unit of output) (Herman et al. 1990); *design for the environment* (the integration of resource minimization and recycling potential into product design) (Lewis and Gertsakis 2001); *cradle-to-cradle resource management* (ensuring that waste materials become inputs for subsequent production processes) (McDonough and Braungart 2002); and *natural capitalism* (learning from nature to design production and consumption systems) (Hawken, Lovins, and Lovins 1999).

2.2. Resource efficiency and SMEs in developing countries

Different nations, and sometimes different ministries within the same nation, often have their own definitions of what an SME is. This makes it difficult to gauge the performance of SMEs in terms of resource efficiency despite the fact that significant numbers of SMEs have emerged in the reuse and recycling sector during the past 10 years. A higher market demand for used or recycled products exists in developing countries than in the developed world because low-income groups, which form the majority of the population, cannot afford expensive new products. Thus, both the supply and demand sides of economies in developing countries provide a suitable environment for expanding reuse and recycling markets. Expansion of recycling businesses in developing countries also leads to improved social benefits through creation of jobs for the poor and the consequent improvement of their living standards (Porter 2002).

In Asia, the recycling market has grown beyond local and national borders (O'Neill 2000). Trade flows of recyclables have increased rapidly between Asian countries over the past decade (Hashi and Mori 2005), and one of biggest driving forces behind this increase is the high demand from China for material resources, including recyclables. This demand offers tremendous opportunities to other countries in Asia for trading in recyclables (Takada and Okumura 2003). In response, an increasing number of SMEs trading in recyclables have emerged in the region (Wang 2005), and the potential size of the market is estimated at over US$300 billion per year (Asian Development Bank 2005).

In spite of increased concerns over scarcity of resources and waste management, national policies for resource use have not been established in most developing countries in Asia (Takada and Okumura 2003). It is not clear if this is because of the absence of national policies or not, but local people, communities, and the informal sector (for example scavengers) currently engage in collecting, sorting, refashioning, and remanufacturing recyclables from local waste streams without support from municipalities (Imura and Regina 2004).

Resource efficiency matches the interests of SMEs in terms of cost concerns and competitiveness in the market (JICA 2001). Small changes in a business's operations, which often do not require a huge investment, can significantly reduce resource use. For instance, a checklist of environmental

performance for Eco Action 21 (a Japanese environmental management program especially designed for SMEs) advocates simple activities such as "double-side paper use for photocopies", and "reduction of packing/wrapping materials for shipment by reusing them". (Ministry of Environment, Japan 2001).

2.3. The cluster approach and resource efficiency

Because of their weak technical capacities and financial vulnerability, SMEs may be better served in some instances by taking collective action. With this in mind, the cluster approach was designed to strengthen the competitive advantage of SMEs by building up local capabilities through support for a broad range of actors (from SME owners and associations to policymakers at local level), and addressing the problems of knowledge fragmentation and lack of coordination and joint action. The fact that a large number of homogeneous industries often locate in a concentrated area means that the provision of technical assistance to individual SMEs is efficient and effective, and also facilitates the spread of good practice, since the needs of the SMEs in a cluster are quite similar (UNIDO 2000). Moreover, networking among SME clusters can lead to other benefits, such as the provision of venues to discuss solutions to shared problems, and the pooling of resources to jointly improve resource efficiency and competitiveness (Nadvi 1995).

While the cluster approach involves horizontal interaction among SMEs, compared to the vertical interaction of supply chains, a central facilitator is necessary in both cases. An industrial association or local authority can facilitate networking of multiple stakeholders associated with industrial clusters. In the Netherlands, SMEs identified municipalities and employers' associations as the organizations they consulted the most when they needed information about waste and emissions management (Hoevenagel and Wolters 2000). As SMEs generally have strong ties to local communities, initiatives and support from local authorities are often critical to the improvement of SMEs' environmental performance. (Martinuzzi et al. 2000).

2.4. Supply chain contributions to resource efficiency

As globalization has become pervasive, the private sector has been shifting its approach to environmental performance from compliance with regulations and standards to the more voluntary approach of corporate social responsibility (CSR). Zadek and Evans (1997) argue that three main drivers of CSR are values, strategy, and public pressure. Whatever motivations lie behind the adoption of CSR practices, companies often find financial benefits through improved efficiency in energy and resource use triggered by CSR concerns.

Although CSR is generally associated with transnational corporations, SMEs have increasingly been encompassed in this global trend through supply chains. Most SMEs use local resources and do business in domestic markets, so relatively few of them are engaged in export-related activities. Yet these few contribute to 75–80 percent of export earnings, more than half of which come from subcontracts and ancillary supplies (Asian Institute of Technology 2002). Thus, SME manufacturing is influenced strongly by the global market through supply chain relationships and, as customers, transnational corporations concerned with their reputation are demanding that SMEs improve environmental management in their production processes (Adversario 2000).

To meet these expectations, SMEs are required to invest in new product design, upgrade technology to minimize the use of energy and materials in production processes, and undertake other housekeeping improvements, all of which impose an extra financial burden (Chiu 2000). Considering the financial and technical constraints on SMEs, however, transnational corporations reciprocate by arranging technical support like training programs, technology transfers, and information sharing (Angel and Rock 2000). SMEs, in turn, have high expectations that such a collaborative process in dealing with environmental issues along the supply chain will result in mutually profitable outcomes (Business for Social Responsibility Education Fund 2001).

2.5. Policies and regulatory arrangements to promote resource efficiency

Formulating appropriate policy for industrial ecology or cleaner production systems requires careful analysis of material flows on different levels and at various scales to understand the entire picture of the industrial metabolism in each sector (Bringezu 2003). In the policy formulation process, a holistic approach that considers the closely intertwined relationships between environmental, social, and economic issues is essential, particularly in developing countries (Ramaswasmy 2003). In the policy implementation process, creating new organizational structures for industrial systems and utilizing partnerships between industrial players may be needed. Through such structures, not only closed material loops (zero waste) should be created but also closed liability loops, where responsibility for all materials and waste remains within the industry (Stahel 2003).

Government policies can provide the incentive structure to encourage adoption of cleaner production, but to reduce the throughput of material in a specific company, internal paradigm shifts are needed so that managers can focus on the root causes of the burden their industry places on the environment. Management and employees need constantly to think of ways to decouple economic success from resource throughput. One possible paradigm shift is to aim for a service economy rather than an "ownership" economy, in which results are measured by resource stocks and their sustainable use instead of by resource flows (Giarini and Stahel 1989, 1993; Stahel 2003).

Despite extensive research, incorporation of the findings of industrial ecology research into public policy is in its infancy. Major reasons include: a missing link between research and concrete political targets; a lack of monitoring instruments; and insufficient attention to the linkage between material flows and economic factors (Bringezu 2003). End-of-pipe or top-of-smokestack command-and-control measures have dominated the environmental policy field for a long time, so the more holistic thinking on industrial ecology will take some time to penetrate the world view of environmental policymakers.

While voluntary initiatives between the private sector and communities create regional and global benefits in terms of resource conservation, government policies and measures are needed for effective implementation of resource efficiency strategies. One study identified five drivers of eco-efficiency: (i) institutional support measures and incentives; (ii) regulatory severity and disposal costs; (iii) cost of energy and materials; (iv) public pressure and awareness; and (v) company policy and market pressures (ACTETSME 2003). Although all drivers are important, regulatory arrangements may provide the strongest back-up for resource efficiency strategies, as is illustrated by Japanese legislation. The Law for Promotion of Utilization of Recyclable Resources (1991) increased industrial material recovery rates from

38 percent in 1990 to 42 percent in 1998 (OECD 2002). While innovation-friendly regulations can improve resource productivity and competitiveness, the problem lies in persuading small industries to cooperate and to adopt resource efficiency as a continuous goal (D'Souza 2001).

Most countries in the region have environmental laws and regulations, but nearly all fail in enforcement. Due to their fragmented nature, large number, and poor mobility from one location to another, it is difficult for enforcement agencies to monitor the regulatory compliance of SMEs (ACTETSME 2003). "Environmental legislation in India, although seemingly as tough as that in major developed nations, is not well enforced. Though multinationals and the large domestic companies are monitored, poorly funded regulatory bodies find it nearly impossible to police the millions of small- and medium-scale units" (D'Souza 2001). Thus, improved regulatory arrangements for SMEs with ensured enforcement are key to further resource efficiency.

Table 1. Details of the case studies used in the study on industrial material and energy efficiency

Subtheme	Case studies	Countries	Partner institutes
Inter-boundary recycling market for promoting resource-recycling society	23	Brazil, Germany, Japan, Malaysia, Philippines, South Korea, Taiwan, Thailand, United Kingdom, Viet Nam	Management Association of the Philippines, Thailand Environment Institute
Improving environmental performance of small and medium enterprises	20	India, the Philippines, Thailand	The Energy and Resources Institute, Thailand Environment Institute

Table 2. Categories in the 540 "success" factors for environmental policies and policy instruments

Actors and Institutions	Processes	Content
Stakeholders	Preparation	Command and control
Institutions	Formulation	Market–based Instruments
Agencies	Linkages	Voluntary agreement
Funding	Implementation	Creation of new markets
	Monitoring/revision	

3. Approach and methodology

3.1. Central research question and hypotheses

From a review of the literature the following research question arises: in developing countries of Asia, what policies will most effectively promote increased resource efficiency in SMEs?

The following hypotheses address the central research question:

Hypothesis 1: To date, the private sector and local communities have led attempts at industrial resource efficiency more effectively than government policy.

Hypothesis 2: In order to formulate comprehensive policies for resource efficiency in developing countries, existing industrial markets and networks (including vertical and horizontal SME networks) do not need to be changed in any major way.

Hypothesis 3: Voluntary instruments through partnerships and networks, supported by consolidated government command and control policy, are most effective in bringing about greater resource efficiency.

3.2. Methodology

a. Collection of data

Case study analysis as a form of qualitative research has been used to verify the three hypotheses. Under two subthemes in the Research on Innovative and Strategic Policy Options (RISPO) program ("inter-boundary recycling market for enhancing resource-recycling society" and "improving environmental performance of small and medium-sized enterprises"), 43 cases of good practice were gathered, mainly from developing countries in Asia, in collaboration with several research institutes in the region (table 1). Additional cases from other countries, like Japan, are also examined from the literature.

The following research protocol was set to find innovative "good practice" cases in the two subthemes. Each case should (i) lead to actual improvement in the environmental area considered, or break new ground in non-traditional approaches; (ii) involve indicators for some visible or measurable change; (iii) demonstrate an innovative (uniqueness of either the product or process) and replicable approach; (iv) be self-sustaining; and (v) involve a range of actors through a participatory process.

Based on these conditions, the cases were collected and written up according to a standard format, which included the following items: background; objectives; description of the activity; critical instruments; impacts; lessons learned; and potential for application. The critical instruments in each case were identified by selecting from a list that included the following categories: regulatory, economic, institutional, partnerships, self-regulation, technologies, awareness/capacity building, and design, planning and management. All the case studies are maintained in an ongoing database by the Institute for Global Environmental Strategies (IGES).

b. Methodology for analysis

A textual pattern-matching analysis based on the approach of King, Annandale and Bailey (2000a, 2000b, 2003) as outlined by Yin (2002) was used to identify "success" factors in the 43 cases. Following a literature review, the pattern-matching analysis was carried out on the case studies in the RISPO Good Practices Inventory in the areas of improving the environmental performance of SMEs and promoting inter-boundary recycling markets for fostering a resource-recycling society. Each case study was coded for occurrences of each of the 540 factors expected to influence the success of the environmental policy, which were in the categories shown in table 2. The frequency of occurrence of each of the factors across the case studies was calculated. The results of this analysis were compared with the actual content of the case studies in order to draw lessons and identify patterns. A more detailed

description of the analytical methodology can be found in chapter 3 of this linked series of papers (King and Mori 2007).

Table 3. Frequency of occurrence of actor and context variables, as percentages of all case studies

Variables	Inter-boundary recycling market (n = 23) (%)	Environmental performance of SMEs (n = 20) (%)	All case studies (n = 43) (%)	All cases in the Good Practice Inventory (n = 139) (%)
2.2 Civic engagement and public participation	74	80	74	77
2.2.1 Willingness to participate	61	80	70	75
2.2.1.3 Private sector involvement	22	35	28	30
2.2.1.4 Industry Associations	0	40	19	12
2.2.1.6 Formal public-private partnerships	13	45	28	24
2.2.1.7 Networking	35	60	47	33
2.2.1.9 Multiple stakeholders	22	0	12	37

Table 4. Frequency of occurrence of institutional variables, as percentages of all case studies

Variables	Inter-boundary recycling market (n = 23) (%)	Environmental performance of SMEs (n = 20) (%)	All case studies (n = 43) (%)	All cases in the Good Practice Inventory (n = 139) (%)
3.3 Sub-national and national government	13	0	7	25
3.3.3 Provincial/county/local government	13	0	7	23
3.4 Funding	17	100	56	68
3.4.1 National government	13	45	28	27
3.4.3 Local government involvement	13	0	7	22
3.4.4 Private sector	35	45	40	35
3.7 Local/regional CSOs and NGOs	30	5	19	35
3.10 Private sector/public corporation	39	80	58	36
3.10.5 Small and medium enterprise	13	60	35	17
3.10.5.1 Capacity constraints	13	60	35	13

The presence or absence of each possible explanatory variable (outlined in the good practice summaries included in the RISPO on-line database) was noted for all 43 cases using linked Excel spreadsheets, where the frequency of occurrence was calculated. Coding records were retained to show the relevant text extract used to match the coding words, so that the results could be independently verified. Observations were drawn from the frequency analysis regarding the most common explanatory variables, across all cases, across countries, and across subthemes.

4. Findings

4.1. Key players

The "actor" variables include relevant stakeholders and institutional factors. Most cases (over 80 percent) showed one or more actors as important in the successful outcomes (table 3), indicating that the social context is an essential factor to consider when trying to improve resource efficiency and introduce related technologies. The high frequency of "civic engagement and public participation" (74 percent of cases) suggests that successful cases of resource efficiency in the region have been mainly led by non-government entities (such as local communities and industry associations). The almost equally high occurrence of "willingness to participate" (70 percent) shows that motivated companies, communities, and individuals have been successful in improving resource efficiency without a heavy hand from regulatory agencies.

While industry associations were not actively involved in all cases (19 percent), in the case of small-scale pipe-fitting units in the state of Punjab in India, local industry associations played a catalytic role in cooperation with the regulatory agency, the Punjab Pollution Control Board, leading to a 20 percent reduction of furnace-oil use. Also, the Thai Tanning Industry Association operates two treatment plants serving 130 tanneries, and reduced discharge of chromium to less than 0.6 milligram per liter from previous levels of up to 4,000 mg per liter.

The frequent occurrence of "networking" (47 percent) and "formal public-private partnerships" (28 percent) shown in table 3 reveals that resource efficiency improvement has been carried out through networks or partnerships (that is, collective action) rather than through individual actors. When focused toward a common objective, it seems that the range of different assets, expertise, and viewpoints that networks and partnerships offer vigorously promotes technological adaptation and information flows, which in turn contribute to resource efficiency (B-LIFE 1998). Often partnerships involve external donors joining with local non-governmental organizations (NGOs) and industry associations, such as the cases involving small-scale foundries and brick kilns in India.

Table 4 shows that funding by the private sector (40 percent) is more frequent than by national government (28 percent), so the low frequency of involvement by economic and environmental agencies (7 percent) and sub-national/local government (7 percent), showing a limited role of governments, is not surprising. However, there are indications that greater involvement of governments in developing appropriate policies and providing seed funding could accelerate the adoption of resource efficiency measures. In one case in the Philippines, the national Environmental Management Bureau established the Industrial Waste Exchange Program but later transferred the program to a non-profit organization established by business executives, admitting the comparative advantage of private sector leadership and participation during implementation.

One surprise was that the pattern matching did not reveal a significant role for provincial or local government (7 percent). One case from outside Asia, in Brazil, was successful largely because of the involvement of the city municipality, which created a partnership with waste pickers and provided financial support to the project. Currently municipalities and local governments in developing countries

in Asia appear not to recognize their potential roles in promoting resource efficiency activities (or their mandates might be too limited), despite the trend towards decentralization. The literature review also pointed out the lack of capacity of local governments in environmental management, and this finding underlines the need to strengthen this capacity. Taking into consideration non-Asian case studies such as the United

Table 5. Frequency of occurrence of policy process variables relating to the policy formulation phase, as percentages of all case studies

Variables	Inter-boundary recycling market (n = 23) (%)	Environmental performance of SMEs (n = 20) (%)	All case studies (n = 43) (%)	All cases in the Good Practice Inventory (n = 139) (%)
4. Policy formulation process	74	95	84	78
4.1 Preparation phase	26	95	58	50
4.1.4 Source of policy innovation	17	20	19	4
4.2 Formulation phase	57	95	74	65
4.2.6 Intersection with other sector policies	48	0	26	14
4.2.7 Screening of policy impact	0	70	33	21
4.2.9 Technology assessment/development	22	45	33	19
4.2.9.4 Cleaner technology	13	35	23	10
4.2.10 Pilot testing	26	20	23	15

Table 6. Frequency of occurrence of policy process variables relating to the policy implementation phase, as percentages of all case studies

Variables	Inter-boundary recycling market (n = 23) (%)	Environmental performance of SMEs (n = 20) (%)	All case studies (n = 43) (%)	All cases in the Good Practice Inventory (n = 139) (%)
6. Policy implementation	87	90	88	80
6.6 Ease of implementation	30	85	79	47
6.6.3 Innovative solutions in implementation	0	0	0	7
6.6.4 Technical support for implementation	70	85	77	41
6.6.4.1 Capacity strengthening	35	35	35	24
6.6.4.2 Awareness raising	61	45	53	33
6.6.4.3 Outreach services	0	25	12	7
6.6.4.4 Technical assistance	26	25	26	10

Kingdom's London Remade and the case of Belo Horizonte City in Brazil, where the role of local government has been important, local governments in Asia could learn from their counterparts in other regions.

The self-reliance of SME entrepreneurs often pushes them to be actively involved in financing their own resource efficiency practices (35 percent). One case from Malaysia focusing on small-scale plastic recycling exemplifies a common pattern of development of SMEs in the recycling business. The company, with just 14 employees, started operating in waste collection and transportation and later, using its advantageous position it saw the potential of the market, expanded into the plastic and rubber recycling business. The company now processes up to 180 tonnes of material per month and exports to China, India, and Thailand. Because SMEs are characteristically entrepreneurial and highly mobile, with the capacity for quick decision making, they are in a good position to read market trends and start new business lines that can capitalize on previously neglected resource efficiency opportunities. However, their capacity constraints (35 percent) often hinder further efficiency in resource use and technical support from other actors, including governments, is therefore essential to help them grow.

4.2. Strengthening support rather than innovation

a. Formulation phase

One would expect that all phases of the policy process, from preparation to review and revision, would be equally represented in successful cases (tables 5 and 6). In fact, policy formulation (84 percent) and policy implementation (88 percent) dominate. In the policy formulation process, the formulation phase (74 percent) had a higher frequency than the preparation phase (58 percent). This could indicate that insufficient time and effort is taken to conduct the necessary investigation before embarking on policy decisions. Under the formulation phase factors, however, screening of policy impacts (33 percent) and technology assessment/development (33 percent) rate fairly highly—both factors that suggest careful weighing of options before proceeding. In addition, intersection with other policies (26 percent), and pilot testing (23 percent) rate quite highly, suggestive of a step-by-step process in policy formulation. Nevertheless, it is clear that additional attention to screening, pilot testing, and impact assessment during policy formulation would increase the chances of success, particularly where policies are copied from other jurisdictions.

Most of the cases from India show a strong dependence on technological solutions, while "cleaner technology" (23 percent) was less prevalent in Thailand. Except for a small number of cases, technologies to facilitate cleaner production are readily available in India because it has a large number of engineering experts. One case in India, "Achieving cleaner production and improved productivity in stone crushing units" is a typical example of adapting a simple design, which is not as costly as more sophisticated technologies borrowed from industrialized countries. Thus, more attention should be paid in policy formulation to supporting locally available technologies and sharing them as widely as possible. Also, South–South cooperation should be promoted, such as in the case where vertical-shaft brick-kiln technology was transferred from rural China to India.

b. Implementation phase

The significance of pragmatism in the policy implementation phase can be illustrated by the gap between "innovative solutions in implementation" (0 percent) and "ease of implementation" (79 percent) in table 6. Generally, innovative or new ideas are not needed in carrying out resource efficiency improvements. Rather "capacity strengthening" (35 percent), "awareness raising" (53 percent), and

"technical assistance" (26 percent) have greater value. Indeed, 26 out of the 43 cases identified capacity building and awareness raising as critical instruments for success. For example, a private consulting firm provided employees of an elevator manufacturing company in Thailand in-house training on operational procedures, including an awareness-raising program on environmental management systems, and the company was soon certified ISO 14001.

Table 7. Frequency of occurrence of policy content variables, as percentages of all case studies

Variables	Inter-boundary recycling market (n = 23) (%)	Environmental performance of SMEs (n = 20) (%)	All case studies (n = 43) (%)	All cases in the Good Practice Inventory (n = 139) (%)
8. Policy content	91	80	86	78
8.1 Command-and-control	35	45	40	34
8.2 Market-based instruments	70	30	51	49
8.2.1 Aimed at producer behavior	70	30	51	32
8.2.1.3 Materials/energy efficiency	52	20	37	13
8.2.1.4 Recycling	52	0	28	10
8.3 Voluntary agreements	70	35	53	30
8.3.2 Producer associations	30	5	19	6
8.3.5 Environmental management system	35	30	33	11
8.6 Creation of new markets	52	0	28	29

With little support expected from governments, SMEs often find NGOs reliable partners for technical support (77 percent) in the implementation of resource efficiency. The Society for Environment and Human Development (a Bangladeshi NGO) worked with a small tannery with 30 unskilled workers in Bangladesh and succeeded in recycling solid wastes as well as minimizing use of water and chemicals (Asia Foundation). The NGO-Business Environmental Partnership Program funded by USAID through the Asia Foundation was also actively involved in several other cases resulting in waste minimization, as well as cost and time savings.

5. Policy content: voluntary approaches with government support

The most striking detail in table 7 is the high frequency of the policy instruments "voluntary agreements" (53 percent) and "market-based instruments" (51 percent). One interpretation is that environmental policies for SMEs in developing countries of Asia have not yet matured, thus voluntary initiatives are filling a gap between the demand for resource efficiency and the supply of government policy measures. However, the significant frequency of command-and-control policies (40 percent) suggests that regulatory arrangements underpin or back up voluntary resource efficiency initiatives by non-government sectors. In most cases, it appears that the combined effort of government regulation, non-government and private sector voluntary agreements, and market incentives yields the greatest success.

The case of cleaner technologies in the small-scale glass industry in India provides an example of how effective combined policy instruments can be. To protect the Taj Mahal (a world heritage site) from pollution, local glass industry SMEs in Firozabad were directed by the Supreme Court to choose between conversion from coal to natural gas, relocation, or closure. Combined efforts by the Supreme Court, voluntary agreements by industry, technical support from overseas, clustering of SMEs, and enforcement of regulations will result in a 55 percent energy saving for each converted coal-fired pot furnace, and once all 800 furnaces in Firozabad are converted significantly cleaner air should result.

Resource efficiency in Japan is also supported by regulatory arrangements. The country is well advanced in the development of new technologies and voluntary actions are broadly practiced, so there is a tendency to rely heavily on technological solutions for energy saving and recycling. Nevertheless, central and local governments have been introducing innovative legislation to promote voluntary initiatives (IGES 2005).

6. Conclusions

Most governments in developing countries have yet to introduce a comprehensive set of policies for promoting resource efficiency. Where governments have begun to examine relevant policy options, many have resorted to borrowing proven policies from developed countries. On the other hand, there are relatively mature economic markets for energy and resource saving in developing countries driven by innovative companies (including SMEs) in the private sector, as well as community initiatives. However, this often occurs in a policy vacuum, and where there are policies in place there tends to be a lack of effective enforcement. Such voluntary activities have been driven not by top-down political intervention but rather by bottom-up economic rationality.

The market for recyclable materials in developing countries has been based on existing networks. SMEs in developing countries create networks vertically as well as horizontally to ensure efficient flows of information and goods. The creation of clusters of SMEs in related industries has been promoted to stimulate synergy and create horizontal networks for complementary activities. With regard to vertical networks, supply chains that include SMEs have been formed as a result of globalization, usually with a multinational company as the key link in the chain. Both horizontal and vertical networks work well for resource efficiency and are complementary.

In addition, local initiatives such as community-based collection and separation of waste are also essential activities in improving resource efficiency in developing countries and provide an important source of income for the poor. However, social concerns, such as possible exploitation and the health problems of scavengers (e.g. exposure to toxic chemicals and injury) should be taken into account when forming policy. While the role of scavenging in waste collection and separation is an important part of resource efficiency, exposure to toxic materials and injury are constant hazards for scavengers. While modernizing waste collection systems may not be an immediate option in developing countries, government measures to tackle such social issues are needed.

The case study analysis demonstrates the rather passive role of consumers in relation to resource efficiency. Companies consistently state that their production output is always guided by consumer

sovereignty: if consumers want products that require lower levels of resource input then companies will find ways of satisfying their demands. Therefore, an important role that governments should play is to ensure that consumers are given adequate information about the resource intensity of the products they buy, for example through energy rating systems and product labeling.

The analysis appears to confirm the first hypothesis, that resource efficiency measures are being led by the private sector and local community initiatives. However, there is ample room for greater efforts to improve the policy environment for resource efficiency and recycling. Asian governments interested in introducing new resource efficiency and recycling legislation and regulations would do well to examine the example of Japan in this area. Governments could also become more involved through the direct provision of industrial parks that are designed and built based on industrial ecology concepts; through green procurement that gives preference to recycled materials; by facilitating the shift away from a consumption-based economy to a service-based economy; and by providing better information to consumers.

In relation to the second hypothesis (in order to formulate comprehensive policies for resource efficiency in developing countries, existing industrial markets and networks do not need to be changed in any major way), there is plenty of evidence that developing countries have relied on such arrangements to date. However, this may reflect the absence of government policy and political commitment, or poor enforcement, rather than being the best way to formulate comprehensive policy for resource efficiency in developing countries. As there is considerable room for governments to become more involved in policy formulation and implementation in this domain, as the case of Japan indicates, further research is needed before this hypothesis can be confirmed.

Finally, the analysis strongly suggests that hypothesis three (voluntary instruments through partnerships and networks, supported by consolidated government policy, are most effective in bringing about greater resource efficiency) is likely to be true. As voluntary initiatives can be abandoned at any time, there is a prima facie case that government policies would consolidate private sector achievements and make sure that resource efficiency gains are not lost. However, as there is relatively little evidence of such a strong combination at the present time, further research is recommended as governments, local communities, and the private sector begin to work together towards this aim over the next decade or so. Learning from the good practice cases collected for this study would be a good starting point.

From the above conclusions, there are three basic considerations in establishing better policy for resource efficiency in developing countries. First, existing local initiatives, networks, and markets related to resource efficiency should be utilized in developing countries. Second, supply chains, especially led by multinational companies, should be utilized to provide technical upgrading and support to SMEs. Third, governments should provide strong political leadership and an appropriate regulatory environment.

It is clear that developing Asia-Pacific cannot hope to achieve the material standard of living enjoyed by developed countries and simultaneously protect environmental quality without radical improvements in resource efficiency. Strong political commitment, educated consumer demand, and strengthened vertical and horizontal networks and partnerships will all play a role in bringing about such reforms.

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