

THE 'GREENING' OF INDUSTRY AND DEVELOPMENT IN SOUTHEAST ASIA: PERSPECTIVES ON INDUSTRIAL TRANSFORMATION AND ENVIRONMENTAL REGULATION; INTRODUCTION

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1. Introduction

Until some 20 years ago, most Southeast Asian countries were primarily agricultural economies, in which industrial production played a limited role. However, as their industrial production has increased rapidly over the last decades, Thailand and Malaysia have become known as newly industrializing countries. Vietnam is also well on its way to follow its neighboring countries and is often labeled as belonging to the second generation tiger economies. In these countries, industrial growth has been much higher than economic growth in agriculture over the past 15 years and the share of industrial production in their GNP is rapidly increasing (be it not necessarily with the same rate in all (parts of) of these countries). Industrial activities in general have however never been without environmental problems and therefore it is not surprising that the accelerated industrialization in Southeast Asia, entailing a dramatic transformation of the industrial sector, included some serious environmental problems (JEC, 2003). These environmental challenges to the industrial performance in Southeast Asia will probably grow in the future as the region is at the same time under pressure to sustain its economic progress and also to reduce the still remaining poverty.

Industrial environmental problems can be related to energy use, resource use, water and air pollution, waste generation, environmental risks, biodiversity, transport, and so forth. The severity of these environmental consequences may vary, depending on the technologies used in the industrial production processes, the organization and management of the production, the coordination of the various steps in the production–consumption chain (in terms of information flows, substance flows, management preferences, etc.), the regulatory regimes at various levels (from local to supra-national), and the reactions from citizens and consumers towards products and

production. These environmental problems occur within the context of a rapidly changing world where technological innovations, new organizational and management approaches, globalizing production–consumption chains, increasing communication and information exchange possibilities, and changing power balances. These economic, political and technological transitions provide new challenges but also new opportunities for the environmental performance in these countries. The export-oriented character of most Asian industries forces them, for example, to include the global environmental requirements for the industrial chains and their products, a pressure which may be expected to become more intense in the coming years.

This special issue of *Environment, Development and Sustainability*, presents several articles that analyze the challenges and opportunities for governing the transformation of industrial activities in Southeast Asia towards more sustainable practices. The following section presents some of the more general trends influencing the environmental performance of industries, particularly in Thailand and Vietnam, followed by a review of recent conceptual innovations on the greening of industry. This introduction concludes with a brief description of the articles in this issue.

2. Key changes in Southeast Asia

2.1. GENERAL TRENDS IN INDUSTRIAL AND ENVIRONMENTAL DEVELOPMENTS IN SOUTHEAST AND EAST ASIA

Societies in Southeast Asia are undergoing dramatic changes resulting from accelerated economic and social transformations. Despite a slowdown in the economic growth during the financial crisis of the 1990s and the recent problems resulting from SARS and avian flu, most countries in the region have regained the path of steady economic growth. Nevertheless, further economic development and poverty reduction are increasingly constrained by environmental concerns (ADB, 2001). As a consequence, the rapidly industrializing countries in this region are facing difficult challenges in coping with environmental deterioration without endangering future economic perspectives.

The dynamic processes, often brought together loosely under themes such as globalization and the coming of the network society, are having a major impact on both the causes of environmental decay and the outlooks for successful environmental governance, management and reform in Asian economies in general. At the same time, the social, political, economic, cultural, and geographic conditions and resources of each country are unique, contributing to important particular challenges and novel solutions. Variations in dynamics and conditions among Southeast Asian nations can be found at the national as well as at the local and sector levels. Different economic sectors, such as agriculture and food production, livestock, fisheries, textiles, and wood products, are impacted by the dynamics of globalization in various ways.

Simultaneously, the rapid process of industrialization in Southeast Asia over the last 20–30 years has changed the global economy in certain fundamental respects. Asia's share of global economic output was roughly 10% in 1950 and 30% in 1995 while it is expected to reach 55–60% in 2025 (Radelet and Sachs, 1997). Although the way this process took place differs from country to country, some similarities can be observed. In most countries, industrialization is characterized by private capital investment – mostly from domestic sources, although in some Asian countries foreign direct investment inflow makes up over 40% of gross domestic product (Mol and Van Buuren, 2003). The industrialization process is nevertheless generally taking place with strong involvement of the state, often described as developmental states (Castells, 1997). Differentiation of economic developments in each country depends on the dominant industrial sector, whereby light industries such as textiles, toys, and food processing, were mostly preferred over heavy industry.

Industry will remain the lead sector in most Asian economies during the next decades and will probably experience a significant expansion. Much of the economic growth may therefore be highly polluting, especially from the category of small- and medium-sized enterprises, and will be located in large cities where the combined loading from industrial and municipal wastes will overwhelm the already weak municipal infrastructures (ADB, 2001). These small- and medium-sized enterprises play a pivotal role in the overall industrialization processes in the region as international companies often sub-contract items of the manufacturing process to these enterprises, making their role essential for the global supply chains. At the same time, most of the small- and medium-sized enterprises need financial support and technological expertise to seriously tackle the resulting wide range of environmental problems, mainly caused by inefficient production processes and by the inability to adopt adequate environmental treatment measures (Frijns et al., 1997). Although sometimes rather simple organizational or technical measures, based on the principles of cleaner technology, could generate promising results in reducing pollution intensity at low or negligible costs, small- and medium-sized enterprises are yet constrained in implementing them by various attitudinal, institutional, organizational, technical and economic barriers.

The rapid industrialization in combination with the explosive urbanization thus seems closely linked to the fast spreading environmental devastation in Asia. The environmental degradation becomes visible in the pollution of surface waters caused by the spreading of various harmful substances from point sources such as industries and from other more diffuse sources such as households, agriculture, and so forth. Lack of clean water is becoming a severe environmental problem in many parts of the region and directly impacts human health and threatens to slow the economic development. Levels of suspended solids in the region's rivers almost quadrupled since the late 1970s, and the rivers typically contain four times the world average and 20 times the OECD-recommended levels of suspended solids (ADB, 2001). Air pollution from industries, energy producers, and the transport sector are among the highest in the world. Of the 15 cities in the world with the highest levels of particulate matter, 12 are located in the Asia and Pacific region

(ADB, 2001). Industrial growth and urban expansion have greatly contributed to and increased the generation and accumulation of solid and hazardous wastes in many cities, soil pollution from industry and landfills; and several other environmental dangers and threats.

This rapid transition from an agriculture-based to an industrial economy with serious environmental problems in Southeast Asia provides radical challenges for environmental scientists. Several conceptual challenges will be discussed in section three, but as the particular dynamics differ in each country, the recent developments in Thailand and Vietnam will be summarized in the following sections, thereby providing additional background to the articles in this special issue that review particular industrial sectors in these countries.

2.2. RECENT ECONOMIC AND ENVIRONMENTAL CHANGES IN THAILAND

Thailand's economic growth was initially propelled by the commercialization of agricultural produce but later on by a rapid industrialization which resulted in a heavy concentration of people and economic activities in the central Bangkok area. After the economic crisis in 1997, the Thai economy has recovered surprisingly fast and in 2004 the real GDP grew by 6.1% (World Bank, 2005b). Processing of food and other agricultural products remains important in this successful economic recovery, while more than before the financial crisis attention is paid to small- and medium-sized industries, in Bangkok and also in rural areas.

Thailand currently faces environmental problems similar to other industrializing middle income countries, such as air and water pollution, soil erosion, watershed destruction, and inadequate sewage and waste treatment systems (Letchumanan, 2004). Jawjit et al. (this issue) identifies the most important sources of greenhouse gasses from the pulp and paper industry in Thailand on the basis of an environmental systems analysis of the environmental pressure. According to the World Bank (2005a), the emissions of organic water pollutants in Thailand have grown to 356 ton/day, of which more than 40% is caused by the food and beverage industry. The generation of household solid waste and industrial hazardous waste has increased significantly and currently poses a major threat to the quality of surface and groundwater, as only a handful of environmentally-safe disposal facilities are available (World Bank, 2000b). At the same time, several technological solutions for environmental improvement are available. Chavalparit et al. (this issue) provide an example using an industrial eco-system approach to solve the environmental problems caused by crude palm oil industries in Thailand. In spite of the many suggested technological options for environmental improvement, their implementation in Thai industries has not been much evident. Explaining this gap requires particular attention to the institutional environmental policy arrangements in the country.

Policy intentions and legal measures pertaining to environmental conservation provide a very positive impression about the commitment of the national authorities in this regard, but the success of the chosen command-and-control approach remains limited. The main reason for this lack of success can be related to the enactment of

very stringent environmental standards that are beyond the ability of existing industries to comply with. The overly regulated situation was compounded by a generally weak monitoring and enforcement regime resulting from insufficient manpower and training (Parasnis, 1999). Thailand is a signatory country of many international conventions, but its commitments and obligations to them vary significantly depending on the objectives and implementation mechanisms of the conventions and the institutional capacity within the country.

However, more voluntary and market based approaches to environmental governance have recently been introduced, particularly the public participation in policy making. This transition offers new opportunities for greening of industries, while the export orientation of the Thai industrial activities raises their sensitivity to foreign demands on quality, safety and environmental performance (Oosterveer, 2004).

2.3. ECONOMIC AND ENVIRONMENTAL TRANSITIONS IN VIETNAM

Vietnam has been through a long period of tumultuous change comprising 30 years of war, 20 years of division between North and South, postwar economic failure, and a radical economic transition. The 'doi moi' (renovation) policy, initiated in 1986, resulted in wide-ranging economic reforms, transforming Vietnam from a 'state-commanded economy' into a 'socialist-based market economy' (Dinh, 2000). The country started from a low base but developed rapidly and despite a temporary slowdown in the late 1990s, the Vietnamese economy showed high growth figures in recent years. For example, Vietnam's economy grew by 7.2% in 2003 despite challenges from SARS and the general slowdown in the global economy (World Bank, 2004). Furthermore, since the early 1990s, the export growth figures have been in double digits, underlining the export orientation of the Vietnamese economy.

This rapid industrialization process in Vietnam has come with a price. The industrialization and modernization policy implemented under the doi moi policy caused new and larger environmental problems in the country. Outdated factories are polluting the environment, garbage services are overburdened, sewage treatment is non-existent and intensive agriculture is contaminating the surface waters. Obsolete equipment and production processes make factories more polluting and industrial health problems inside factories are especially serious. Pham Hong Nhat (this issue) observes, for example, that the small- and medium-sized slaughterhouses in Ho Chi Minh City lack effluent treatment facilities while their use of groundwater is largely free and generally unrestricted. The wastes generated by factories making textiles, dyed goods, paper, chemical fertilizers, insecticides, and other products are released untreated or improperly treated, even if they contain toxic substances (JEC, 2003). In general, factory waste is being disposed together with municipal solid waste instead of separately. There is high demand for industrial solid waste and hazardous waste treatment from the 76 industrial parks and export processing zones in the country (Letchumanan, 2004). Tran Thi My Dieu (this issue) discusses the concrete possibilities for improving the environmental performance of industrial zones in Vietnam by utilizing the concepts of cleaner production, waste exchange,

and industrial ecology to get closer to a zero-waste industrial eco-system. Without substantial improvements, the environmental problems in Vietnam will intensify, as indicated by the current severity of the river pollution which corresponds to the degree of industrialization and the growth in mass consumption. The pressure on the available infrastructure will most likely further intensify as the urban population is expected to increase from 25% of the total population, or 20 million today, to 45% of the total population by the year 2020. Although the concern for environmental protection in Vietnam has always taken a back seat to the more pressing challenges of economic development, the opening up of the country is currently forcing the national authorities to cope with foreign criticism and monitoring of its environmental protection policy (JEC, 2003).

3. Conceptual challenges facing the greening of industries in Southeast Asia

The serious environmental problems resulting from the industrial development in Southeast Asia signify complex challenges for attempts to contribute to the greening of industries in this region. These challenges include the identification of appropriate technological options in combination with economic, social and political aspects. The Asian Development Bank (2001) concluded that the root cause of the poor state of the environment Asia was principally a failure of policy and of institutions. A new approach is, therefore, required with regard to the design and implementation of environmental policy within the region.

Traditionally, central national government organizations have been the cornerstone of governance in Southeast Asia. Until recently, it has been the practice to depend upon a stand-alone environmental agency as the institution responsible for environmental protection. Since 1980, such agencies have been established in most countries but they generally remain small, dispose of limited institutional capabilities and lack the necessary political clout (World Bank, 2000a). At the same time, devolution of responsibilities regarding the environment from central to regional and local level government institutions was undermined due to inadequate coordination in the preparatory process and inefficient transforming mechanisms. It was only recently that the importance of more inclusive arrangements involving private firms and civil society organizations is realized and these countries begin to adopt market-based mechanisms. For example, the regional government institutions such as the Association of Southeast Asian Nations (ASEAN) acknowledge the need for achieving sustainable development in an increasingly globalizing world and today support the use of environmental management systems and certification schemes such as ISO 14001 has become common practice. In general, government authorities and social organizations increasingly realize that effective environmental governance depends on transparency, accountability, and the availability of high-quality information concerning economic processes and related environmental effects. Therefore, environmental concerns must be integrated across sectors and mainstreamed into economic policy and practice. Environmental protection must be considered an

essential factor in the basic decision making process of firms, households and policy makers (ADB, 2001; Mol, 1995, 2001).

Until very recently, the rate of improvement in energy and materials efficiency, and pollution prevention through the adoption of green environmental technologies has been slow relative to the rate of economic growth in many Southeast Asian countries. In the past, industries were only keen on adopting specific environmental technologies or products on a piecemeal basis to meet specific regulatory requirements. However, this does not reap the potential benefits of managing environmental problems in an integrated manner over the longer term. The theory of ecological modernization (Huber, 1982; Mol, 1995; Spaargaren, 1997) stresses the necessity of including environmental considerations in overall decision-making and management practices within firms. Combining environmental and economic considerations in management decision-making in a consistent manner can contribute to substantial improvements in the environmental as well as the economic performance of industrial enterprises. Environmental investments should be looked at as part of a comprehensive program of longer term environmental management that also contributes to the financial viability of the business (Letchumanan, 2004). It is therefore vital that strategies for greening industries in Asia go beyond the selection of optimal technological option for a particular industry or sector and support effective environmental pollution abatement through in-depth understanding of their social and institutional contexts (Frijns et al., 1997). The tool of triad network analysis (Mol, 1995), mapping the relevant economic, political and environmental actors, may provide useful information for environmental policy-making by visualizing the power relationships surrounding private firms. Successful environmental change in industries depends on technological, managerial, economic, political and societal considerations. For example, based on a large number of case studies on industrial transformation in Europe, Binder et al. (2001) conclude that the most important conditions for the greening of industries seem to be:

- the end of an investment cycle in the affected sector,
- satisfactory technological alternatives,
- an innovator in the branch to promote the diffusion of alternative technologies,
- clear environmental targets,
- a high degree of political integration between different government actors, and
- the availability of funding for compensation to lessen the social and regional disruption caused by change.

This example clearly underlines the importance of non-technological considerations in the successful transition towards greening industries. The authors furthermore underline that although industries play a key role in changing their environmental performance, a green industrial policy remains indispensable.

Applying the concepts developed within the ecological modernization approach and combining insights in technological options with good comprehension of the relevant social and political dynamics, applying the triad-network approach, provide

interesting directions for the greening of industries in Southeast Asia. Scientific research should therefore perform in-depth case studies on industrial transformations in specific sectors, on the successes, failures and challenges of environmental policy by national states, paying attention to changing state-society relations, and on the contributions from different Asian governments to international environmental regimes and vice versa. The articles in this issue provide further insights into these challenges.

4. Introduction to the articles

This special issue of *Environment, Development and Society* brings together recent innovative academic research on the potentialities for the greening of industries in response to the contemporary environmental problems in Southeast Asia. These articles are based on a selection of papers presented during the INREF-AGITS¹ conference 'Environmental Governance in Asia: New State-Society Relations, Globalization, Industrial Transformation and Environmental Regulation' organized at Chiang Mai University, in Chiang Mai, Thailand, on 10–12 October 2003.

The first article by Tran Thi My Dieu reviews the constraints and opportunities for the greening of food processing industries in Vietnam. The large industrial sector of food processing plays a vital role in the country's economic development. However, this development seems to go hand-in-hand with environmental deterioration. Up till now, most environmental research and policy measures have been focused on processing wastes and emissions but this end-of-pipe approach only treats the environmental symptoms instead of the pollution problems themselves. Although the appropriate technological (end-of-pipe) solutions to overcome pollution problems are important, it is essential and also more environmentally and economically friendly to prevent wastes from being generated. Based on three case studies at household-scale, large-scale and at the level of an industrial zone, this article provides a methodology to analyze possible steps towards a more sustainable development of (agro-) food processing industry in Vietnam. The article briefly assesses the possibilities to move existing food processing industrial systems towards zero-waste industrial ecosystems. Particularly, an industrial environmental policy that includes contributions from cleaner production, waste exchange and industrial ecology, can indicate concrete directions for successful environmental improvements. The introduced physical-technological model for the greening of food processing industries in Vietnam, linking industrial and agricultural activities, can also provide foundations for governmental authorities, planners, policymakers and environmentalists in reforming existing industrial systems and establishing new industrial systems.

The second article by Pham Hong Nhat studies environmental practices in Vietnamese industries. His object of study is the sector of small- and medium-sized slaughterhouses in Ho Chi Minh City. Though for a long time slaughtering has been

viewed as a low technology operation and not to be taken seriously by environmental scientists, the recent increase of public awareness on the environmental problems caused by these activities attracts growing attention. This article analyzes the shortcomings of the present poor environmental performance and management of this agro-industrial sub-sector and their causes. The main environmental problems caused by the small- and medium-sized slaughterhouses are the uncontrolled use of groundwater and the discharge of untreated wastewater with high contents of organics as well as with substances that might easily endanger human health. Applying simple pollution prevention measures seems, at the moment, the most promising approach for solving these environmental problems. In the specific case of small- and medium-sized slaughterhouses in Ho Chi Minh City, this study argues that taking pollution prevention measures at their existing location may be more advantageous than relocation to industrial parks, mainly because of the high costs involved.

Greening the crude palm oil industry in Thailand is the topic of the article by Chavalparit et al. This sector provides obvious benefits of the industrial development of the country but it also contributes to considerable environmental degradation at both the input and output sides of the production process. At the input side, crude palm oil mills require large quantities of water and energy. At the output side, the manufacturing process generates much wastewater, solid waste/by-products, and air pollution. After presenting concrete data about these environmental impacts, the authors review the possibility of using an industrial eco-system approach to deal with them. Such an industrial ecosystem approach for the crude palm oil industry, based on reuse, recycling, and utilization of solid and liquid waste, and appropriate energy management, can achieve the goal of nearly zero-waste discharge (against acceptable costs).

Jawjit et al. in their article on the pulp and paper industries in Thailand apply an environmental system approach. The industries meet the demand for paper within the country as well as export to foreign countries but cause various types of environmental problems such as water and air pollution, and solid waste generation. In addition, as 80% of the pulp is produced from eucalyptus, the eucalyptus plantations themselves pose an environmental threat. The environmental costs and benefits from the pulp production and eucalyptus forestry need to be carefully considered in decision-making processes intended to achieve the optimal way of addressing the mutually related dynamics in environment, economy and society. This article considers the environmental impact of two sub-systems (1) eucalyptus forestry and (2) pulp production processes. Particular attention is paid to specifying the system boundaries, as well as the inputs and outputs and their relationships. The study concludes that the emissions from the eucalyptus forestry sub-system are small compared to those from pulp production. This subsystem includes four important sources of environmental pressure: the energy generation unit, chemical recovery unit, pulp production unit and the wastewater treatment unit. The most important emissions resulting from these

units are CO₂, CO, NOX, SO₂, TRS, AOX, and P causing damages to global climate, human health and the surrounding environment.

5. Conclusion

This special issue intends to present the results of innovative empirical environmental scientific research in Southeast Asia and thereby to contribute to the greening of industries in this region.

The different articles make clear that the adoption of systematic environmental management in industries is still in its infancy, particularly among small- and medium-sized enterprises. The intensity and severity of the resulting environmental problems obviously depend on the particular industrial sector concerned, specific characteristics of the region, and on the actual governmental policies. At the same time, the studies showed that adequate technological solutions are often available and that in particular, industrial ecology-based approaches offer promising possibilities by preventing waste and recycling by-products. Nevertheless, these technological options for reducing the environmental burden of these industrial activities are not always put into practice. Very often the existing institutional and economical circumstances prevent their implementation and therefore these elements should be integrated more adequately in environmental policies in Southeast Asia, by governments as well as by the industries themselves.

Note

¹ The conference was organized by the project 'Agro-Industrial Transformation towards Sustainability; Southeast and East Asia in Global Perspective (AGITS)' with the help of the INREF from Wageningen University, the Netherlands.

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