IKMAS WORKING PAPERS
Number 7, April 1997

EXPLAINING ASIA-PACIFIC PULP FIRMS' ADOPTION OF ENVIRONMENTAL TECHNOLOGIES

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Dr. David Sonnenfeld is assistant professor of sociology at Washington State University. This paper was presented at IKMAS, Bangi in January 1997. The author wishes to thank Profs. Andrew Szasz, Paul Lubeck, and James O'Connor, University of California, Santa Cruz; and Dr. John Dargavel, Australian National University, for encouragement at various points along the way with ideas developed in this paper. The study has been supported by the Australian-American Educational Foundation (Fulbright Commission); the University of California Institute on Global Conflict and Cooperation; the Switzer Foundation; the Centre for Resource and Environmental Studies, Australian National University; and the Division of Graduate Studies and Sociology Graduate Program, University of California, Santa Cruz.

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C O N T E N T S

T A B L E S

F I G U R E S

EXPLAINING ASIA-PACIFIC PULP FIRMS' ADOPTION OF ENVIRONMENTAL TECHNOLOGIES

1. Introduction

In the last ten years, almost every bleached virgin pulp mill in Australia, Indonesia, Malaysia, and Thailand has adopted new, environmental technologies, belying their own notoriety, and the region's reputation for 'dirty' production. How did this happen? I argue it is partially the result of Asia Pacific social movements' campaigns against pulp industry development and European social movements' success in encouraging development of 'greener' technology.

In this paper, I present findings from four years' research on social movements' influence on adoption of environmental technologies in the pulp and paper industries of Australia, Indonesia, Malaysia, and Thailand.[1] Focusing on changes in pulping and bleaching technology in mills producing bleached virgin pulp, I review what happened in each country and analyze how it happened, at country and mill levels, respectively.

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[1] For detailed presentations of the Australian, Indonesian, and Thai cases, please see Sonnenfeld (1996).

2. What happened?

Many changes in process and end-of-pipe technology occurred in Asia-Pacific pulp manufacturing operations in the last decade. Perhaps most dramatic is the construction of six new bleached kraft pulp mills using "elementally chlorine free" (ECF) pulping and bleaching technology. These mills operate more efficiently and with less downstream pollution than many North American mills. During the same period, no bleached kraft pulp mills were built in the countries of my study without these technologies. In addition, Kimberly-Clark Australia, Australia's leading tissue producer, commenced operating a "totally chlorine free" (TCF) sulfite pulp mill, substituting a "deep steep" oxygen bleaching process for its former chlorine-based process.

Asia-Pacific pulp companies have improved environmental performance at older mills, as well. They have done so by changing raw materials, upgrading pre-processing, modifying process technology, and improving waste treatment. Highlights include:

- Australia's only newsprint manufacturer completely eliminated chlorine use by shifting from native-forest grown hardwood to plantation-grown softwood. Researchers at Australia's largest pulp and paper company developed a clever process modification allowing it to substantially reduce chlorine use. A third company converted a smaller semichemical mill from chlorine to peroxide bleaching.

- Older Indonesian pulp mills have added new pre-treatment processes, reduced elemental chlorine use, and improved wastewater treatment.

- Malaysia's solitary bleached pulp mill incorporates what was world-class technology when it was built in the late 1980s, including an oxygen-activated sludge treatment system. Since beginning operations, the mill has substantially decreased elemental chlorine usage.

- Owners of Thailand's largest bleached kraft pulp mill added oxygen delignification and upgraded wastewater treatment facilities. The country's largest pulp and paper group installed advanced wastewater treatment systems, and is experimenting using enzymes and bacterial pre-treatment to reduce use of elemental chlorine.

3. Country-level dynamics

These changes were the result of a combination of social, economic, political and environmental factors operating simultaneously at local, national, regional and international levels. Community and environmental groups organized for years to bring attention to many of these companies' social and environmental practices. Government agencies intervened to encourage or force company adoption of cleaner production technologies. Pulp company engineers and researchers in the public sector developed creative process modifications. Local environmental conditions also came into play. These dynamics played out differently in each of the countries I studied:

3.1 Australia

The pulp and paper industry's impact on the environment became a major public issue in Australia in the late 1980s and early 1990s, in the course of a lengthy protest by farmers, fishermen, and urban environmentalists against the proposed "Wesley Vale" bleached kraft pulp mill on the northcoast of Tasmania. The "Concerned Residents Against Pulpmill Siting" (CROPS) waged a successful, multi-level campaign, working locally, in the Tasmanian state parliament, and in the national parliament.

While having limited success in getting RGM to improve operations at Indorayon, activists' pressure helped 'green' technology elsewhere in the RGM group, and in Indonesia generally. When RGM went to build a new pulp mill on Sumatra, it hired a Jaakko Pöyry, Finnish consulting engineering firm, as designer and project coordinator, and incorporated latest pulping, bleaching, and wastewater technologies. A boiler explosion at Indorayon in November, 1993, led to demonstrations in Medan and elsewhere, and to a government statement that henceforth all pulp mills in Indonesia would have to be "ECF or better."

The Sinar Mas group of companies, Indonesia's leading pulp and paper producer, took advantage of cyclical downturn in international economy & global pulp industry to purchase advanced technology at a substantial discount. Its subsidiary, PT Indah Kiat Pulp and Paper Co. (IKPP), itself the target of community protest over land, forest, and water resource conflict, developed in-house engineering expertise, made use of consulting engineering services, and international environmental aid. IKPP adopted environmental technologies, in part, also, to help guarantee future access to 'green' export markets.

Historically, environmental activists in Indonesia had a cooperative working relationship with the Minister of Population and Environment, who was also the head of the Bureau of Environmental Impact Management (BAPEDAL). Their relations with BAPEDAL continue, but have cooled off, according to inside accounts. Activists also maintain a positive relationship with the staff of the Institute for Research and Development of the Cellulose Industry (IRDCI), who work primarily with state-owned and smaller, older mills.

International consulting engineering and technology supply firms played an important role in the adoption of environmental technology in Indonesia's pulp and paper industry. Jaakko Pöyry has advised almost every new pulp mill project in Indonesia. Technology suppliers were assisted by strong home-country government support, and close working relationship with consultants. Some

suppliers went so far as to become joint venture partners with Indonesian manufacturers.

A half-dozen or more aid programs have contributed to the adoption of environmental technologies in Indonesia's pulp and paper industry. Canadian and Australian aid agencies have supported development of national environmental regulations and administration. Austraid and other agencies contributed to PROKASIH, the Clean Rivers project, under which the province of East Java developed perhaps the toughest local water environmental standards in Indonesia. The United States Agency for International Development (US AID) supported a "Clean Technology" assistance program targeted specifically at Indonesia's pulp and paper industry. Swedish and Japanese aid agencies supported environmental research at IRDCI.

3.3 Malaysia[4]

Sabah Forest Industries (SFI), located in northwest Borneo, is Malaysia's sole 'greenfield' pulp mill. It is probably one of the most thoroughly studied mills in Southeast Asia, with extensive baseline and follow-up environmental impact assessments (Murtedza and Landner 1993). Principle concerns regarding the mill's (downstream) environmental impact related to its effect on fisheries in the Brunei Bay, into which it discharged its effluent. Even more consequential to the health of the Bay than the mill's discharge, however, was heavy siltation caused by upriver soil erosion due to logging (ibid.).

For a number of years, until 1994, Sabah was one of only two states in Malaysia whose government was not led by the United Malays' National Organization (UMNO), Malaysia's main ruling party. At the roots of this

[4] The information in this section is based on a field visit to the SFI pulp mill in December 1993, discussions at the Malaysian Industrial Development Authority (MIDA) in 1993 and 1994, an interview with an official of an Australian pulp and paper company, conducted in May 1994, and archival material.

opposition-led state government are substantial cultural, religious, and ethnic differences between Sabah residents and West Malaysia, and resultant sentiments towards regional autonomy (Vatikiotis 1992; *Australian* 1994). As a state-owned enterprise, SFI was caught in tension between national and state authorities. Kuala Lumpur officials favored West Malaysian printers and publishers over the new mill, refusing to grant it trade preferences. SFI was kept under strict environmental oversight -- it was required to conduct annual environmental audits, with improvements following.

SFI used in-house research facilities to improve plant environmental performance, supplemented by expertise from suppliers, university researchers, and UNEP's Bangkok-based Network of Industrial Environmental Management (NIEM). The Swedish government provided training for pulp engineers & operators (some of whom 'jumped ship' after a few years, to work for IKPP). When I visited SFI in December 1993, all 'non-essential' mill upgrades, including some that staff said would further improve environmental performance, had been halted due to the firm's financial crisis and pending privatization.[5]

3.4 Thailand

Like its counterparts in the region, the Thai pulp and paper industry also has been at the center of long-running public controversy. In Thailand, small farmers, supported by a strong network of local, regional, and national NGOs, and by academics and urban professionals, including in the media, have protested establishment of pulpwood plantations, industrial pollution, and loss of rural livelihood. Two foreign/minority-owned firms in northeast Thailand have received the greatest attention.

[5] In 1994, the Sabah state government sold controlling interest in SFI to the Lion, itself recently purchased by Mirzan Mahathir, son of Malaysian Prime Minister Mahathir Mohamad (Jayasankaran 1996).

An industrial accident involving one of those firms had an important catalytic effect in public and governmental scrutiny of the industry. A massive fish kill in a northeastern Thai river was blamed on a mill operated by the Phoenix Pulp and Paper Company, joint venture of a USA-born expatriate and Ballarpur Industries, from India. With an important election drawing near, the government responded to public demands for action, taking the unprecedented action of shutting down the Phoenix mill until it could upgrade its wastewater treatment system.

Phoenix management airlifted a wastewater treatment system already on order from Finland, got it operational in record time, and resumed operations. They proceeded with plans to add a second pulp line, supported by an interest-free Finnish loan, incorporating the latest pulping and bleaching technology from Nordic technology firms. The construction project included upgraded pre-processing for the original mill.

With the region beset with an extended drought, the government further required Phoenix to phase out all discharges into the nearby river. In response, the company developed a program to use treated wastewater to irrigate pulpwood plantations in the vicinity of the mill. The company is now hoping to "turn necessity into a virtue," by marketing its products to 'green''markets internationally.

The Thai government's shutdown of the Phoenix mill rippled through the Thai pulp and paper industry. The Federation of Thai Industries' Pulp and Paper Club became actively involved in the US AID-sponsored Industrial Environmental Management (IEM) program within weeks of the shut-down. Club members actively exchanged information about environmental technology, conducted environmental audits of each others' manufacturing facilities, and visited environmental technology suppliers in the USA.

The Soon Hua Seng group, a Thai-Chinese business which had previously run into trouble establishing eucalyptus plantations, created Advance Agro, a new subsidiary, to develop a pulp mill in northeast Thailand. It hired Presko, a Thai-Finnish public relations firm, to actively monitor popular concern about the pulp industry in Thailand; and Jaakko Pöyry as designer and general contractor for new mill. The new mill, which recently began operations, was designed as an ECF mill, and with advanced wastewater treatment facilities, from the start, to help Soon Hua Seng forestall getting into the kind of political trouble it had before.

The Siam Pulp and Paper Company group, a subsidiary of partially crown-owned Siam Cement, appears to have been less frequently the target of public and/or political pressure to environmentally improve its operations. Nevertheless, the Siam Pulp and Paper group has taken strong environmental leadership in both its own operations and in the Thai Pulp and Paper Industry Association. It upgraded wastewater treatment facilities at its largest production site, and has experimented with using enzyme and bacterial pre-processing to reduce chemical use.

Foreign technology supply and consulting engineering firms have played an active role in promoting adoption of environmental technology in Thailand's pulp and paper industry. Both new ECF mills in the northeast were designed by Jaakko Pöyry, and incorporated advanced, Nordic-sourced technology. H.A. Simons, a Canadian consulting engineering firm, was the major contractor for upgrading wastewater treatment facilities at the Siam Pulp and Paper group's mills.

International aid agencies, also, have been heavily involved in supporting adoption of environmental technology in Thailand's pulp and paper industry. Finnaid provided aid and trade credits for purchase of pulp manufacturing equipment, and was considering a proposal to fund a pulp and paper technology program at the Asian Institute of Technology (AIT). US AID supported training in environmental management and waste minimization. Austraid contributed to the

development of the Thai government's environmental management capacity. Japanese and Canadian agencies underwrote industry and environment studies at the Asian Institute of Technology (AIT), and Thailand Development Research Institute (TDRI), respectively.

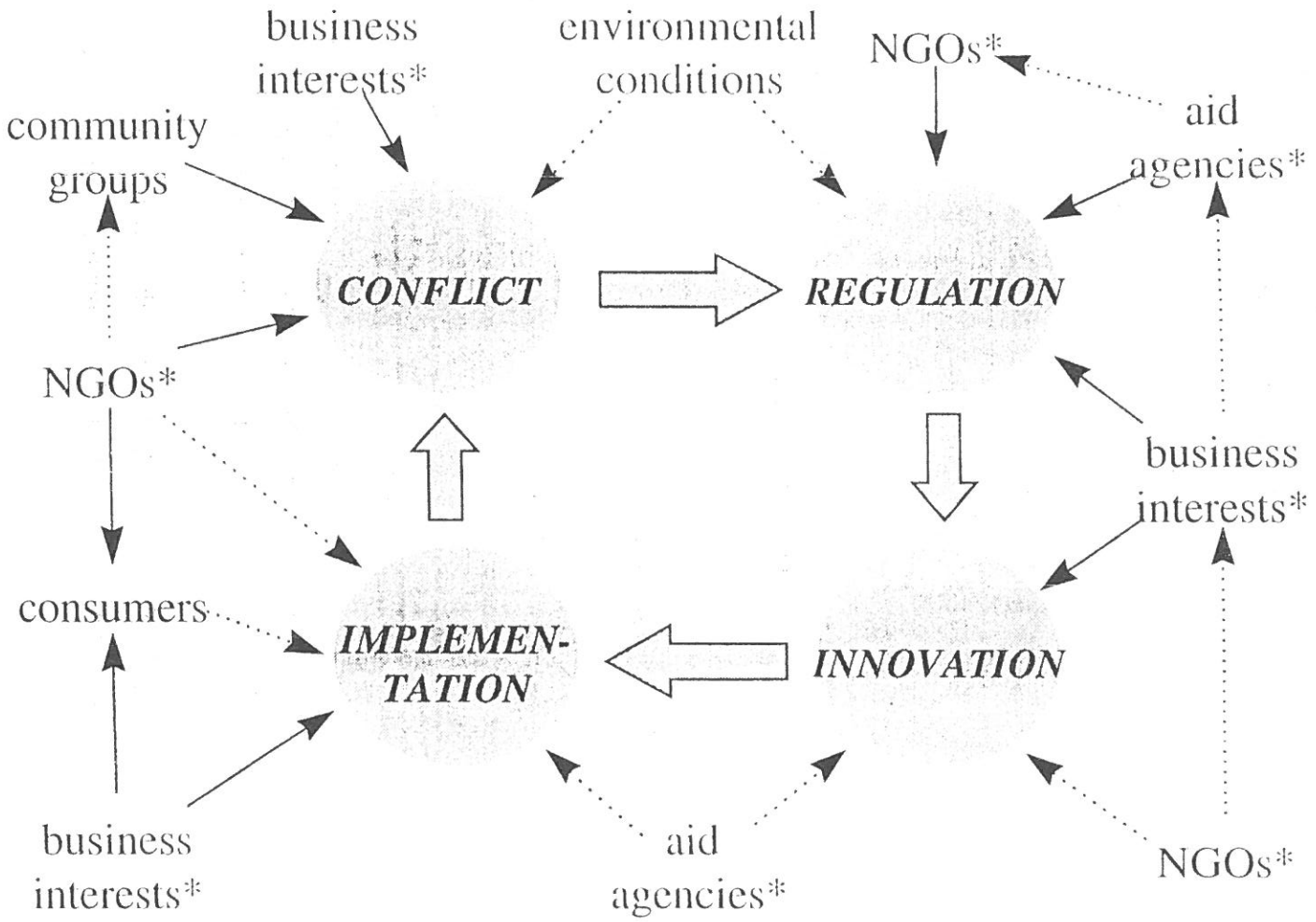
3.5 *International institutions*

Regional and global institutions have contributed to technology development in Asia-Pacific pulp and paper industries since their beginning. Some of Southeast Asia's original bleached chemical pulp mills were built in conjunction with industry partners in nearby countries. The partially state-owned Taiwanese pulp companies, Yuen Foong Yu and Chung Hwa, were joint venture partners with both Indonesian and Thai start-ups. The Taiwanese firms provided capital, expertise, *and* the original pulp line to their Indonesian partner.

Indorayon, in North Sumatra, was started up with used equipment from the Finnish Repola firm. Ballarpur Industries, from India, provided capital and expertise with non-wood raw materials in starting up Phoenix Pulp and Paper's Pulp Mill #1 in Thailand, designed as one of the world's first commercial kenaf pulp mills. As mentioned above, SFI's original 'class' of engineers received extensive training in Sweden, compliments of Swedish International Development Assistance (SIDA).

Although the Association of Southeast Asian Nations (ASEAN) has a "Pulp and Paper Club" which meets periodically, and Appita and other international pulp and paper technical associations have served certain regional purposes, the Asia-Pacific region has lacked effective regional consortia to deal with environmental aspects of especially smaller-scale, and non-wood based pulp mills. And, although both India and China have substantial, and growing non-wood based pulp

Figure 1. Establishing a new environment-technology regime



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4. Mill-level dynamics

Our understanding of social movements' influence on adoption of environmental technologies can be further deepened by comparatively analyzing three groups of mills: the oldest, mostly in Australia, built from 1937-1970, an intermediate group, the first wave of large mills in Southeast Asia, built in the 1980s and early '90s; and the newest 'crop,' built from 1992 to 1996, also mostly in Southeast Asia (Table 1).

4.1 Oldest mills

The oldest Asia-Pacific bleached pulp mills -- built between 1937 and 1970 -- were not the first to adopt environmental technologies. Once the environmental "ball got rolling," some became industry leaders, however. They were assisted in this quest by experienced, in-house research and development personnel. Two of the mills also benefited from not being kraft chemical pulp mills. All four Australian mills in this group faced pressure from environmentalists, intensified in the wake of the 'landmark' Wesley Vale case.

It was relatively easy for two of the non-kraft mills, ANM-Boyer and APPM-Wesley Vale to dispense with chlorine use altogether. ANM-Boyer accomplished this largely by shifting its raw material to plantation softwood from native (eucalyptus) hardwood. APPM-Wesley Vale adopted a new peroxide bleaching system for its relatively small runs of plantation softwood. APM-Maryvale,[7] the oldest mill studied, had one of the more ingenious environmental upgrades, with its peroxide injection pre-bleaching processing, significantly reducing use of elemental chlorine.

[7] Now Australian Paper (AP) Maryvale; still owned by Amcor.

Table 1. Australia, Indonesia, Malaysia, and Thailand: correlates of environmental improvements at bleached pulp mills

opns date	*manufacturer*	*country*	*env. imp.*	*begin date*	*pre-proc.*	*upg. wwt*	*reduce Cl2*	*ECF +*	*kraft*	*high capac.*	*strong regs.*	*strong mvts.*	*Nordic conn.*	*minority-owned*	*export-orient.*
1937	APM-Maryvale Pulp Mill #1	Australia	Y	1989	Y	Y	Y	N	Y	Y	Y	Y	N	N	N
1939	APPM-Burnie	Australia	Y	1979	Y	Y	N	N	N	N	N	Y	N	N	N
1941	ANM-Boyer	Australia	Y	1991	N	Y	Y	Y	N	Y	N	Y	N	N	N
1968	Siam Pulp & Paper	Thailand	Y	?	Y	?	?	N	N	N	N	N	N	N	N
1970	APPM-Wesley Vale	Australia	Y	1991	N	Y	Y	Y	N	N	N	Y	N	N	N
1981	Phoenix I	Thailand	Y	1989	Y	Y	Y	N	Y	N	Y	Y	Y	Y	Y
1984	Indah Kiat - Pulp Mill #1	Indonesia	Y	1987	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y
1988	Sabah Forest Industries	Malaysia	Y	1989	N	N	Y	N	Y	N	N	N	Y	Y	Y
1988	Inti Indorayon Utama	Indonesia	Y	1993	?	Y	-	Y	N	Y	N	Y	Y	Y	Y
1991	Indah Kiat - Pulp Mill #2	Indonesia	Y	1992	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y
1993	Siam Cellulose	Thailand	Y	1993	Y	Y	?	N	Y	N	N	N	Y	N	N
1992	KCA/Appeal	Australia	-	-	-	-	-	Y	N	N	Y	Y	N	N	N
1994	Phoenix II	Thailand	-	-	-	-	-	Y	Y	N	Y	Y	Y	Y	Y
1994	Indah Kiat - Pulp Mill #8	Indonesia	-	-	-	-	-	Y	Y	Y	N	Y	Y	Y	Y
1994	Wira Karya Sakti	Indonesia	-	-	-	-	-	Y	Y	Y	N	Y	Y	Y	Y
1995	Riau Andalan Pulp & Paper	Indonesia	-	-	-	-	-	Y	Y	Y	N	Y	Y	Y	Y
1996	Advance Agro	Thailand	-	-	-	-	-	Y	Y	Y	?	Y	Y	Y	Y
1997	Kiani Kertas	Indonesia	-	-	-	-	-	Y	Y	Y	N	Y	Y	?	Y

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KEY:

opns date = date pulp operations started
env. imp. = implemented environmental improvements
beg. date = date environmental improvements began
pre-proc. = added environmental pre-processing improvements
upg. wwt = upgraded wastewater treatment
reduce Cl2 = reduced use of elemental chlorine
ECF + = pulp produced without use of elemental (or any) chlorine
kraft = uses kraft chemical pulping process
high capac. = greater than 100,000 admt/year of bleached pulp
strong regs. = strong governmental environmental regulations/enforcement
strong mvts. = strong community, environmental, or other social movements related to mill construction or operation
Nordic conn. = relationship with Jaakko Poyry, Nordic technology supply firms, and/or Nordic aid agencies
Nordic aid = recipient of Finnish or Swedish foreign aid, trade credits, interest-free loans, etc.
minority owned = mill owned by ethnic/national minorities, or expatriates
export-oriented = mill designed for production/sales to global markets

Southeast Asian pulp companies have been guided and assisted by Nordic technology firms and aid agencies in environmentally upgrading their manufacturing operations -- with Nordic-supplied and maintained equipment, of course.

4.3 Newest mills

The seven newest bleached pulp mills to be built in the countries of my study from 1992-1996 all use elementally or totally chlorine free (ECF or TCF) technologies. They include a bleached sulfite tissue mill in Australia, and six bleached kraft pulp mills in Indonesia and Thailand.

The Apcel mill in Australia, owned by Kimberly-Clark Australia (KCA), uses a unique "deep steep" oxygen bleaching process developed in Australia by Amcor research and development engineers. The mill is an expansion for Apcel, which continues to operate its original pulp mill, nearby.

Engineers I talked to at Amcor's Research and Technology center were proud of their accomplishments in the development of the "deep steep" process used at Apcel. But they also cautioned that, while this was a relatively easy accomplishment for a sulfite tissue mill, it was nontransferable to other pulping processes and product segments, particularly to bleached kraft production, such as at Amcor's Maryvale mill.

What explains Apcel's adoption of environmental technologies? Environmental activism can be identified as the principle cause, both directly (in the Lake Bonney and Wesley Vale campaigns) and indirectly (through toughened project approval standards, and internalized environmental values among company managers and engineers).

Using non-chlorine bleaching methods and adding improved wastewater treatment facilities at the Apcel mill helped get the project approved at a time of close public and governmental scrutiny of KCA and the pulp industry in general. Once the new Apcel pulp mill was built and supplying the Australian market with non-chlorine bleached tissue products, KCA lost no time making full play of its environmental friendliness in advertising aimed at Australia's highly educated, urbanized, and environmentally-oriented consuming public.

International political economic factors played a greater role in the adoption of environmental technologies in the six Southeast Asian bleached kraft mills than they did in the KCA/Apcel case. Business and social movement factors also contributed to these technologies' adoption in Southeast Asia.

The technologies was developed in Sweden and Finland, in response to European social movements' efforts to tighten environmental regulations and increase demand for 'green' products. Not only are they 'cleaner' technologies, but they also use raw materials and chemicals more efficiently.

When these technologies were coming on the market (in the late 1980s and early 1990s), Finland and Sweden were undergoing their worst economic (and political) crises in over 60 years, and Europe and North America were in the midst of a major economic slump.[8] The Asia-Pacific region was one of the few areas of the world expanding rapidly at the time. Technology supply firms and Nordic governments gave Asia-Pacific pulp producers excellent financial incentives for adopting the new technologies, in the form of price discounts, trade credits, interest-free loans, even joint venture capital.

Southeast Asian pulp firms adopted the new technologies also to boost their image, secure regulatory support for continued and expanded operations, guaranteed access to 'green' export markets, and help obtain financing on

[8] See Sonnenfeld (1996).

international capital markets. Southeast Asian social movements helped ensure adoption of advanced post-process, as well as process, technologies by keeping pressure on local manufacturers and regulatory agencies.

Expressed graphically, the global flow of innovation involved with the adoption of environmental technologies especially in the newest Asia Pacific pulp mills might look something like Figure 2.

5. Conclusion

While not being the only 'cause' of the adoption of environmental technologies in Asia Pacific pulp industries, social movements have played an indispensable role. In Australia, Indonesia, and Thailand, conflict around poorly-sited, ethnically/foreign owned, export-oriented, 'intermediately aged' mills resulted in tightened regulation of existing mills and even more restrictive requirements for new mills. Global social movements helped catalyze development of new, cleaner technologies and 'green' export markets, and disseminate environmental information to Asia Pacific governmental, academic, and citizens' groups.

Figure 2. Global Flow of Innovation

N AMERICA	Greenpeace USA; Greenpeace Canada	US & Canadian PPIs; US EPA	dioxin research; increasingly tight pulp mill regulation
EUROPE	Greenpeace Int'l	European PPI	Scandinavian co's develop new pulping & bleaching technologies
AUSTRALIA	Greenpeace Australia	Australian PPI; state & Common-wealth EPAs	scuttling of Wesley Vale project; NPMRP; local mill innovation
SE ASIA	community groups & NGOs	Indonesian & Thai PPIs; environmental ministries	new pulp mills built with ECF technology; what to do with old mills?

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