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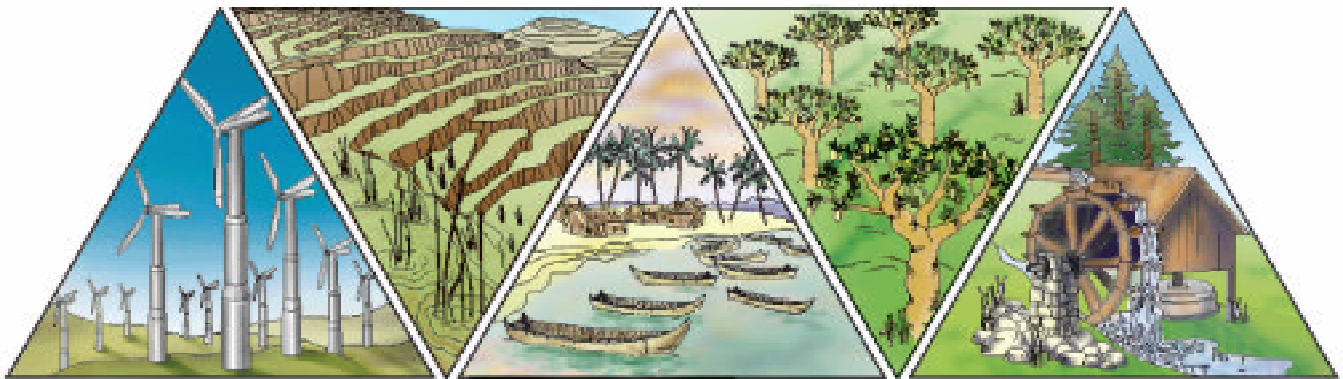
WORKING PAPERS

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**SOCIAL MOVEMENTS AND
ECOLOGICAL MODERNIZATION**

THE TRANSFORMATION OF PULP AND PAPER MANUFACTURING

David A. Sonnenfeld



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SOCIAL MOVEMENTS AND ECOLOGICAL MODERNIZATION: THE TRANSFORMATION OF PULP AND PAPER MANUFACTURING

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INTRODUCTION

No industry has been affected by environmental social movements as much, in so short a time, and on such a wide geographical scale, as pulp and paper manufacturing. Environmental social movements have had a profound influence on the industry since the mid- to late 1980s. In just a few years, “state of the art” pulping and bleaching has become more environmentally friendly. Manufacturers around the world have spent billions of US dollars adopting new technologies, modifying old ones, and developing local innovations to meet rising environmental demands, expectations, and regulations. Additional millions of US dollars have been spent by public and private institutions on research, development, and testing of new environmental processes and technologies for the pulp and paper industry (cf. API 1992; Porter and Linde 1995). The transformation is incomplete—many environmental problems remain—but nonetheless profound. All of this can be attributed at least initially to the efforts and influence of environmental social movements.

This paper analyzes social movements’ influence on the environmental transformation of pulp and paper manufacturing from the perspective of ecological modernization theory, which hypothesizes that *social movements play a central role in the environmental transformation of contemporary society in collaboration with government agencies and manufacturing firms*. Such a thesis is examined here using empirical evidence from fieldwork and interviews in Southeast Asia and Australia, correspondence, and available data.

This paper is organized in four sections. First, ecological modernization theory is introduced and reviewed with regard to its analysis of the contributions of social movements to environmental transformation. Research methods, definitions, and assumptions are summarized in the following section. In the third section, the paper examines social movements’ influence on five “moments” in the transformation of pulp and paper manufacturing. The paper concludes with a discussion of implications of the present study for ecological modernization theory and by making suggestions for further research.

ECOLOGICAL MODERNIZATION THEORY

Ecological modernization theory was founded in the late 1970s by German political sociologist, Joseph Huber (see Huber 1982; 1984; 1985; 1989). This school-of-thought has evolved over the last two decades to become one of the more ascendant sociological theories of the environmental transformation of advanced industrial societies (cf. Blowers 1997; Christoff 1996; Cohen 1996; Hajer 1995; Jänicke et al. 1989; Mitsuda 1994; Mol 1995; Mol 1996; Simonis 1989; Spaargaren and Mol 1992; Weale 1992). Today, scholars are exploring the usefulness and applicability of ecological modernization theory to a wide variety of contexts and countries beyond those initially envisioned by the theory's founders (see Mol and Sonnenfeld 2000).

Ecological modernization theory combines a 'realist' attitude towards market ideologies and dynamics hegemonic in the world today (see Mol and Spaargaren 2000; see also Szerszynski et al. 1996) with a reformist approach to the environmental redesign of contemporary societies. One of the strengths of ecological modernization theory is its attempt to explain institutional changes in modern societies related to the internalization of new environmental values and norms. One change identified but barely analyzed by ecological modernization theorists relates to the evolving role of environmental social movements in the reconstitution of modern society along more market- and ecologically-oriented lines.¹

Ecological modernization's thesis is that *environmental social movements play an increasingly important and direct role in the ecological transformation of society* (Mol 1995, p. 48). As an aspect of this, the theory holds that environmental social movements were previously largely outside centers of power in society and oppositional in character. Today, pro-environmental values have been generalized throughout society and environmental considerations have been "deregulated" and "marketized." Social movements play a critical role, increasingly "from the inside" of centers of power, in the regulation of environmental action of private and public producers and consumers (*ibid.*, pp. 80-83). Increasingly, environmental social movements communicate, negotiate, and consult directly with "economic agents and state representatives" (*ibid.*, p. 58). Environmental social movements are integrally involved in long-term planning and redesign of technologies of production and consumption, and the forging of effective instruments and institutions of "market" regulation of firm environmental performance (*ibid.*).

In his most recent work, Mol suggests that as further manifestation of the changed role of social movements in processes of ecological modernization, environmental movements have moved from radical opposition to capitalism, industrialization and bureaucratization, to being more oriented towards institutional reform; become more single-issue oriented rather than being part of broader social movements; shifted from working closely with the state to closer relationships with market actors; and no longer dominate environmental agenda-setting, rather now have to compete with other institutions to do so (Mol 2000).

1. Some of the most interesting recent work in this area focuses on the role of social movements in the environmental transformation of societies in transition from state-socialism to some form of market capitalism. (Cf. Rinkevicius 2000; Gille 2000).

Ecological modernization's theses regarding the changing role of social movements have been developed within the European social democratic, corporatist political paradigm, including the experience of green party politics. They appear applicable in varying degrees to advanced industrial societies around the world, particularly those with European cultural, political and institutional roots, such as Australasia and North America. But how do they hold up when examined more closely on a global basis? One approach to answering such a question would be to look at social movements' contributions to efforts to establish global environmental regulatory regimes, such as the so-called Montreal Protocol for global regulation of chloroflourocarbon (CFC) emissions, part of broader climate change negotiations (cf. Litfin 1993). An alternative approach, more akin to work done to-date in ecological modernization theory, would be to examine social movements' contributions to transformations in particular industries or sectors world-wide (cf. Mol 1995; Frijns et al. 1997; Green et al. 1994; Schot et al. 1994). The present research falls within the latter approach.²

2. A third, promising line of research on such questions is that of technology and the world-system, (cf. Raumolin 1991; Smith 1993; Hornborg 1998; Sonnenfeld 1998a; 1999).

RESEARCH METHODS

Before examining more closely social movements' influence on environmental transformation of pulp and paper manufacturing, key terms and sources of data are first specified.

Definition of Key Terms

In this study, key terms were defined as follows:

Social movements. This research is concerned with environmental social movements in the broadest sense. Here, “social movement” refers to both broader, loosely connected social formations pressing for social, especially institutional, change(s),³ and specific organizations such as Greenpeace, Friends of the Earth (FoE), and the Women’s Environmental Network.⁴ This study includes movements and organizations self-identified as environmental, as well as those whose involvement in other issues—such as community, human rights, women’s, workers’, ethnic and religious concerns—touches on or includes environmental matters. This broad definition is particularly apropos in newly industrializing countries, where environment is an important concern but people address it as much as communities, human rights groups or others, rather than as specifically environmental groups.

With regard to pulp and paper manufacturing, environmentalists were not only on the outside of processes of transformation. Indeed, as one pulp company executive expressed in an interview, “some of our toughest critics are inside the firm.” Environmentalism is ubiquitous in contemporary industrial (and even industrializing) societies, existing within manufacturing and technology firms and regulatory agencies as well as “outside” in social movements. The analytical independence of these entities is blurry as well, as individuals may be simultaneously industry or government employees and participants of environmental social movements.⁵

Environmental transformation. This research focuses on the development and adoption of a particular set of process technologies used in manufacturing paper: chlorine-free pulping and bleaching (both elementally and totally chlorine free, ECF and TCF, respectively). As such, only one dimension of environmental transformation of the industry is addressed; important environmental aspects of the industry beyond the scope of this study include airborne emissions, energy use, chemical utilization and raw material supply.⁶ This study focuses on industry’s use of chlorine and substi-

3. Not unlike Keck and Sikkink’s “environmental advocacy networks” (Keck and Sikkink 1998).

4. The latter have also been referred to as environmental non-governmental organizations (NGOs or ENGOs) or transnational social movement organizations (TSMOs) (cf. Smith et al. 1996).

5. Rinkevicius (2000) refers to this as a phenomenon of ‘multiple identities’, sometimes resulting in ‘identity crises’ among individual activists.

6. Concerns over the latter, involving the use of native forests, recycled/waste material, timber plantations, and other sources, have been particularly acute, and have received substantial attention (cf. Sargent and Bass 1992; Marchak 1995; Carrere and Lohmann 1996; Dudley et al. 1995)).

tute substances because this transformation was the subject of a global campaign by Greenpeace,⁷ extensive regulatory review and reform, and ultimately expenditure of billions of dollars in research and development and technology replacement. It is an important chapter, if not the whole story, of the contemporary transformation of pulp and paper manufacturing world-wide.⁸

Pulp and paper industry. This study focuses primarily on those segments of the pulp and paper industry which have historically used elemental chlorine, including especially bleached kraft chemical pulp mills, but also mills manufacturing consumer paper products such as tissues, toweling, paper diapers and women's sanitary products. Less relevant for the present research are those industry segments using recycled or waste materials and mechanical pulping technologies, including newsprint manufacturing. Production of *unbleached* chemical pulp, for use, e.g. in corrugated paper and other "brown" paper products, figures in the present research only to a limited degree.

Data Sources

This study draws on field research and interviews conducted between 1992-96 in Southeast Asia, Australia, and North America; correspondence with industry and government officials, environmental activists, and others around the world; and available data. The research also draws to a limited extent on the author's personal experience in the pulp and paper industry.⁹ Altogether, the author visited 16 pulp and paper mills, three pulpwood plantations, and two pulp industry research centers; conducted 76 interviews; attended seven technical conferences and one pulp industry short-course,¹⁰ gathered hundreds of documents; did library research in five countries; and made use of various electronic data and communication resources.

Site selection and visits. This study's main empirical focus is on pulp mills in Southeast Asia and Australia manufacturing bleached pulp from virgin raw materials. Indonesia, Malaysia and Thailand were purposively selected as being among those countries in the world with the most rapidly growing pulp and paper industries (see Figure 1). Australia was the author's primary base of operations and provided a useful example proximate to Southeast Asia of an advanced economy with a mature forest industry sector. Social movements focused on the pulp and paper industry were active in Australia, Indonesia, and Thailand. New environmental technologies and/or environmental innovations were adopted in those countries as well as in Malaysia.

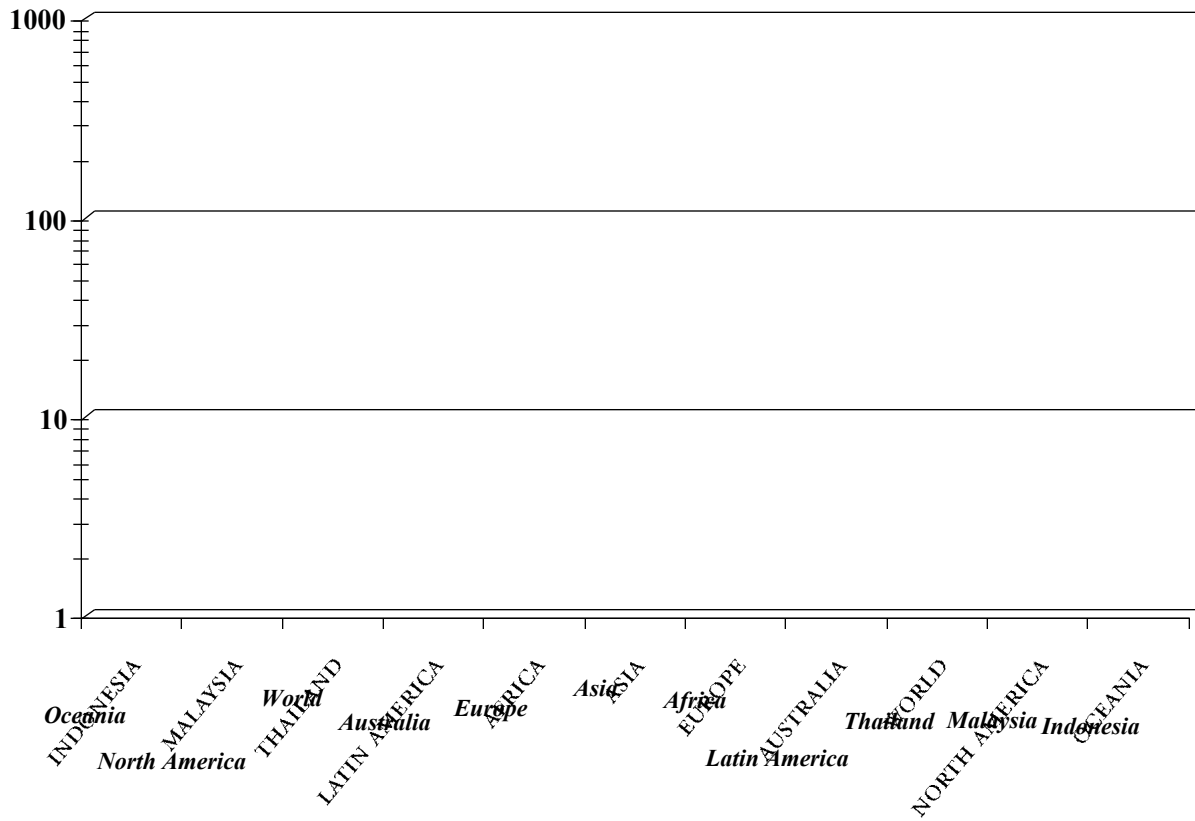
7. David Peerla notes that "by 1990 [Greenpeace's] pulp and paper campaign had expanded beyond toxics to consider the question of fibre and paper consumption as part of a [product] life cycle, clean production analysis" (Peerla 1999).

8. For insightful analyses of other dimensions of the environmental transformation of pulp and paper manufacturing, see (Smith 1997; IIED 1996). See also the fascinating story of the Natural Resources Defense Council's \$100 million recycled paper factory venture, the Bronx Community Paper Company (Holusha 1994; Harris 1995) and via the enterprise's website: <www.bronxpaper.org>.

9. The author worked as a laborer and machine operator for a pulp and paper company in the Pacific Northwest of the USA in the late 1970s.

10. The Technical Association of the Pulp and Paper Industry (TAPPI) short-course, "Introduction to Pulp and Paper Technology," Atlanta, Georgia, August 1993.

Figure 1. Wood pulp production average annual growth rates, 1981-97 (FAO 1993; 1998).



This study focused first on “model” pulp mills employing new environmental technologies in Australia, Indonesia, Malaysia, and Thailand, then on other mills manufacturing bleached pulp from virgin raw materials. Data were gathered on all bleached kraft pulp mills in operation and under construction in those countries at the time of fieldwork.

Interviews. During the fieldwork phase of this study, individuals were interviewed from a variety of institutional positions, geographical locations, and viewpoints, including pulp industry officials and engineers, environmental, community and other activists, government environmental regulators, academics, research scientists, and officials and representatives of technology firms. Interviews were conducted in Australia, Indonesia, Malaysia, Singapore, Thailand, and the USA. In addition, extensive correspondence was conducted with several individuals in Finland and Sweden (see Table 1). Interviews varied in length from twenty minutes to several hours, and in form from relatively structured to informal. Interviewees were purposively selected, with extensive “snowballing.”

Table 1. Interviews conducted, by sector and location.¹¹

	<i>Aus</i>	<i>Fin</i>	<i>Indo</i>	<i>Mys</i>	<i>Sng</i>	<i>Thai</i>	<i>USA</i>	TOTALS
Academic	0	1	1	1	0	3	2	8 (11%)
Government	1	0	8	1	0	3	0	13 (17%)
Industry	11	0	3	3	4	6	1	28 (37%)
Labor	0	0	0	0	0	0	4	4 (5%)
SMO	7	1	5	0	0	2	1	16 (21%)
Scientific	4	0	3	0	0	0	0	7 (9%)
TOTAL	23	2	20	5	4	14	8	76 (100%)

Available data. Extensive primary and secondary documentation exists on the environmental transformation of pulp and paper manufacturing world-wide. Primary sources utilized in this study include materials from Greenpeace’s pulp and paper campaigns, manufacturers’ environmental impact assessment reports, and government planning and regulatory documents. Secondary sources included industry trade journals such as *Asia Pacific Papermaker*, *Pulp and Paper International* (PPI), the *TAPPI Journal*, and others. The Miller Freeman Company donated back issues of *PPI*, as well as a copy of their international directory of pulp and paper manufacturers and suppliers (Miller Freeman 1991). Online sources were used for many of the manufacturing and technology firms studied.

11. The location of the interviews is not necessarily indicative of the country of origin of the interviewee. E.g. interviews conducted in Singapore were of employees of Nordic-based pulp technology firms; interviews in Australia included those conducted at two industry conferences including of international participants.

TRANSFORMATION OF PULP MANUFACTURING

For analytical purposes, it is useful to distinguish five 'moments' in the ecological modernization of pulp and paper manufacturing: problem definition, political action, government response, technology innovation, and technology adoption, respectively (see Figure 2). In practice, this model's five moments overlap in time and space. Social movements influenced each moment, being especially important in the first two, problem definition and political action. Governmental agencies, research institutions, technology firms and manufacturers figured as central actors in other moments. Activists' contributions to all five moments are examined here, with reference to North America, Europe, Australia and Southeast Asia.

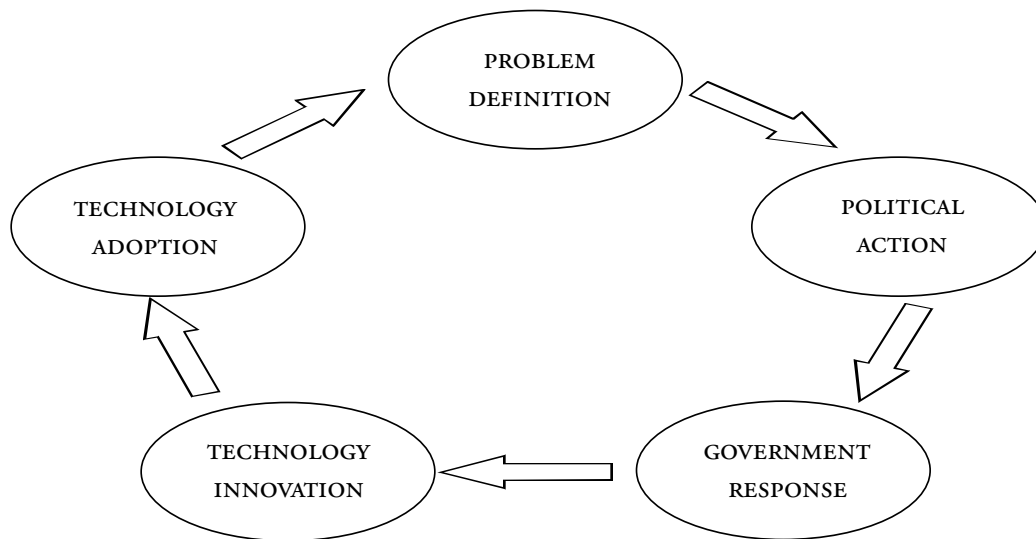


Figure 2. Five moments in the ecological modernization of an industry.

Problem Definition

Environmental problems relating to pulp and paper manufacturing in the 1980s and '90s were defined through scientific fact-finding; initiatives by environmentalists, government agencies, manufacturers, and suppliers; and media coverage. While government agencies and private firms had substantial organizational and financial resources to draw from in influencing problem definition, environmentalists had important influence as well through skillful use of sympathetic news media.¹² Problem definition differed in advanced industrial and newly industrializing countries.

Advanced industrial countries. In advanced industrial countries, recent concern about environmental impacts of pulp and paper manufacturing focused on toxics issues related to waste and product safety. In particular, it targeted use of elemental chlorine (Cl_2) in pulping and bleaching and

12. As major institutional consumers of paper, some print news media have conflicts of interests with regard to the pulp and paper industry, however. Some media firms have equity stakes or even controlling interest in their own pulp and paper mills. Print media firms without their own mills may be vulnerable to pressure from pulp and paper firms and distributors who supply them with paper.

the by-production of dioxin,¹³ a highly toxic substance some suggest is the “most studied chemical in existence.” Dioxin was identified as an acute toxin in connection with an industrial accident in Seveso, Italy, in the 1970s, where citizens were affected by a chemical plant explosion. It is chemically associated with the ‘Agent Orange’ defoliant used by the USA’s military in Viet Nam and which has resulted in continuing health problems among Vietnamese citizens and former ground troops.¹⁴

Dioxin was first linked to the pulp and paper industry in a 1985 US Environmental Protection Agency (EPA) river contamination study. This association was not publicly disclosed until reported by Greenpeace in 1987 (Kroesa 1990; Brown and May 1991). Dioxin was discovered in milk in 1988, having leached from paper containers (*Science News* 1988). Shortly thereafter, traces of dioxin were found in paper toweling, sanitary and other products (*Advertiser* 1989; Ardill 1989; Costello et al. 1989; *FDA Consumer* 1989; Henderson 1989; *Science News* 1989a; 1989b; 1989c; 1989d; WEN 1989).

In the USA, people living down-river from paper factories attempted to link their illnesses with dioxin. In the early 1990s, cancer victims and their families litigated against paper manufacturers for damages.¹⁵ Pulp and paper manufacturers were defensive at first, refusing to acknowledge any problem or liability. The US Environmental Protection Agency, however, was forced to acknowledge existence of a problem and the need to do something about it.

Concern about dioxin as a by-product of chlorine-based pulp manufacturing spread from North America to Europe and elsewhere through the efforts of Greenpeace and other transnational NGOs and networks such as Friends of the Earth and the Women’s Environmental Network (Peerla 1997, pp. 24-27 ff). Industry trade journals, research institutes, supply firms, and a small handful of mills producing chlorine-free products amplified debates over use of chlorine, presence of dioxin, and new regulatory standards. Although with important roots in North America, the broad movement against use of chlorine in pulp and paper manufacturing found its deepest support and greatest effectiveness in Europe.

Greenpeace brought the chlorine/dioxin issue to Australian pulp and paper manufacturing in 1987-88 in the course of a grassroots campaign against a new export pulp mill on the north coast of the island-state of Tasmania (see Sonnenfeld 1996a). Early on, local residents opposed the proposed mill as an inappropriate use for prime agricultural land. With introduction of concerns about chlorine and dioxin, the controversy shifted to toxics, however. Popular sentiment turned against building the mill unless and until the venture partners agreed to use chlorine-free pulping and bleaching technologies. As the debate continued, market conditions shifted and the Canadian partner, Noranda, pulled out, ultimately resulting in the project’s cancellation, a victory for environmentalists. Shortly thereafter, activists broadened their campaign to make all Australian pulp manufacturing “Chlorine-Free by ’93.”¹⁶

13. 2,3,7,8 tetrachlorodibenzo dioxin, also known as 2,3,7,8 TCDD, and related substances.

14. For an interesting political history of dioxin, see (Commoner 1994).

15. Cf. *Van R. Comfort Jr., et al. v. Kimberly-Clark Corp.*, No. CV-90-616, 18th Judicial Circuit Court, Shelby County, Alabama, as referenced in (*Toxic Torts* 1993).

16. Greenpeace’s slogan in Australia and elsewhere.

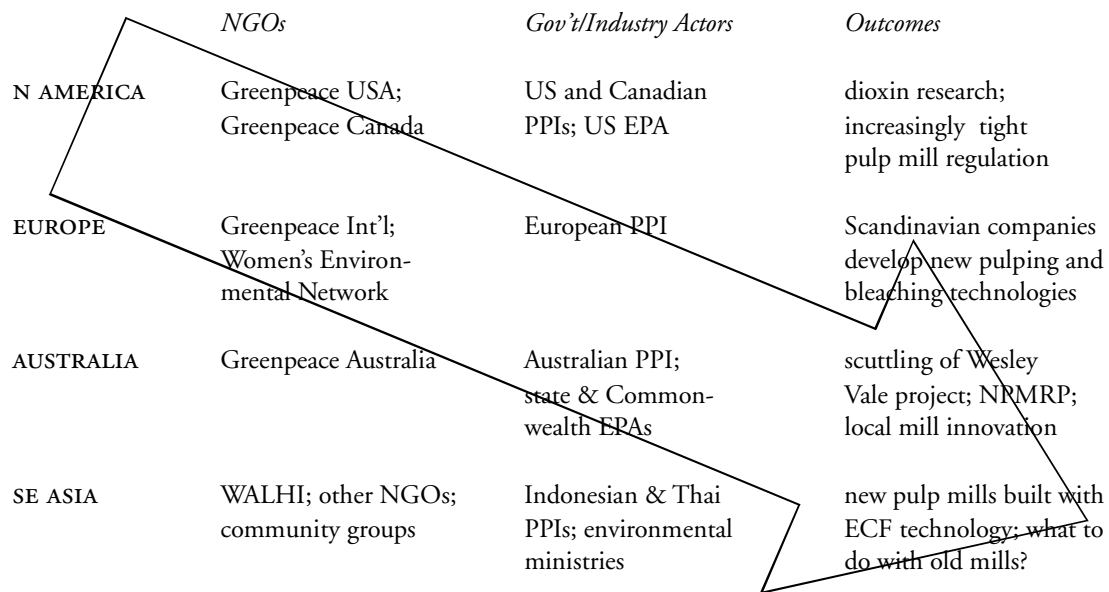
Newly industrializing countries. In newly industrializing countries, the pulp and paper industry has been a major focus of popular struggles over top-down, rapid economic development. Environmental issues have been an integral part of such struggles since the beginning—often taking the form of resource conflicts (cf. Carrere and Lohmann 1996; WALHI and YLBH 1992; Marchak 1995; Mayer 1996), getting linked to toxics issues as in the North only belatedly. Since the 1980s, pulp manufacturers in newly industrializing countries have faced controversies with regard to expropriation of land and forests from local communities, effects of deforestation, establishment of exotic pulpwood plantations, and air and water pollution. Popular protest against the industry manifested in communities immediately affected by existing operations or proposed new ones and in national and international activist networks.

Chlorine and dioxin came into the political mix of protest against the pulp industry in newly industrializing countries in the early 1990s, due in large part to Greenpeace's efforts to provide information about environmental and health concerns involving the substances to local and national NGOs, government agencies, news media, and even manufacturers. In addition, Greenpeace trained local citizens and NGO participants in wastewater sampling techniques and assisted them getting samples analyzed at professional laboratories. The pulp industry's use of chlorine and by-production of dioxin thus entered into discussions of social and environmental impacts of ongoing operations, and choice of technologies in expansion projects. National and local news media were responsive to such concerns, as were local environmental officials and academic researchers.

In the context of formative regulatory apparatuses, poorly developed local expertise in environmental monitoring and assessment, a booming industry, and international financing, Greenpeace's efforts helped raise the level of discussion. Such concerns helped create regulatory and business environments supportive of the adoption of cleaner production technologies. A highlight was reached in 1993, with Indonesia's then-Minister of Environment, Mr. Sarwono Kusumatmadja, declaring that any new pulp mills built in Indonesia would have to be "ECF or better" (*World Paper* 1994). Refracted through news media and the campaigns of local activists, Greenpeace's efforts may also have strengthened popular fears about impacts of large-scale development of the industry.

In sum, social movements played a key role in defining the problem of using chlorine in pulp manufacturing across the globe; regulatory agencies, businesses, and news media also were involved. Greenpeace played a doubly critical role through making public the connection between chlorine, dioxin and pulp manufacturing, then taking its chlorine campaign around the world: from North America and Europe in the mid- to late 1980s to Australia and Southeast Asia in the early to mid-1990s (see Figure 3). Other social movement organizations—transnational, national, and local in orientation—joined in informal alliance with Greenpeace. In advanced industrial countries, the issue was framed as not only a toxics but also a women's/public health and food safety issue. Concerns about chlorine were heard loudly in newly industrializing countries, as well. There it was linked to broader concerns about social and environmental impacts of large-scale, top-down, rapid rural industrialization, and calls for increased popular participation in decision-making regarding same.

Figure 3. Global flow of social movement influence on the ecological modernization of pulp and paper manufacturing.



Political Action

Engaged from the onset in framing the problem of using elemental chlorine for pulping and bleaching, NGOs carried out international campaigns around its elimination. Greenpeace called for industry adoption of totally chlorine-free (TCF) manufacturing technologies. The Women's Environmental Network (UK) and others campaigned to eliminate chlorine from the manufacture of sanitary napkins, pads and disposable diapers. Student and community activists in Indonesia and Thailand rallied against chlorine use and by-production of dioxin at local mills (see Sonnenfeld 1998a; 1998c). Surfers in California brought legal action against the Louisiana-Pacific Corporation for ocean out-flow of chlorinated wastes (*Business Week* 1991; *Paperworker* 1992; *Progressive* 1991). And so on ...

The campaigns were broad, utilizing sophisticated communication strategies and networks to span the globe; and deep, as NGOs contributed scientific, organizational, and political expertise, and financial resources; and local activists combined expertise in local conditions and social networks with passions for cultural and ecological preservation and social change. The campaigns had sustained impacts on producers, consumers, investors, suppliers, intergovernmental organizations, and others often far-flung from sites of immediate action. Two of the most important were transnational campaigns conducted by Greenpeace and the Women's Environmental Network, respectively. Each is reviewed briefly here, along with local campaigns in Australia and Southeast Asia.

Greenpeace. Greenpeace's world-wide pulp and paper campaign evolved out of efforts against ocean incineration,¹⁷ and was active on at least four continents—Europe, North America, Australia, and Asia—by the early 1990s (see *PPI* 1989; Gladwell 1990; Kroesa 1991; Thornton 1991; Peerla

17. Interview, Ms. Lisa Bunin, former anti-toxics campaigner, Greenpeace International, Santa Cruz, California, September 1993.

1997). Aimed at convincing firms to cease using chlorine in manufacturing pulp and paper, this organization's campaign included intervening in regulatory policymaking debates, carrying out direct action, educating institutional and individual consumers, and negotiating with producers.

In North America, Europe and Australia, Greenpeace communicated directly with governmental agencies and testified at public hearings around the world, arguing that standards for permissible levels of chemicals in pulp mill effluent be set low to force manufacturers to adopt totally chlorine-free pulping and bleaching processes. In Australia, Greenpeace initiated independent monitoring of pulp mill operations, organizing a blockade of the effluent outlets of at least one of the mills;¹⁸ in Indonesia and Thailand, it worked together with local organizations, training them how to do the same. Sample results were sent to independent labs for analysis.

An educational broadside oriented towards the general public, individual and institutional consumers, and government officials was launched in Europe and elsewhere. One of the most famous moments of this effort took place in Germany with mass distribution of a simulated edition of the weekly newsmagazine, *Der Spiegel*, printed on totally chlorine-free paper from a Swedish mill. The campaign demonstrated that totally chlorine-free paper could be almost as bright and white as chlorine-bleached paper and meet the requirements of corporate consumers.¹⁹

Greenpeace interacted directly with industry officials, including e.g. those of the Australian Newsprint Mills (ANM) and Advance Agro (Thailand) companies. ANM won Greenpeace's praise for completely eliminating chlorine use in its Tasmania newsprint mill and for designing its start-up New South Wales mill using chlorine-free processes.²⁰ The Advance Agro Co. was developing a new, integrated greenfield pulp and paper mill in northeast Thailand. Not wanting to run into political trouble as had some of its competitors, the company was receptive to Greenpeace's input regarding technology choice.²¹

Operating in many countries, on multiple institutional levels, and with various tactical approaches, Greenpeace had a great impact on public perception, institutional and personal consumption, the regulatory environment, and operations of the pulp and paper industry world-wide. Just a few years later, trade journal pundits proclaimed the death of elemental chlorine in pulp and paper manufacturing: "Chlorine is dying, we told you so!" (Pearson 1991).

Women's Environmental Network. What Greenpeace did for use of elemental chlorine in chemical pulping, the Women's Environmental Network (WEN) and others tried to do for use of chlorine in production of sanitary paper products. Beginning a little later than Greenpeace but working closely with it, WEN launched a world-wide campaign against use of chlorine in production of tampons, sanitary pads and disposable diapers. Calling attention to discovery of traces of dioxin in such products, women in the USA, Canada, and Australia as well as the UK pressured

18. (Kneebone 1989, excerpted in Sonnenfeld 1996a, p. 391).

19. For an excellent account and analysis of this campaign, see Peerla 1997, pp. 172-83).

20. Interview, Mr. Robert Cartmel, Greenpeace Australia, Sydney, May 18, 1994.

21. *Ibid.*

manufacturers to stop using chlorine. Such campaigns encouraged Australia's leading tissue producer, Kimberly Clark Australia, to switch to totally chlorine free (TCF) production.

According to Peerla (1997), WEN's European campaign was so successful in part due to the ready availability of chlorine-free sanitary paper products on that continent. Chlorine and dioxin-free sanitary paper products were not just a slogan, but a reality. 'Green competition' helped push producers in those markets towards chlorine-free processes. A further factor, Peerla argues, was the existing technology base of European sanitary paper manufacturers: while rewards for being able to respond to a vociferous, new, environmentally-conscious market were ample, costs for that segment of manufacturers to convert to chlorine-free production were modest.

Australia/Southeast Asia. In Australia and Southeast Asia, Greenpeace's efforts against use of chlorine in pulp and paper manufacturing were carried out in cooperation with local campaigns against top-down rural industrialization. The latter campaigns addressed communities' right to participate in decision-making regarding economic development, environmental conservation and pollution mitigation. Often, pulpwood plantations, pulp mills, and pollution were imposed on local communities and ecosystems as a result of central government and private decision-making, with no popular input until the resultant transformations were a *fait accompli*.

Local activists made effective use of Greenpeace's analyses of environmental and health risks associated with chlorine use, methodologies for scientific assessment of mill pollution, and public relations techniques to strengthen campaigns for rural empowerment. Some campaigns became polarized and continued for years, with activists calling for shutting down polluting mills. Other campaigns were more educationally oriented, aimed at forcing regulatory intervention and obtaining compensation for individuals and communities affected by pollution; in such campaigns, consultation and cooperation were emphasized.²² In the course of these campaigns, important legal and regulatory precedents were set, including the ability to use traditional law as a basis for civil court actions (Indonesia), the right of third parties including NGOs to have legal standing in court (Indonesia), and government shut-down of persistent violators (Indonesia and Thailand). In Australia as well as Southeast Asia, activists were able to create political climates in which pulp and paper industry operations were given regulatory oversight beyond that required in formal law and regulations, and to influence industry technology choices, both directly and indirectly.

Australia's well-educated and highly urbanized population was receptive to the consumer-oriented campaigns for "green" paper developed by WEN, Greenpeace, and others in Europe. Kimberly Clark Australia and other producers were able to capitalize on such sentiments by launching premium, totally-chlorine free paper products (see Sonnenfeld 1996a). In Southeast Asia, domestic consumer-oriented campaigns had limited immediate popular appeal, however consumer concerns in a broader sense remained significant through the impact of green global markets. The region's export-oriented producers have been motivated to obtain certification under standards set by the

22. In a well-known case in Indonesia, local communities with assistance from national environmental and human rights organizations, negotiated directly with Indonesia's largest pulp and paper producer to establish a "Consensus" governing company operations and compensation for pollution effects. See "Kesepakatan," (Appendix E in Sonnenfeld 1996b, pp. 198-200).

International Standards Organization for quality assurance (ISO 9002) and environmental management (ISO 14001), in order to meet demanding requirements of global customers.

In Australia and Southeast Asia, environmentalists worked closely with government officials and research scientists regarding regulation, development, choice, and use of cleaner pulp and paper technologies. Australian activists consistently lobbied government commissions and research bodies formulating new pulp mill environmental standards and developing new technologies. Although its relations with the Government of Indonesia have had its ups and downs, the Indonesian Forum on the Environment (WALHI) has had a positive, cooperative relationship with officials and staff of Indonesia's Office of Environmental Impact Management (BAPEDAL), as well as with staff at the government-run Institute for Research and Development of Cellulose Industry (IRDCI). In Thailand, activists collaborated with the Office of Environmental Policy and Planning in monitoring the controversial Phoenix Pulp and Paper Co. mills in the northeast region of the country.

Initiated and initially most well funded and staffed in North America (Peerla 1997), activist campaigns for the environmental transformation of pulp and paper manufacturing soon reached around the world, having their greatest near-term effect in Europe.²³ Carried out from c. 1987 through the mid-1990s, these efforts entailed the expenditure of the equivalent of millions of US dollars (*ibid.*), involved tens of thousands of people, catalyzed new government policies and regulations, stimulated development and adoption of cleaner production technologies, and transformed significant segments of a global industry. Activists, firms, and government agencies in newly industrializing as well as advanced industrial countries were involved.

Government Response

Government response to scientific investigation and political action regarding health risks of chlorine-based pulp manufacturing varied from country to country and over time. Consistent with ecological modernization theory, early agency responses focused on toughening regulations and enforcement, while later ones included more communicative and collaborative approaches, and ones more oriented towards "market incentives" and self-regulation. With increasing cooperation between activists, regulators, and manufacturers, environmental performance standards for the industry began to converge world-wide (see Table 2, below), based on a growing regulatory consensus in favor of elementally chlorine-free pulp manufacturing. At the same time, environment-related conflict continued between communities, activists and firms in certain locales, especially in newly industrializing countries, forcing governmental agencies into mediating roles. This section examines the dynamic role of government agencies in environmental oversight of pulp and paper manufacturing in Australia, Indonesia, Malaysia and Thailand. It includes a compilation of findings with regard to water quality standards for the pulp industry in these and other countries.

Australia. In Australia, environmental protection and regulation historically had been the province of state governments. New export-oriented industries had to be approved by the national agencies, however. Activists used this federalist division of responsibility to their advantage, launch-

23. Peerla notes that Greenpeace's German office had the greatest financial resources and expenditures over the duration of the organization's campaign (Peerla 1999).

ing local environmental lobbying efforts and political campaigns, even while pushing for a role in national environmental oversight.

In such a political environment, officials of the Commonwealth Scientific and Industrial Research Organization (CSIRO) succeeded in winning government funding for a five-year National Pulp Mills Research Program (NPMRP). One of the NPMRP's first projects was an international "best practices" regulatory assessment. From this effort came new Bleached Kraft Eucalyptus Mill (BKEM) environmental performance guidelines (see Table 2, below). These guidelines were updated six years later in 1995, following completion of various pulp mill environment studies. In addition to the BKEM guidelines, the NPMRP financed research which tested and adapted chlorine-free bleaching processes to the country's particular raw materials and environmental conditions; developed customized bio-assay techniques for monitoring environmental quality in Australian marine environments; and supported creation of sophisticated modeling techniques for predicting dispersion and impacts of oceanic mill effluent discharges.

In Victoria, the state Environmental Protection Agency negotiated a "best practices environmental management" agreement with the Amcor corporation, the country's largest producer of virgin pulp, governing its flagship Marysvale integrated pulp and paper manufacturing facilities. As part of this agreement, the company agreed to conduct annual environmental audits and to be held accountable for meeting goals for environmental improvement established the previous year. In Tasmania, state officials finally implemented a ban on mercury-cell production of elemental chlorine at the Australian Newsprint Mills (ANM) Boyer plant, precipitating the company to abandon chlorine-based processing altogether. In South Australia, primed by months of protests against pollution caused by existing operations, state regulators levied extensive environmental requirements on the planned new Apcel pulp mill on Lake Bonney, leading to development of innovative chlorine-free processes. Various governmental agencies, NGOs, and industry representatives negotiated formulation of guidelines for eco-certification of paper products.²⁴

Indonesia. A variety of regulatory initiatives relating to environmental performance of the pulp and paper industry took place in Indonesia in the late 1980s and early 1990s. Some of the most important were initiated by community activists with assistance from national legal assistance and environmental law attorneys. In a celebrated case involving the PT Inti Indorayon Utama mill in North Sumatra, the Indonesian Forum for the Environment (WALHI) established the basis of being able to sue in civil court based on alleged violations of customary law, and further won the unprecedented right as a third-party to have standing in court in legal action against the Government of Indonesia for not enforcing environmental laws and regulations.

In a separate case, WALHI and the Indonesian Legal Aid Foundation (YLBH) successfully negotiated with one of Indonesia's largest pulp and paper manufacturers, Indah Kiat Pulp and Paper (IKPP), in Sumatra, on behalf of local communities. The NGOs obtained a "consensus" whereupon the company agreed to compensate villagers for damage incurred due to pollution and the governmental environmental impact management agency, BAPEDAL, agreed to institute new, more strict air

24. For further information about these and other developments in Australia, see (Sonnenfeld 1996a).

pollution standards for the mill. (See “Consensus,” Appendix E, pp. 198-200 in Sonnenfeld 1996b.)

New environmental impact assessment requirements were used by local activists to effectively lobby for government intervention in extreme cases, such as in the wake of a series of industrial accidents at the Indorayon mill. That mill was shut down several times for environmental mismanagement.²⁵ In response to continuing protests regarding environmental impact of pulp mill projects in Sumatra, the Minister of the Environmental Planning and Impact Assessment Agency (BAPEDAL), Ir. Sarwono Kusumatmadja, announced c. 1994, that henceforth all new pulp mills built in Indonesia would be “ECF or better.”

Drafted with assistance from overseas environmental agencies, new national environmental guidelines were announced for existing pulp and paper mills in Indonesia, effective in 1995; and for new mills, effective in 2000. In selected cases, such as with East Java’s PROKASIH clean rivers project, local authorities were permitted by central authorities to establish standards stricter than the national government’s.

In June 1995, Indonesian environmental authorities implemented a new color-coded “business performance evaluation program” called PROPER (Program for Pollution Control, Evaluation and Rating), wherein companies were assigned one of five color codes for environmental performance, gold for outstanding, green for very good, blue for acceptable, red for failing to meet environmental standards, and black for disgraceful. Firms achieving the highest ratings were announced to news media in commendation for superior environmental performance; those with the worst ratings were threatened with public exposure.

With the country’s strong export-orientation, the Government of Indonesia has strongly supported Indonesian companies’ participation in environmental certification efforts, including ISO 14001, eco-labeling, etc. It has also worked together with the United States Agency for International Development (US-AID) and United States–Asia Environment Program (US-AEP) in promoting environmentally-oriented technical assistance, such as environmental audits, workshops on cleaner production, etc. Local community and environmental protests continue to focus on the Indorayon mill and a new mill recently completed in South Sumatra.

Malaysia. With only one, remote, greenfield pulp mill at the time of this study, the Malaysian Ministry of Science, Technology and the Environment (MOSTE) had little incentive to develop elaborate standards for pulp manufacturing. Regulations written for rubber and palm oil manufacturing were applied to the pulp industry as well. As remote as it is, the Sabah Forest Industries (SFI) integrated pulp and paper mill in northeast Borneo, did not escape controversy, however. Controversy involved the mill in its siting, forest practices, effluent discharge, operations and management.

SFI is one of the most studied pulp mills in South-East Asia, with extensive baseline and follow-up environmental impact assessments conducted in association with the United Nations Environment Programme’s (UNEP) Network on Industrial Environmental Management (NIEM) project (cf. Murtedza and Landner 1993). Principle concerns articulated in those studies relate to effects of the

25. Even to this date.

mill's effluent on fisheries in Brunei Bay. During a visit to the site, this author was told that local fishermen had protested the mill's discharges into the Bay early in the plant's history, due to perceived impacts on their catch; since then they have moved on to other locations, however.

During its start-up and initial years of operation, SFI was kept under strict environmental oversight by Malaysia's national government. SFI was required to conduct annual environmental audits and improve environmental performance. The close attention paid to SFI by Malaysia's national government may be partially explained by the mill's ownership by the state of Sabah. At the time, Sabah was one of only two states not led by the United Malays National Organization (UMNO), Malaysia's ruling party.²⁶ SFI was caught in tension between local and national authorities on matters such as the granting of tariff protection and building of infrastructure.²⁷

Thailand. Thailand also has a relatively small number of mills and had not developed elaborate environmental regulations governing the pulp industry at the time of this study. Thailand's environmental regulation of the pulp industry was evolving rapidly then, however, on an ad hoc basis. In response to sharp protest regarding operation of the Phoenix Pulp and Paper Co. mill in the north-east region of the country, however, the government intervened strongly, shutting the mill down following a massive fish kill in the nearby Phong River. Later, the Office of Environmental Policy and Planning did something quite innovative, establishing a Special Environmental Zone on the river including the mill. Though environmental regulations for the pulp and paper industry are relatively weak in Thailand (see Table 2, below), the Special Environmental Zone designation allowed government agencies to set more demanding, site-specific standards for the mill and its expansion project.

Phoenix's problems sent shock waves through the rest of Thailand's pulp and paper industry. With support from the United States Agency for International Development (US-AID), the Federation of Thai Industries Pulp and Paper Club formed an environmental committee. Representatives from seven mills met regularly, exchanged information, went on an environmental study tour to the United States, attended environmental management seminars in Bangkok, and conducted environmental audits of each others' facilities. Advance Agro's new mill in northeast Thailand was required by the government to produce an environmental impact assessment, minimize water usage, and recycle treated wastewater as irrigation on nearby fields. Startup of operations at a new newsprint mill was delayed until it met pollution standards.

With a growing industry, government and industry alike recognized a shortage of trained pulp and paper technicians in Thailand, including in environmental areas. Kasetsart University's pulp and paper technology program was expanded and a new pulp and paper technology program was begun at the Asian Industry of Technology, with assistance from the Finnish Agency for International Development (Finnida). Although controversy continues at the Phoenix mill—at least in part due to its poor, low-lying site—on the whole, public and private initiatives have combined to improve environmental performance of pulp manufacturing in Thailand.

26. Underlying the opposition-led state government were cultural, religious, and ethnic differences between Sabah residents and West Malaysia (Vatikiotis 1992; *Australian* 1994).

27. UMNO recaptured the state government in 1995.

In Sum. Table 2 summarizes findings regarding pulp mill wastewater effluent environmental standards in effect or planned at the time fieldwork was conducted. Four standards are most relevant to water quality issues for chemical pulp mills: biochemical oxygen demand (BOD),²⁸ chemical oxygen demand (COD),²⁹ total suspended solids (TSS),³⁰ and absorbable organic halides (AOX).³¹ BOD, COD, and TSS are typically measured in milligrams per liter (mg/l), AOX in kilograms per ton of pulp (kg/t). AOX is widely used as an indicator of chlorine and (derivatively) chlorine by-products in pulp mill effluent.

A number of trends were observed with regard to the environmental regulation of pulp manufacturing in Southeast Asia and Australia in the 1980s and '90s. During this period, government agencies were increasingly forced to intervene in strong ways in response to popular protest against pulp mill pollution. Among regulators' tool bag of responses to protest were rigorously enforced environmental impact assessment and site licensing requirements and creation of special environmental zones. In extreme cases, regulators were even moved to shut down mills flagrantly and consistently violating environmental regulations. When they did occur, shut-downs of high-profile pulp mills and expansion projects had extensive political and regulatory "ripple" effects.

In addition to "command-and-control" regulatory approaches, government agencies also were developing increasingly communicative and collaborative tools to encourage development and adoption of cleaner production technologies in the sector. These included supporting government and industry environmental research programs; cooperating with bilateral cleaner production assistance programs; instituting environmental incentive programs; establishing "Best Practice Environmental Management" programs; mediating environmental conflicts between local residents and companies; and encouraging use of market tools, including environmental certification, e.g. ISO 14001, eco-labeling, and environmentally preferred purchasing policies.

Technology Innovation

Environmentalists' actions related to use of chlorine in pulp manufacturing resulted not only in strengthened government oversight, but also in redirection of technology research and development for the industry. As one of the largest and most capital-intensive industries in the world, pulp and paper manufacturing has a steady stream of technological innovations "in the pipeline" from basic

28. "... a property of water or wastewater, determined by measuring the quantity of oxygen consumed by a sample under controlled conditions (20° C, neutral pH) for a defined time period. The most commonly used period in North America is 5 days, which is sometimes written as BOD₅. BOD is expressed as mg/l ('parts per million') ..." (Folke and Landner 1993, p. 3).

29. "... a similar concept to BOD except that the measurement is of oxygen consumed, based on rapid chemical oxidation of the sample. BOD and COD are generally poorly correlated..." (Folke and Landner 1993, p. 4).

30. "Particles of matter suspended in the water. Measured as the oven dry weight of the solids, in mg/l, that are retained on a standard filter paper. Less than 25 mg/l would be considered clean water, while an extremely muddy river might have about 200 mg/l of suspended solids..." (Folke and Landner 1993, p. 14).

31. "A measurement of the amount of chlorine attached to organic substances... Chlorine is the only halogen used in significant quantities in pulp mills. The measurement is expressed as weight of the halogens (chlorine) ..." (Folke and Landner 1993, p. 2).

Table 2. Pulp mill regulatory standards, c. 1994³²

<i>Country</i>	<i>Date</i>	<i>BOD₅</i>	<i>COD</i>	<i>TSS</i>	<i>AOX</i>
Australia					
Tasmania	1974	25	—	—	—
Victoria	1991	40	—	60	2.5
NPMRP Guidelines	1989	7	—	8	1
NPMRP Guidelines	1995	6	25.4	8	0.3
Canada	1992	5.5–30	—	9.5–14.5	(1.4–1.5)
Indonesia					
Existing Pulp Mills	1991	15	35	20	—
Existing Pulp & Paper Mills	1991	25.5	59.5	25.5	—
New BK Mills (Draft)	1994	7	21	7	—
New Bleached Kraft Mills	1995	8.5	29.75	8.5	(1.5)
Finland	1992	6.8–34	65	5–15	(1.4)
Malaysia					
A - Catchments	1979	20	50	50	—
A - Catchments (proposed)	1995	—	(80)	—	—
B - Other	1979	50	100	100	—
B - Other (proposed)	1995	—	(200)	—	—
Norway	1992	—	90	5	6
		—	(57)	(3.5)	(2)
Philippines	1990	30–150	60–300	50–200	—
Sweden	1992	17.5–17	39–107	0.3–5.8	1.5–2
		—	—	—	(<1)
Thailand	1978	100	60	30–60	—
		(60)	(100–400)	(50)	—
USA	1992	5.5–8	—	9.5–16.4	—

32. Adapted from Jappinen 1992; Zakaria 1994; Mittal 1994; Mehta 1994; Ministry of Science 1992; NPMRP 1995; Department of Environment 1995; Niyomwan et al. 1995; Hendayani et al. 1995; Department of Industry 1989; Tasmania 1974; Murtedza et al. 1995). Values in parentheses were *proposed* as of the date of record. Null values indicate *no published standard* (or data not available) as of the date of record.

research at universities and industry centers to applied research at such centers and technology firms. The profitable, applied segments of research and development often are the domain of private, for-profit firms, while fundamental research is carried out in public institutions or with public support.

From time to time major technological breakthroughs take place; the advent of kraft pulping (including using elemental chlorine for pulping and bleaching) in the first part of the 20th century was one such breakthrough. With activists' and regulators' intense scrutiny of the industry on environmental matters in the 1980s, numerous innovations related to elimination of elemental chlorine in kraft pulping (and bleaching) were "fast-tracked" for rapid development and commercial application. This took place in the Nordic countries of Europe where environmentalists were institutionally strong, including with members of parliament and even ministerial portfolios through green party participation in governing coalitions. By 1991, leading industry trade journals declared elemental chlorine "dead" as an ingredient for papermaking in Europe and North America (Pearson 1991; see also Capps 1990).

Technology development managers interviewed acknowledged the influence of environmental activism and stricter regulatory standards in hastening innovation in pulping and bleaching technologies. This was termed "adapting to new market demands." Many of the new techniques "had been around for a while" but "no one took much interest in them" until environmental considerations came to the fore, according to one research and development manager communicated with.

Several firms developed, tested, and marketed advanced elementally chlorine-free kraft pulping and bleaching technologies within a few years. These technology firms were all based in northern Europe: Kvaerner Pulping, Sweden-based division of an Anglo-Norwegian shipping, construction and engineering conglomerate; Ahlström Co., a private, family-owned, Swedish-Finnish firm; and Sunds Defibrator, based in Sweden, owned by a Finnish company. The technologies were marketed under the trade names of SuperBatch™ (Sunds) and ITC™ (Kvaerner) (see Sonnenfeld 1999).

By the mid-1990s, the Nordic firms claimed to be ready to build "closed process" ("totally effluent free" or TEF) pulp mills, promising to improve environmental performance even further, and remove political and locational constraints from further pulp mill development (Edstrom 1994; Silander 1994). North American firms were slow in moving to reengineer pulp manufacturing technology; they had concentrated instead on "end-of-pipe" solutions to North American environmental regulatory requirements.

At the same time Nordic researchers and firms were developing advanced chlorine-free pulping and bleaching technologies, engineers and scientists in public and private laboratories around the world addressed local dimensions of the problem, including pilot-scale testing of new processes with local raw materials. Different types of wood and other fibrous materials have varied chemical compositions and physical characteristics; therefore, new processes must be adapted to them.

Local innovation took place in direct response to environmentalists' demands and regulatory requirements in each country where fieldwork was conducted. In *Australia*, under the NPMRP, public and private researchers carried out a multitude of research projects over a five-year period to improve the Australian pulp and paper industry's environmental performance (cf. Nelson et al. 1993; Abel 1994; Irvine 1994). Researchers at individual firms made important site-specific innovations

leading to reduction or elimination of chlorine use (see Sonnenfeld 1996a). This took place at several of Australia's leading pulp and paper firms including Australian Newsprint Mills (ANM), Amcor/Australian Paper, and Apcel/Kimberly Clark Australia.

Economic and social conditions differ in Southeast Asia. But there, too, researchers and engineers looked for ways to reduce use of elemental chlorine in pulp manufacturing. Engineers at Sabah Forest Industries' (SFI) remote *Malaysian* mill, used in-house research facilities to reduce use of elemental chlorine and improve waste water processing. Engineering supply firms, university researchers and the Bangkok-based United Nations Environment Programme (UNEP) Network on Industrial Environmental Management (NIEM) supplemented SFI's in-house efforts. In *Thailand*, the Siam Cement Group experimented with methods for reducing elemental chlorine use at its two pulp mills, including use of substitute chemicals such as anthraquinone (AQ) and bacteriological pretreatment of raw materials.

Environmental NGOs played a direct, informal role in the innovation process in *Australia* and *Indonesia*, with Greenpeace actively following the NPMRP process, and WALHI conducting seminars at Indonesia's public-run Institute for the Research and Development of Cellulose Industry (IRDCI) in Bandung.

Technology Adoption

Once developed, the new advanced cleaner pulping and bleaching technologies were adopted around the world. Adoption was more likely to happen where social movements had been pressing for environmental reform, in certain industry segments, and in newly constructed and export-oriented mills. It was less likely to happen at smaller, older, less profitable mills; facilities under severe physical constraints, e.g. those operating in densely populated locations; and with businesses primarily producing for domestic markets.

Different industry segments have been affected in various ways by social movement pressure. Manufacturers concentrated in some product/ process/ market segments have benefited from new, environmental technologies more than others; also, some are able to convert to chlorine-free processing more easily and less expensively than others.

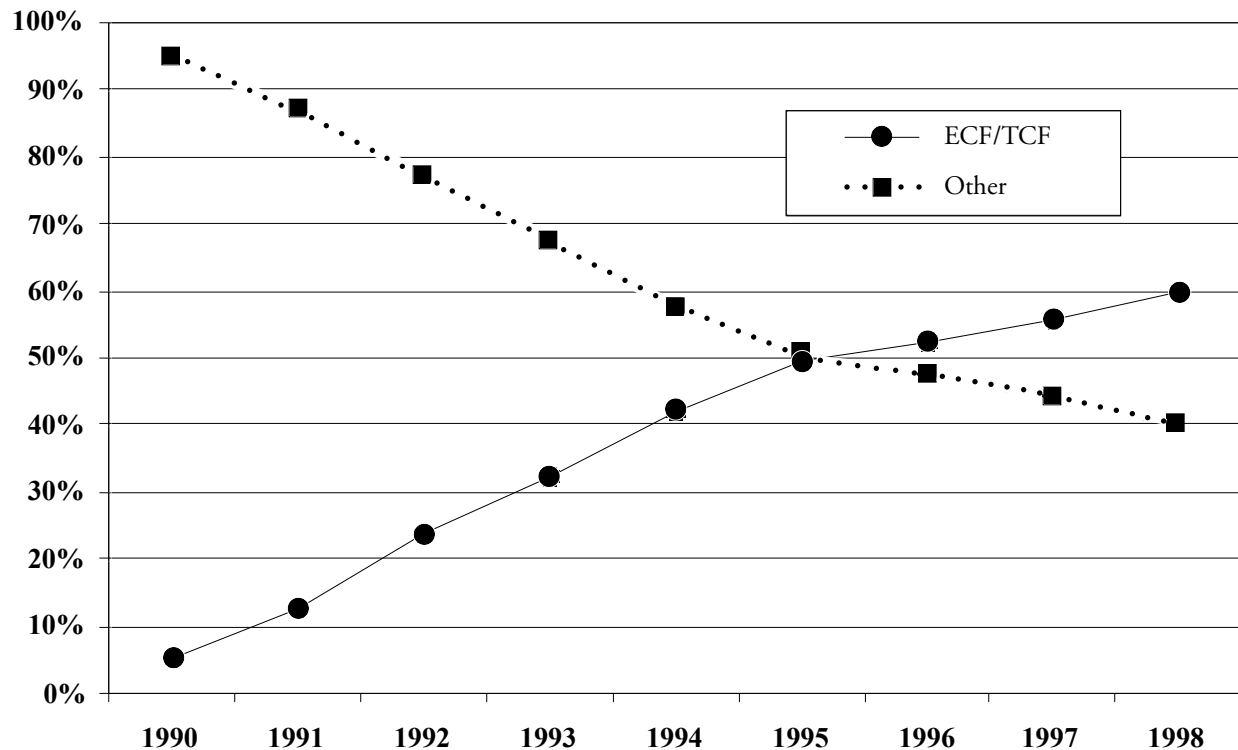
Tissue and sanitary paper manufacturers are subject to pressure from consumer-oriented activism. This segment of the industry tends to be concentrated in a few producers of well-known name brands; highly competitive; and vulnerable to consumer anxieties. Consumers are concerned about the safety of products they come into intimate contact with. Fears about dioxin in women's sanitary products, paper diapers (nappies), toilet tissue, paper napkins (serviettes), paper toweling, and facial tissues have impacted producers in Europe, Australia, and to a lesser extent North America. Brightness, whiteness, and strength requirements for paper used in such products are relatively forgiving; changes eliminating chlorine use can be made relatively inexpensively, given this segment's non-kraft processing technological base.

Manufacturers of *fine printing and writing papers*, especially those using kraft pulping techniques, have had a more difficult time. Business and institutional customers often require specified whiteness, brightness, and strength—all said to be enhanced by elemental chlorine—and are sensi-

tive to price. Retrofitting kraft pulping and bleaching technologies to eliminate elemental chlorine is a major undertaking and costly.³³ Nevertheless, leading kraft pulp mill operators are reducing or eliminating elemental chlorine use through modifying existing processes and adopting new, cleaner process technologies.

The first chemical pulp mills to use the new advanced chlorine-free processes developed in Sweden and Finland went online in the early 1990s in Europe and North America (cf. *New York Times* 1992). By 1998, approximately 60 per cent of all bleached chemical pulp produced worldwide was elementally or totally chlorine-free (see Figure 4).

Figure 4. World-wide chlorine-free bleached chemical pulp production, 1990-98 (AET 1998).



Timing was a key factor in the adoption of advanced elementally chlorine-free (ECF) pulping and bleaching technologies in the countries where fieldwork was conducted for this study (see Figure 5). In *Malaysia*, the SFI mill was built in the mid-1980s, before chlorine use became an international issue and advanced chlorine-free technology was made widely available. Engineering staff made a steady stream of environmental improvements to the mill, including reducing use of elemental chlorine until the mill started running in the red in the mid-1990s.

In *Australia*, a new pulp mill was proposed in 1988, after the chlorine/dioxin issue had developed in North America and Europe, but again before the advanced chlorine-free technologies were widely available. Environmentalists prevailed, preventing construction of an “old-technology” mill.

33. Though, as Peerla notes, less expensive than going to closed-loop or totally chlorine-free processing (Peerla 1999).

Two operating non-kraft mills were able to dispense with use of elemental chlorine relatively easily. The Australian Newsprint Mills' Boyer facility accomplished this largely by shifting its raw material to plantation softwood from native (eucalyptus) hardwood. Australian Pulp and Paper Mills' Wesley Vale plant adopted a new peroxide bleaching system for its relatively small runs of plantation soft-

wood. Ironically, though they hadn't wanted to make the changes, officials acknowledged with good humor that their companies had ended up benefiting economically (as well in public relations) from making the changes.

		<i>Timing of Expansion</i>	
		EARLY	LATE
<i>Environmentalists' Strength</i>	WEAK	OLD TECH., MILL BUILT (Malaysia, Indonesia, Thailand)	ECF (Indonesia, Thailand)
	STRONG	PROJECT BLOCKED (Australia)	TCF TEF (???)

Figure 5. Influence of timing of expansion and strength of environmentalism on adoption of environmental technologies in Asia Pacific pulp and paper industries.

Indonesia's industry boomed during the period studied. New mills built in the 1980s, some with second-hand equipment, used "old technology." Those mills coming online in the 1990s adopted elementally chlorine-free (ECF) technology. *Thailand's* first large-scale export pulp mill added oxygen delignification and upgraded wastewater treatment facilities. The country's largest pulp and paper group installed advanced wastewater treatment systems and experimented with reducing elemental chlorine use. Thailand's newest large-scale, integrated, export-oriented pulp and paper manufacturer, the Advance Agro Co., also adopted elementally-chlorine free pulping and bleaching processes in their new mill.

While not being the only influence on adoption of environmental technologies in pulp and paper manufacturing at the end of the 20th century, social movements played an indispensable role. In Australia, Indonesia, and Thailand, conflict around poorly-sited, export-oriented, older mills resulted in tightened regulation of existing mills and restrictive requirements for new mills. Transnational social movements catalyzed development of new, cleaner technologies and "green" export markets, and disseminate environmental information to governmental, academic, and citizens' groups around the world.

CONCLUSION

This paper has reviewed in detail social movements' impact on the environmental transformation of pulp and manufacturing in the late 1980s and 1990s, with special reference to those locations in Southeast Asia and Australia where the author conducted field research. Analytically, five 'moments' in the ecological modernization of the industry were distinguished: problem definition, political action, government response, technology innovation, and technology adoption. The final section of this paper summarizes findings at a more general level, discusses implications of these findings for ecological modernization theory, and suggests directions for future research.

Summary of Research Findings

Social movements played a strong role in each moment of ecological modernization of pulp and paper manufacturing:

Problem definition. Greenpeace, together with the Women's Environmental Network (WEN), Friends of the Earth (FoE), and others, played a critical role in establishing the world-wide use of chlorine in pulp and paper manufacturing as a "problem." It did so not through formal, intergovernmental environmental institutions such as the global climate change commission, but rather through scientific research, direct action, education, lobbying, and consultation at the local and national levels in countries around the world. In advanced industrial countries, the chlorine/dioxin/pulp problem was linked to women's/public health and food safety issues as well as to toxics. In developing countries, concerns about health risks of dioxin/chlorine/pulp manufacturing were important "cases in point" in demands for stronger popular roles in decision-making regarding large-scale, rapid rural industrialization.

Political action. Activist campaigns against use of elemental chlorine in pulp and paper manufacturing were carried out around the world, at a cost of millions of US dollars, and involving tens of thousands of people. Not only environmentalists, but also women's, community, human rights and other activists, and small farmers and fishermen were involved. Making use of a broad array of forms and issues—so many and with such conviction that it was difficult for industry to counteract them—the campaigns indelibly affected the industry world-wide, especially in Europe, through engaging producers, consumers, technology firms, research scientists, regulators, and the media. Industry trade journals soon declared, "Chlorine is dying ...!"

Government response. Due to social movement activism, government agencies were increasingly forced to intervene strongly with regard to pulp and paper manufacturing. Even agencies considered weak, such as in newly industrializing countries, *shut down* offending pulp factories. New environmental regulations were developed in countries around the world—indicating a long-term trend towards global convergence of regulatory values, expectations, and standards—along with innovative approaches for dealing with conditions at particular mills. Social movements collaborated with government agencies in evaluating the industry, including regulatory review, standards revision, and implementation and enforcement of environmental standards and procedures. Government agencies mediated conflicts between local communities, activists, and manufacturers over environmental practices at particular sites. Government-managed or sponsored research institutes redoubled environmental research and development related to the pulp and paper industry.

Technology innovation. Social movements redefined technology development priorities for the pulp and paper industry, in the Nordic countries of Europe and elsewhere, including both advanced and newly industrializing countries. Environmental products and processes already “in the pipeline” were fast-tracked and new ones initiated. Technology firms soon were selling elementary-chlorine free (ECF) pulping and bleaching systems everywhere. Innovation took place at global technology firms and world-class pulp and paper research institutes as well as by individual pulp and paper firms and local research centers. Social movements not only initiated but in some cases helped gain funding for these technology innovation processes; once underway, they played an active role in monitoring their progress and development.

Technology adoption. Environmentalists and others kept public attention—and pressure—focused on manufacturers until they moved to reduce or eliminate use of elementary chlorine in pulping and bleaching, including through adoption of new, cleaner production technologies and development and implementation of local innovations. By 1998, approximately 60 per cent of all chemical pulp manufactured in the world was elementally or totally chlorine free, up from less than 10 per cent in 1990 (see Figure 4).

In short, social movements played a critical role in the environmental transformation of pulp and paper manufacturing around the world, through linking dioxin to the industry, campaigning for reform, spurring governmental intervention, resetting research and development agendas, and persisting until manufacturers adopted new process technologies and modified old ones.

Implications for Ecological Modernization Theory

What implications do these findings have for ecological modernization theory? This question is addressed through revisiting the propositions summarized earlier in the paper, numbering seven in total.

1. The present research finds strong validation for the thesis that *social movements play an increasingly important and direct role in the ecological transformation of society*. The pulp and paper industry will never be the same following more than a decade of scientific research, political campaigning, government regulation, technology development and adoption aimed at the elimination of elemental chlorine from pulping and bleaching. This transformation is one of a handful of examples (including the stalled expansion of nuclear power in the US and elsewhere, replacement of chloroflourocarbons, elimination of lead additives in gasoline, and banning of DDT) demonstrating the substantial influence of local, national, and transnational social movements and NGOs working together to push global society/societies in a more ecological direction.

2. Ecological modernization theory posits that even as they have transformed societies, so too have *environmental social movements been transformed, moving from radical opposition to capitalism, industrialization and bureaucratization, to being more oriented towards institutional reform*. Mol (2000) suggests this is a result of the rationalization and institutionalization of environmental considerations and practices in contemporary western societies, as well as an accommodation to environmental “backlash” (cf. Rowell 1996).

There was mixed experience with regard to the pulp and paper industry during the period

studied. Greenpeace International and affiliates, major actors with regard to environmental reform of the pulp industry, combined radical demands with attention-grabbing direct action, plus reform-oriented direct relations with governmental agencies and firms. An essential part of Greenpeace's global strategy was actively cultivating green capital in competition with brown capital (see Peerla 1997). In balance, the political trajectory of Greenpeace's pulp and paper campaign supports Mol's proposition.

At the same time, radicalism persisted in particular pulp mill controversies. In Australia, what started out as a local, reform-oriented movement to relocate a proposed new pulp mill became increasingly radical, growing to become a strong national (and even international) movement to place a moratorium on any new pulp mill construction until strict environmental requirements were met. Part of this may be explained ecologically, with water issues being acute in the driest continent; another part may be explained socially, as the reaction of a highly urbanized population to rural environmental destruction and contamination—what might be considered a “green” backlash to historically “brown” practices. Ultimately, some of the more mainstream environmental organizations such as the Australian Conservation Foundation (ACF) were more oriented willing to tread a reform-oriented path, while others such as Friends of the Earth (FoE) Australia continued in radical directions.

In Southeast Asia, too, though for different reasons, pulp mill controversies encompassed both radical and reform tendencies. Most militant were rural ethnic minorities directly affected by pulp mill construction and operation, and city-based, student NGOs. National NGOs and NGO networks were more reform-oriented, willing to work directly with all parties concerned: local citizens, government agencies, manufacturing firms. Strong constraints on political activity including “licensing” of NGOs and the threat of being labeled subversive tempered radicalism by national NGOs.

In both Australia and Southeast Asia, where the question was commencement of new rural industry, in some cases it didn't matter how clean it was. This was the case especially where there was concern about the mills' extensive resource requirements and impacts on traditional rural livelihoods. Some controversies involving existing mills became quite polarized, while others focused on cleaning up production while maintaining employment.

On the whole, with regard to the pulp and paper industry, there was no simple movement of environmental NGOs from opposition to reform. Rather, both tendencies were present and there were movements back and forth. This was a function of the huge “ecological footprint” of the industry and the likelihood of industry expansion generating resource conflicts in local, national, and even international political arenas.

Analytically it makes sense that there is a dialectic between radicalism and reformism in environmental politics. Either could emerge in a given context, moment, location depending on the constellation of social forces and environmental circumstances (cf. Rinkevicius 2000). This dual character is functional, in that with only partial institutionalization of environmental values, when push comes to shove or individuals change, social movements may find themselves starkly outside institutions of power they once were close to or part of, and the “cycle” of opposition-reform starts again.

3. Ecological modernization theory suggests that, as a further part of their transformation, environmental social movements *have become more single-issue oriented rather than remaining part of the broader social movements in which they originated*. Mol argues that this is due to a pragmatic turn by environmental NGOs to gain “better access to both the general public and the core of policy communities” (Mol 2000). The present research found limited support for this proposition with regard to the pulp and paper industry.

Greenpeace’s global pulp and paper/chlorine campaign succeeded due to its substantial financial and human resources, creative and multi-faceted tactics, extensive geographical scope and high degree of focus. On first take, this would seem to support Mol’s proposition. On the other hand, it could be argued that the campaign succeeded because of its ability to link with broad social movements: women’s and public health, consumer product safety, agricultural preservation, minority rights, democracy, etc.

New pulp manufacturing projects tend to be very large scale, involving hundreds of millions of US dollars, high profile investors/investment groups, regulatory processes, news coverage, etc. In Australia and Southeast Asia pulp industry development and concomitant environmental issues were lightning rods for public sentiment regarding these broader issues. In the case of the pulp and paper industry, these two characteristics—being single-issue oriented and part of broader social movements—are not in opposition, but coexist and complement each other. It took the highly focused campaign and support activities of Greenpeace combined with the activities of a broad array of social movements to turn the industry in a more environmental direction.

4. Ecological modernization theory hypothesizes that the above-referenced transformations in the character and orientation of environmental social movements are part of *their movement from outside to increasingly inside roles in environmental transformation of institutions*. This study found evidence tending to support this proposition for the pulp and paper industry. Social movements were very much involved in each “moment” of ecological modernization of pulp and paper manufacturing. Their involvement was more “inside” in some and “outside” in others. Social movements were more involved in earlier moments of ecological transformation (problem definition, political action and government response) than later ones (technology innovation and adoption). But in the latter moments, as well, social movements did have a role, albeit from arms length as consultants and reviewers.

Reinvoking the definition at the beginning of this paper of “environmental social movements” including individuals not only in NGOs but also in firms and government agencies, this may be seen in an even more positive light, however. One of the remarkable aspects of the transformation of the pulp and paper industry is the preponderance of environmentally-oriented individuals within each of the institutions involved. While important differences in fundamental interests, such as in the cost of developing and implementing new, cleaner technologies, remain between the parties, not only NGOs but also government agencies and manufacturing firms have strong environmental advocates within them.

Even with some grumbling by firms, there was broad consensus among most parties that the industry had to change process-technologies, moving away from use of elemental chlorine. There were disagreements about “how much” and “how fast,” but not about “whether,” to adopt cleaner

production processes and technologies. Leading producers and the industry associations which represent them conceded the shift to elementally chlorine-free (ECF) pulping technologies. Debate remains over the merits, costs and benefits of conversion to totally chlorine-free (TCF) processes, even while research continues on development of totally effluent-free (TEF) pulp manufacturing, which would have the effect, coveted by firms and regulators, of freeing the industry from locational restrictions with regard to its waste stream.

Debate continues as well, in advanced as well as newly industrializing countries, on what to do with smaller, older manufacturing facilities utilizing outdated, dirtier technologies yet providing needed employment (cf. Iritani 1994). In some cases, e.g. where downstream urban water supplies are at risk, pollution caused by such firms may be deemed more important than benefits in providing jobs.

5. Ecological modernization theory proposes that as part of the institutionalization of environmentalism in contemporary societies, *environmental social movements communicate, negotiate, and consult directly with “economic agents and state representatives” including in long-term planning and redesign of production technologies* (Mol 2000). This research found strong support for this thesis with regard to pulp and paper manufacturing.

In the pulp and paper industry, one of the things that made Greenpeace so effective in its chlorine/ pulp and paper campaign, was its willingness to engage directly with government agencies, producers, technology firms, as well as citizens groups around the world. While aggressively maintaining an uncompromising stand vis-à-vis industry use of chlorine, Greenpeace was not anti-company, anti-industry, or anti-capitalist. Rather, it worked together with all parties to bring manufacturers to adopting what Greenpeace considered to be more sustainable, chlorine-free technologies.

More broadly, social movement interaction with government and industry regarding the pulp and paper industry has involved both collaboration and conflict. The collaboration is most notable in the Nordic countries, which have completely shifted to elementally or totally chlorine-free pulp production, and which are home to today’s leading pulping technology firms (see Sonnenfeld 1999). In those countries, leading pulp manufacturers and technology firms have significant government ownership. Environmentalists have extraordinary influence over the pulp and paper industry through participation in the legislative and administrative branches of government as well as boards of directors of state-owned firms.

In newly industrializing countries, activists exert their influence in direct and indirect ways: directly, through working with (or confronting, where collaboration is not possible) producers and government agencies; indirectly, through working with news media and international allies. As suggested by ecological modernization theory, where there is weaker institutionalization of social movement involvement in environmental transformation, alliances between activists, regulators, and producers shift back and forth, varying with particular circumstances and actors involved (see Mol 2000).

6. Ecological modernization theory suggests there is a “price to pay” for institutionalization of reform-oriented environmentalism: *social movements no longer dominate environmental agenda-setting and now have to compete with other institutions to influence those processes*. This study finds support for this proposition, with different dynamics in the North and South. In the North, environmental NGOs competed increasingly with state-led and corporate environmentalism, while in the South,

dependent ecological modernization emerged, with domestic actors responding to changing international norms, ideologies, and practices of environmental regulation.

Early in its campaign, Greenpeace was highly influential in setting the environmental agenda for the pulp and paper industry world-wide. It did so through a multi-pronged, global campaign, lobbying public officials, educating individual and corporate consumers, working with research scientists, and negotiating with manufacturers around the world. Once it had succeeded in re-setting the environmental agenda for pulp and paper manufacturing, however, Greenpeace increasingly had to compete to maintain influence. Regulatory processes were prolonged by debates and compromises. And the chemical and pulp industries launched counter-organizations such as Chlorophiles, based in Germany, and the Alliance for Environmental Technology, representing the interests of the US pulp and paper industry.³⁴

In newly industrializing countries, environmental NGOs faced similar but different dynamics. These organizations rose in response to the excesses and impacts of unbridled rapid industrialization—in this case with regard to the pulp and paper industry. In the first instance, it was a substantial accomplishment for environmental NGOs in the South even to get a seat at the table. In unstable, authoritarian political environments, initial participation in the agenda-setting process was dependent on patronage of sympathetic élites, strong local grassroots networks, and support from NGOs and institutions overseas.

Once environmental values became more generalized among élites in newly industrializing countries and once international institutions and other actors pressured for improved environmental performance, regulatory officials welcomed NGO activism in augmentation of their limited power to enforce environmental regulations. It was not too long before neo-liberal market ideology became increasingly dominant in newly industrializing countries as well, however, again through influence of international institutions, with the result that regulatory agencies reoriented themselves towards “market tools” and industry self-regulation, and environmental NGOs were forced to compete again over environmental agenda-setting.

7. Finally, ecological modernization theory posits that, as a characteristic of the more general transformation of contemporary society, *environmental social movements have shifted from working closely with the state to working more closely with market actors*. This study found support for this proposition, with important differences between advanced and newly industrializing countries.

In Europe and North America, Greenpeace increasingly turned to the corporate sector to maintain its influence, forming alliances with chlorine-free pulp and paper producers, negotiating directly—with success—with such high-visibility corporate consumers of paper, as Time magazine. In newly industrializing countries, environmental NGOs used multiple avenues to strengthen their position: working directly with local producers where possible; strengthening ties with community, labor, human rights, religious and other organizations; and networking with international NGOs, aid agencies, and intergovernmental organizations.

34. While accepting the original terms of the debate – moving away from use of elemental chlorine in pulp and paper manufacturing – such groups drew the line at total elimination of chlorine from manufacturing.

Environmental NGOs in the North were in a stronger position to negotiate directly with economic actors—consumers as well as producers—than their counterparts in the South. With weaker institutions for popular participation in economic (as well as political) decision making, NGOs in the South sought a wider range of international and domestic allies, reinforcing their tendency to retain connections with broader social movements, as discussed above.

* * *

In sum, with regard to the pulp and paper industry, this study found 1) strong support for the thesis that social movements play an increasingly important and direct role in the ecological transformation of society; 2) mixed support for the proposition that environmental NGOs have become more reform-oriented; 3) limited support for the suggestion that environmental social movements have become more single-issue oriented; 4) validation for the thesis that environmental social movements had moved increasingly to the inside of the environmental transformation of industries; 5) strong support for the proposition that environmental social movements communicated, negotiated and consulted directly with economic agents and state representatives; 6) different dynamics in the North and South in how environmental social movements now compete for influence on environmental agenda-setting; and 7) differences also between North and South in environmental social movements relations with states and market actors.

This research supports the value of empirical and theoretical work on ecological modernization in contemporary societies. It indicates a need for more nuanced studies of the influence of social movements on ecological modernization in different sectors and in different countries, and especially on the particular dynamics of newly industrializing countries, where a more tenuous and dependent form of ecological modernization may be emerging.

Directions for Future Research

Empirical research on the contribution of social movements to environmental transformations in contemporary societies is in its infancy. Such research will likely proceed from a number of approaches:

- First, the study of cases by economic sector, sub-sector, and/or country will continue, with increasing attention to intermediate-sized, transitional, and newly industrializing societies. Additional attention will be paid, too, to small and medium-sized enterprises, state-owned enterprises, and processing vs. extractive industries.³⁵
- Second, in this era of increasing social, political and economic globalization, studies will examine transnational social movement linkages in environmental transformation. A number of recent works demonstrate the fruitfulness of such research (Keck and Sikkink 1998; Smith et al. 1996; Fisher 1998; Rothman and Oliver 1999; Lipschutz 1996).

35. Tammy Lewis makes a number of excellent suggestions for comparative lines of inquiry on related topics, including cases where environmental social movements have been *ineffective*, different types of states, varying industry ownership structures, and high and low technology costs (Lewis 1999).

- Third, important social scientific research remains to be done examining the “life-histories” of particular environmental social movement organizations and campaigns; Peerla’s (1997) work is exemplary in this respect.
- Closely related to this task is continued work on the ideology and discourse of ecological modernization, especially in environmental NGOs (cf. Hajer 1995; Dryzek 1997; Richardson et al. 1993; Sherman and Gismondi 1997).

Though each is capable of illuminating only certain aspects, together such studies will allow further refinement of more general arguments about the character of social movements’ contributions to ecological modernization, as has been attempted here.

Epilogue

At the end of the 20th century, environmental demands on the pulp and paper industry are as strong as ever; the industry is undergoing unprecedented consolidation, with predictions that 10-12 firms will dominate global production within a decade; technology firms and government research institutes particularly in the Nordic countries continue their quest for closed-loop totally effluent-free (TEF) pulp production; and social movements maintain their focus on the industry. Greenpeace has been undergoing major reorganization and restructuring due at least in part to major financial shortfalls. At one level Greenpeace’s pulp and paper campaign has been won, at another it continues in more diffuse form through efforts of various organizations around the world. The environmental transformation of pulp and paper manufacturing will continue until the industry is able to remake itself once again with closed-loop, totally effluent free (TEF) processes and technologies—perhaps not far in the future.

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Founded in late 1996, the **BERKELEY WORKSHOP ON ENVIRONMENTAL POLITICS** emerged from a long-standing commitment to environmental studies on the Berkeley campus and from the presence of a core group of faculty whose research and scholarly interests linked environment, culture, and political economy. The workshop draws together over fifty faculty and doctoral students from San Francisco Bay Area institutions (the University of California campuses at Berkeley, Santa Cruz, and Davis, and Stanford University) who share a common concern with problems that stand at the intersection of the environmental and social sciences, the humanities and law. The Berkeley Workshop on Environmental Politics has three broad functions:

- ◆ to assist graduate training and scholarly research by deepening the theoretical and methodological toolkit appropriate to understanding environmental concerns in an increasingly globalized world;
- ◆ to bring together constituencies of local and international scholars, activists, and policy makers for transnational conversations on environmental issues; and,
- ◆ to bring community activists and policymakers to Berkeley as Residential Fellows, thus providing synergistic possibilities for developing new learning and research communities.

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